

MATHEMATICAL MODELS AND DECISION MAKING IN BUREAUCRACIES:

A CASE STORY TOLD FROM THREE POINTS OF VIEW

by

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A.B., Dartmouth College
(1970)

SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE

DEGREE OF

DOCTOR OF PHILOSOPHY

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

August, 1977

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Alfred P. Sloan School of Management, August 24, 1977

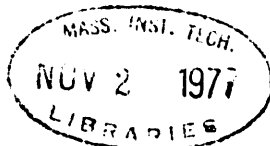
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Submitted to the Alfred P. Sloan School of Management on August 24, 1975
in partial fulfillment of the requirements for the degree of Doctor of
Philosophy.

ABSTRACT

Increasingly, mathematical models designed for policy analysis are being built and not used. This lack of use lies partly in the intrinsic validity and usefulness of the models being built, and partly in the poor state of research into how to implement models. A further part of the problem is that modelers lack a theoretical discussion of how decisions are made within bureaucracies and how policy modeling interacts with these decision-making processes.

The purpose of this research is to explore how to manage better policy modeling exercises in public sector bureaucracies. This problem is examined from three theoretical perspectives: the rational, organizational, and cognitive theories of decision making.

The study is based on a modified participant-observer research strategy spanning a two year period. The case under study is a reexamination of the fiscal policy for funding Chapter 766--a comprehensive reform of special education in Massachusetts enacted in 1972 and first implemented in 1974. The policy redesign was housed in the Division of Special Education, Massachusetts Department of Education.

As part of the policy reform, a system dynamics simulation of the funding of 766 was constructed. The study examines the impact of the system dynamics model on decision-making processes from the rational, organizational, and cognitive points of view.

Conclusions from the study are organized on three levels. First, recommendations for better managing policy modeling projects are derived for each of the theoretical perspectives applied to bureaucratic decision making. Second, a preliminary framework for mapping the theoretical, empirical, and normative points of overlap and tangency between the three perspectives is presented. Finally, the conclusions explore the implications of a multiple-theory approach to applied social scientific research in general

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ACKNOWLEDGEMENTS

In this work, I am indebted to many persons, both personally and intellectually, for their time, interest, and concern. It is with pleasure that I recognize these debts.

My wife, Deborah, has accomplished the major feat of getting us both through this thesis writing period. Her efforts have involved not only emotional support and technical assistance in putting together the final document, but she has also made the effort to understand this work in detail and has served as an intellectual partner in its development.

Ed Roberts has served as a guiding beacon for the whole effort, encouraging me early on to explore broadly, yet at the same time holding me to solid ground. More than once his thoughtful and pointed advice has transformed ill-defined avenues of inquiry into well-defined projects. Hayward Alker has helped me to see my own work in the context of many broader issues in the social sciences. Through his efforts, I have come to appreciate the rich diversity of available social theory. Jim Lyneis has provided consistent support in the lines of inquiry that I have chosen to follow. He has continually emphasized the concrete problems of using system dynamics models in bureaucracies. Lloyd Etheredge has provided an expanding perspective, ever viewing this research from fresh points of view and reexciting me about the work.

The Friday Morning Group," a voluntary seminar of peers, has participated actively in the germination and cultivation of this work. Mike Garet with his meticulous attention to intellectual detail has unpacked many puzzles in the work. His awareness of the normative content of the three perspectives is a major contribution to this work. Ali Mashayekhi tenaciously strove to clarify the purpose of the whole effort, and in so doing has sharpened my own thinking. George Richardson continually managed to find exciting insights in areas where my senses had been dulled by a false sense of familiarity. Mats Lindquist provided our discussions with a refreshing counterpoint, using his wit and uncanny ability to summarize to find a kernel of simplicity among a morass of detail.

Although they may not directly recognize their mark upon this work, Gerry Flynn and Hoyt Alverson have taught me as an undergraduate to recognize the important intellectual distinction between people and social systems. This simple insight has motivated much of this work.

To Alan Frohman, I owe several debts. He has served as my guide through the early phases of this project and he has opened my eyes to the importance of organizational factors in determining decision outputs.

I owe thanks to many persons within the Department of Education for stepping over the line of a professional relationship and taking a personal and intellectual interest in my thesis work, making the research reported here possible. First on this list are : Bob Audette, Hal Gibber, Bambi Levine, and Fred Williams.

At a rather different level, thanks are due to Gerry Bourke for two years of providing a very down-to-earth perspective on my work as well as supplying some much needed concrete motivation.

Finally, the finished document would not have come together had it

not been for the willing assistance of many extra hands. Cairn Huff typed the bulk of the manuscript with precision. Four persons put in critical efforts near the end of the project, putting the end thankfully within sight. They are Mr. and Mrs. Raymond Lines, Michael Garet, and Melanie Mintzer. The final myriad of details would be yet uncomplete without the additional efforts of Gerry Bourke, Irene Drew, Ali Mashayekhi, and Deborah Andersen.

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*NOTE: Originally a memo from D.F. Andersen to R.H. Audette and Fiscal Policy Group, "Preliminary Policy Recommendations from System Dynamics Simulation of Parts of the Special Educational Fiscal Policy System."

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CHAPTER ONE
OVERVIEW AND MOTIVATION

1.1 MOTIVATION

The Problem

As modern societies become more complex and regulated, large portions of our lives are increasingly molded by policies established and enforced by public agencies. How policies are set within these public agencies is therefore of increasing importance in shaping the fabric of modern society. As social complexity rises, time tested modes of decision making falter. Bureaucracies must interact with a society, all of whose component parts are tightly interconnected. Actions in one sector of society often have unintended consequences in other seemingly uninvolved sectors. And failure of one component part of a complex social system can lead to paralysis of the larger system. A large metropolitan area can be virtually ground to a halt by a failure in the power grid providing electricity, by a failure in a telecommunications network, or even by a strike of the garbage collectors.

Also, public bureaucracies themselves are becoming more and more complex. At both the state and federal level, the grinding inertia of public agencies appears to be almost beyond the control of the elected legislative and executive arms of government. Public agencies are finding it harder and harder to understand and control their own internal operations let alone regulate sectors of a much more complex external society.

The broad problem facing modern governmental agencies is how to

make the right policy decisions in the face of growing complexity within the bureaus themselves as well as increasing interconnectedness, uncertainty, and sheer scale of operations in the external society. Furthermore, the complexity of modern societies and bureaucracies far exceeds the capacity of the unaided human mind to understand it. Thoughtful men reflecting on the problems of modern society simply cannot process enough information, and gather all of the relevant issues together into a unified picture to make the "best" intelligent decisions. Too much is happening at once. The human mind can only focus on several of the myriad of events of importance occurring at any point in time. Most of the important detail and the sense of interconnectedness between events evades our perception.

Attempts to solve complex problems by attacking them incrementally, solving one small understandable portion of the overall problem and then moving on to the next piece, also fail in a modern era of complexity. The whole of complex problems is greater than the sum of the parts. Even if all of the sub-problems could be squarely addressed, there is no assurance that the greater problems within the system, stemming from the interconnection of these sub-problems, would also be solved. Furthermore, the organization of modern bureaucracies assures that small subunits of the overall agency will address similarly small sub-parts of the greater problems facing the agency. Hence organizational and cognitive factors virtually assure that the complexity of modern society will not be fully understood, and decisions within public agencies will be based upon a less than adequate understanding of the scope and causes of the

major problems within society. Traditional management practices almost insure that public agencies will not be able to totally manage a complex society.

The Promise

During the late 1950s and the early 60s, a new science of management appeared on the horizon—a potential saviour for public and private agencies alike who were increasingly baffled by modern complexities. Spawned in the amazing advances in operations research during the Second World War, the new management science brought an impressive arsenal of new discoveries and innovations to the traditional problems of management. The most important of these was the electronic digital computer. The computer complements the human mind with an amazing ability to consider both massive amounts of data and literally thousands of simultaneous interactions. Once the human mind was freed from the constraints of its own limited information processing abilities, new vistas opened up for the consideration of an information-rich and deeply interconnected modern society. Traditional fields of mathematics were quick to produce new techniques and methodologies for making use of the emerging potential of the computer. Mathematical programming, statistical decision theory, artificial intelligence and computer simulation soon became the common tools of the new management scientists. New advances into the technologies of computing yielded faster, larger and less expensive machines that promised the ability to manipulate even larger amounts of data and to allow the diffusion of computer technologies to all corners of society.

The new science of management held forth the glitter and promise of the future. At last, managers, bound until then by the rather primitive tools of an intuitive craft, would be able to move into the frontiers of science and participate in the cumulative gains of scientific progress. Indeed, modern managers would not only be able to understand the roots of modern complexity, they would themselves become architects of complexity, able to design new agencies and social structures capable of controlling social and economic events.

The Disillusionment

By the later part of the 1970s, it appears that the promise of the new science of management by far outstrips its performance. The preceding two decades have seen an immense proliferation of management science applications, but with an apparent underlying stagnation in the field itself. Roberts notes that the field has seen no new technical innovations during the past decade--new advances being refinements and rehashings of earlier discoveries.¹ Furthermore, questions of model validity and how to implement and use models have not advanced significantly.

Independent observers have begun to document the poor track record of mathematical modeling projects, leading to a building sense of skepticism among model users. For example, Brewer documented the rather disastrous performance of two massive federally-funded modeling projects in San Francisco and Pittsburgh. He appraised these projects along theoretical, technical, ethical and pragmatic dimensions, and found the projects to be riddled with inflated expectations, misestimations of the scope of

problems and both theoretical and technical blunders.² Little examined the properties of good modeling projects and found that technically elegant efforts were not necessarily the most useful ones.³ Apparently, a host of non-technical and non-scientific interactions exist between model builders and model users that are as important if not more important than the "scientific" aspects of the model itself in determining the usefulness of the model.

By the mid 1970s the management science community had begun to turn its attention to the problem of implementing and using the results of formal mathematical models as decision aids. In contrast to the seemingly scientific aspects of the models themselves, understanding how such models are actually used quickly reduces to ad hocery and unsophisticated hypothesizing. In 1975 Ginzberg reviewed the mushrooming body of literature on management science implementation and found that what could be said about implementation usually fell into one of two categories. On the one hand, experienced implementors with a track record of apparent successes would set down an atheoretical anecdotal discussion of "how to" implement models. On the other hand, a massive body of literature existed that statistically analyzed the "significant factors" contributing to model success. These factors of models were based upon simplistic hypotheses concerning how decisions are actually made and led to little convergence over what was actually important.⁴

Recently, some research has begun to borrow from a more theoretical knowledge of how organizations function and make decisions.⁵ However, these theory-based descriptions of how formal mathematical models are used

to aid decision making have not been fully elaborated nor integrated. Nor has the literature even begun to exhaust the available theoretical perspectives on how decisions are made within organizations.

1.2 PURPOSE OF THE RESEARCH

In a spirit of retrenching from the initial pie-in-the-sky approach that characterized the early years of management science, we begin this study with the realization that formal mathematical models are not policy panaceas. Instead, they are useful tools that must fit within an overall arsenal of intuition into problems, organizational and political acumen, good guesses, and a bit of luck.

That is, the purpose of this research is to examine how can and should analysts and managers alike better manage policy modeling efforts to maximize the strengths of formal models as decision aids and to compensate for their predictable deficiencies.

Theoretical Puzzles

Before we can begin to understand how to better manage policy modeling, we need to better understand the basic decision-making processes that they support. Fortunately, decision making is a much studied topic in the literature on organizations. Unfortunately, there is little convergence within this rather massive body of literature. The more the field is studied, the more it tends to diverge. The field of decision making is currently experiencing a geometric expansion in the number of theoretical perspectives perceived relevant for its study.

In the early 1950s the field of decision making was dominated by economically based notions of the value-maximizing rational man. Today, fully articulated, organizational, cognitive, and political theories stand in competition with the original rational view.⁶ Attempts to unify the literature into synthetic wholes have been singularly disappointing. Often

these attempts reduce to an anthology of articles from several diverse perspectives with the interweaving of perspectives left to the reader. Other attempts borrow pieces of theory from several perspectives and gloss them over with a unifying jargon.

The theory on decision making lacks what Geertz has labeled "thickness" of description.⁷ That is, these various theoretical perspectives focus on one or two aspects of the decision-making process and elaborate on these in detail, suppressing from consideration the many other layers of meaning and interpretation that could be applied to this same series of decision-making events (these suppressed interpretations often being highlighted from an alternate point of view). "Real" decision-making processes are "thick," that is, characterized by multiple layers of meaning and subject to interpretation on many levels. The relatively flat theoretical descriptions currently available within the literature produce a view that is tractable and manipulable (reducing to measurable variables and testable hypotheses), but lack the thick richness of description that surrounds the activities of real managers making live decisions.

One approach that holds out the promise of retaining some of the thickness that arises from several different points of view, yet retains theoretical tractability within each perspective is a multiple perspective approach. First employed by Allison in his analysis of the Cuban missile crisis,⁸ this approach views a single case from several theoretical perspectives, applying different theoretical lenses, emphasizing different bodies of evidence, and drawing different conclusions about what should be done--how to better manage policy modeling.

A multiple-perspective approach is taken within this study. The study

examines how to better manage policy modeling while using three distinct theoretical lenses for looking at a single policy modeling project--those lenses being the rational, organizational, and cognitive theories of decision making.

1.3 DESIGN OF STUDY

To implement a multiple approach, a modified participant-observer research strategy was undertaken. The problem under study was the use of a system dynamics model to aid the development of fiscal policy within the Division of Special Education, Massachusetts Department of Education. The time period of participant-observer research was two years.

The Case

In 1972, Chapter 766, a comprehensive reform of the education of children with special needs passed the Massachusetts State Legislature. The law was first implemented in local districts in the fall of 1974. By December of 1975, a full year after the formal implementation of the law, the state agency administering the law realized that immediate improvements in the procedures and policies used to fund the law would be necessary if the law were to survive.

For six months prior to the fiscal crisis of December 1975 the author had been involved as part of an external consulting team in an internal review of the management practices within the Division of Special Education. He continued that involvement from December 1975 through April 1977, when the division underwent a process of reexamining its own stance with respect to the funding of the Chapter 766 legislation. As part of that policy re-examination, a system dynamics simulation was constructed and used to aid in the policy redesign process. (A more detailed discussion of the background of the Chapter 766 law and the author's involvement in the policy redesign process is contained in Chapter 3.)

The case of Chapter 766 fiscal policy reform within the Division of

Special Education has several interesting properties:

1) Long Run Policy Development. The policy development that occurred within the division was not a "one shot" affair. This development spanned nearly two years, during which time the agency had an opportunity to exhibit considerable learning. The study emphasizes how formal modeling projects can contribute to the longer run learning of individual managers and of the organization as a whole.

2) Scale of the Project. The scale of activity over the two year period was fairly well-contained within the Department of Education. The active locus of policy development covered no more than twenty or thirty managers. Furthermore, internal management procedures could make a difference in this case; the division had considerable latitude in defining how it wished to interpret the funding language contained within the enabling legislation. Hence this particular case was of such a scale that it could reasonably be understood and explained in a project of the scope and magnitude of thesis research.

3) Access to Evidence. Because the author was actively involved in the agency, both with the construction of the system dynamics model and with the non model-based aspects of the policy redesign, he had excellent access to a fine level of evidence in the form of meeting agendas and minutes, personal notes taken at such meetings, and private conversations and candid observations on the part of key managers. Such evidence is customarily lost after decisions have been made and researchers are left with whatever evidence becomes deposited in the agency's archives.

Furthermore, by a serendipitous turn of events, the author had already gained "entry" into the organization and was actively involved in

another project when the "fiscal crisis" of December 1975 first began to break. Hence, almost by chance, the author was privy to many of the early question-asking and problem-forming stages of analysis that often occur before an external analyst is called in to conduct a formal model-based analysis.

Paradoxically, the same access to evidence and the author's intimate familiarity with the case and key managers--a major strength of this study--is its principal flaw. To some degree, by studying the model-building process within the Division of Special Education, the author is studying himself. Although attempts have been made to reflexively understand the biases that must result from such a self-studying design, the reader is reminded that a lack of "objective" distance between the researcher and the processes that he desires to study is a potential flaw of this study. Early on in the research, a strategic decision was made that the benefits associated with an intimate familiarity with the case and the thinking of key managers far outweighed the loss of "objective distance" between researcher and the objects being studied.

Methods and Evidence

Figure 1.1 summarizes the four steps in the research strategy used for each of the three perspectives: formulate naive theory, empirical investigation, modify original theory, and derive conclusions.

Each of the four steps is described in more detail below.

1) Formulate Naive Theory. The first step in researching each of the perspectives was to comb the literature for a set of theoretical propositions that would summarize that body of theory. Based upon the theory

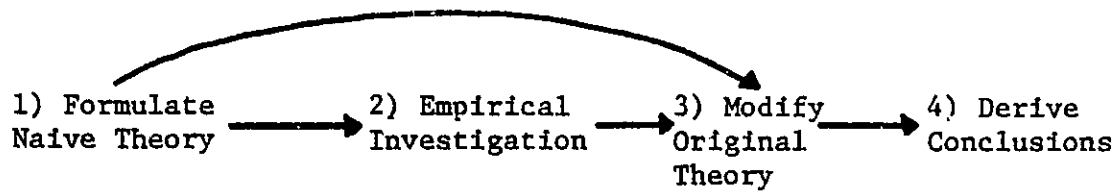


FIGURE 1.1: Four Steps in Research Strategy Used in Each of the Three Perspectives

drawn from the literature and a description of the system dynamics methodology, a set of "naive" propositions were derived, hypothesizing how a system dynamics model should support decision making as viewed from the given theoretical perspective. These naive propositions formed the working hypotheses guiding the initial field work.

2) Empirical Investigation. Armed with three sets of working propositions, one for each of the three theoretical perspectives chosen, the actual investigation of the impact of the system dynamics model on decision making within the Division of Special Education was begun. Since the purpose of the research was not to test specific hypotheses, but rather to generate new insights (that may be more rigorously verified later on), the original, naive theory acted as guideposts, filtering out the important from the inconsequential within each frame of reference. It was hoped that the empirical investigation would generate empirically-grounded insights that could be used to modify the original propositions.

3) Modify Original Theory. Based upon the original naive theory and experiences gained in the case study, three modified sets of propositions were derived that served to frame the case story from each of the three perspectives chosen. By examining the original naive propositions and the

modified propositions, it became possible to succinctly describe what had been learned from experiences in the case study since the changes between the two bodies of propositions must be attributed to learning that occurred during the case study.

4) Derive Conclusions. Finally, based upon the modified theory and the case study, a set of specific recommendations were derived detailing how to better manage the policy modeling process from each of the three perspectives chosen. Each of the three perspectives created a different world of policy analysis. Each perspective was based upon different theoretical priors, emphasized different bodies of evidence, and arrived at somewhat differing conclusions on how to better manage policy modeling.

In addition, after the three separate sets of conclusions had been derived, it was possible to reflect on the points of tangency and overlap between the three perspectives. That is, when taken together, the three perspectives create a view of model use within bureaucracies that is richer, more complex, and generates deeper insights than any view taken one at a time. That is, a "thicker" description of model use results when points of overlap between the perspectives are considered.

Because the investigation is based upon three different bodies of theory, the research had to rely on multiple streams of evidence. Five independent streams of evidence used in the study are summarized below.

Formal Interviews. Over thirty formal interviews were conducted during the course of the research. These interviews were transcribed either from tape or notes and returned to the interviewee for comment and review. They form a rich source of first-hand descriptive quotations detailing how key managers were thinking at various points in time. Some of the interviews

were "real time." That is, they record what the manager was thinking at the time a decision was being made or what he thought would be happening in the near future. Other interviews were retrospective. In these interviews, managers comment on what they were thinking during key decisions and why they thought events unfolded as they did.

Questionnaires. Self-administering questionnaires were distributed to assess how key managers were allotting their time to fiscally-related tasks. The results of these time study questionnaires are reported in Appendix B.

Archival Evidence. Publications external to the Department of Education, such as journal articles and newspaper articles, chronicle how the world outside of the department was looking at Chapter 766 and the adequacy of its funding mechanisms. Evidence of this sort provides an important check on how well the division was monitoring the mood in its own operating environment.

Decision-Making "Residue". In the course of a decision-making process, an organization normally amasses an immense quantity of records that capture the thoughts and activities of key managers in a most detailed fashion. Most of these agendas, minutes, working memos, first sketches of position papers, and guidelines are normally lost to the public record. Once decisions have been made, they are summarized in a "cleaned up" after-the-fact manner and many of the blind alleyways and dead-ends explored and then dropped from consideration are lost to the public record. A distorted image of the decision-making process as more orderly than it actually is emerges. In this study, several thousand pages of such decision-making "residue" has been systematically collected, catalogued, and combed for meaning.

Personal Observations. Perhaps the richest source of evidence upon which this study is based is the personal observations of the author himself. These personal observations represent notes taken at key meetings, informal and candid discussions with key managers, and reflections on the meaning and significance of events from each of the three theoretical perspectives. In addition, these personal observations, captured in a daily log of events, detail how the author spent all of his time while working within the agency as well as the initial steps in the conceptualization of the system dynamics model. The final form of the system dynamics model is adequately captured under the category of archival evidence (the final model being summarized in the form of a position paper reproduced in Appendix A) and "residue" evidence.

For a further description of some of the methods used in the systematic collection of these various streams of evidence, the reader is referred to Appendices B and C.

1.4 A PREVIEW OF CONCLUSIONS

The conclusions of the study are broadly organized at three levels: single perspective views of how to better manage policy modeling, multi-perspective views of how to manage better policy modeling, and broader implications of multiple perspectives for applied social research. Each of these three levels of conclusions are briefly discussed below.

Single Perspective Views of How to Better Manage Policy Modeling. The closing section of each of the three major substantive chapters of this research (Chapter 4--rational perspective, Chapter 5--organizational perspective, and Chapter 6--cognitive perspective) contains a set of prescriptions, addressed to analysts and managers alike, recommending some concrete steps that may be taken to better manage policy modeling in public sector bureaucracies. These three sets of prescriptions are derived from the modified body of theory and the experiences gained in the case study.

Each of these "one-at-a-time" sets of prescriptions has the property of focusing on a single group of concepts and insights central to the particular theoretical perspective chosen. As such, each set of prescriptions, taken by itself, is somewhat thin, giving insight into only several of the myriad of possible focuses for studying model use within bureaucracies. Richer and thicker insights into how to better manage policy modeling can be attained by considering more than one perspective at a time on bureaucratic decision making.

Multi-Perspective Views of How to Better Manage Policy Modeling. A central conclusion of this study is that analysts and managers alike who conceive of policy modeling efforts in terms of several theoretical perspec-

atives on the decision-making process will be better able to achieve successful policy modeling projects. Previous analysts of decision making who have invoked a multiple-perspective approach to studying decision making have claimed that such an approach is critically important to the student of decision making who wants to better understand how bureaucracies function.

To quote Allison

"[the fact that] different analysts relying predominantly on different models produce quite different explanations should encourage the analyst's self-consciousness about the nets he employs." 9

This research concludes more forcefully. Multiple perspectives are more than an intellectual curiosity of interest only to the academic who wishes to understand after-the-fact how decisions were made. In fact, there are multiple, coexisting worlds of decision making and the analyst who wishes to effectively manage policy modeling projects must understand each of these worlds and be able to move easily and effectively between the different worlds. Furthermore, the existence of multiple, coexisting policy-making realities is not an ad hoc construction of academicians trying to elegantly describe why policy innovations do or do not work. Instead, the existence of multiple coexistent policy realities is an important empirical fact that is often neglected or obscured by researchers bent on hammering their observations into a single, rather flat theoretical perspective. The manager or analyst who conceives of policy-making in terms of the thin, single-perspective views presented in the literature is apt to misperceive the richness and thick complexity of real decision-making situations and produce simplistically misguided policy modeling efforts that will have little impact on real decision processes.

Claiming that there are multiple coexistent policy realities is not claiming that these different realities are disjoint and without interesting points of tangency with other views of the policy process. Each separate reality is constructed from a distinctive theoretical perspective and bolstered by different types of evidence. Each reality treats different concepts and variables. Each reality covers different bodies of evidence. Taken together, multiple perspectives explain more evidence and provide a richer and more detailed view of how to manage policy modeling precisely because each perspective treats different aspects of the policy process--each perspective creates a different policy reality.

But the claim to multiple realities is a disturbing one. One is left with a nagging feeling that there must be a more fundamental underlying reality of which these different "policy realities" are just several snapshots of the same thing taken from different points of view. If such a more fundamental and unified policy reality does in fact exist, twenty years of research into decision making has not been able to make the slightest inroads toward its discovery. In fact, the past twenty years of research has accentuated a sense of multiple, fractured decision-making realities. In any case, speculation about the nature of a more fundamental policy reality is almost metaphysical speculation. At present, pragmatic observations of the available bodies of theory and close observation of detailed case studies mitigate in favor of retaining a view of policy making as constituted of multiple, coexistent policy realities with interesting and important points of tangency and overlap.

Broader Implications of Multiple Perspectives for Applied Social Research. Finally, at its broadest level of conclusions, the research

ends with the observation that the problem of better managing policy modeling within bureaucracies belongs to a more general class of problems--namely problems dealing with how to manipulate, control, or improve the performance of complex social processes that can be interestingly described from more than one theoretical perspective. The research proposes, by inference, that the existence of multiple coexisting realities must be an important empirical fact in arriving at improved understandings of how to better manipulate, control, or improve the performance of this general class of phenomena.

For example, the analyst who wants to improve organizational decision making by intervening with a mathematical model would do well to conceive of his task in terms of several realities defined by several different theoretical perspectives (rational, organizational, and cognitive theories of decision making, for example). Similarly, a teacher who wants to improve learning among his or her students by changing teaching styles would do well to conceive of his or her task in terms of several different "learning realities" defined by several different theoretical perspectives on the process of learning (for example, behaviorist, developmental, or experiential theories of learning).

In general, researchers and practitioners who are interested in better managing or controlling complex social processes that may be interestingly described from several theoretical perspectives would do well to conceive of their tasks in terms of several separate but interrelated "social realities" defined by the several different possible theoretical perspectives on the process under study.

1.5 NOTES FOR CHAPTER ONE

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CHAPTER TWO

THEORETICAL FOUNDATIONS

No single theoretical perspective dominates the study of bureaucratic decision making. Many disciplines ranging from economics to political science and cognitive psychology consider the description of decision processes to be within their bailiwick, and each of these theoretical perspectives creates a distinctly different view of what decision making is about. Rational perspectives are highly normative detailing how both individuals and organizations should behave to make best decisions. Psychological theories focus on understanding how individuals process information, respond to stress, and rely on their own intuitions and feelings to make decisions. Organizational theories explain decision outcomes in terms of the pressures and incentives created by the routine functioning of a large and often cumbersome bureaucracy.

An additional layer of theoretical complexity is added when the focus narrows to how mathematical models interact with bureaucratic decision making. The literature on mathematical modeling is alive with discussion over the criteria for defining valid and useful models.¹ Recently, an extended body of literature has emerged around the so-called implementation question--a discussion of how to translate model-based recommendations into real world policy outputs.²

Since this study explores strategies for better managing model-based policy design projects within public sector bureaucracies, the questions raised above concerning theory will have to be addressed.

2.1 PRELIMINARIES

This chapter, designed to explicate the theoretical foundations of the research, has six broad objectives:

- 1) To give a feel for the texture of the decision-making literature.

The past twenty years have seen a rapid expansion of the literature, both theoretical and empirical, studying decision making. Several trends have emerged from this complex and inter-disciplinary field of research. The major trends in the literature on decision making will be traced, laying the foundation for the perspective taken in this research.

- 2) To explain the use of methodological priors as an organizing concept.

Mathematically based approaches to policy design differ from non-quantitative approaches in that they rely upon methodologies whose fixed form imposes certain broad constraints on the final form of the analysis. Some of the advantages and disadvantages of relying upon methodologies that are based upon subtle prior views of the world are briefly discussed.

- 3) To sketch the three theories chosen to guide the study. As outlined in the introduction, this research does not rely upon a single theoretical view of the decision-making process. Instead, it employs three different views of decision making (rational, organization, and cognitive). The literature supporting each of these views is briefly reviewed and a series of propositions summarizing the essence of each perspective will be crystallized from the review.

- 4) To derive some initial propositions to guide the empirical investigation. Based upon the three reviews of the literature and the methodological priors of the system dynamics approach, a series of initial pro-

positions will be derived to serve as guides through the empirical research. Later as the evidence from the case is combed and analyzed, these initial propositions will be modified and enriched to reflect the learning that occurred during the case study. The initial, naive propositions are presented for two reasons. First, these propositions give a clear picture of what the case study was designed to accomplish; these propositions are the prior filters that guided the selection and analysis of evidence in the case study. Second, by serving as a type of theoretical baseline, these original propositions can help to gauge what was learned from the case. By comparing the naive propositions derived only from the consideration of theoretical questions with the final modified propositions reflecting empirical corroboration, it will be possible to determine how the evidence has extended the original theory.

5) To motivate the selection of the three perspectives. Three perspectives were chosen. Implicitly, other perspectives were omitted when the three were chosen. Some justification will be given for the selection of rational, organizational, and cognitive perspectives.

6) To characterize differences in orientation between the perspectives. Each of the three perspectives chosen represents a quite different view of the basic character of organizational decision making. Each perspective emphasizes different types of evidence and leads to quite different implications concerning the roles of models as aids to decision making. Some of these differences in orientation will be highlighted briefly.

2.2 STRUCTURE OF THE DECISION-MAKING LITERATURE³

Historically, the field of decision making has gone through several stages. These stages can be characterized as 1) preoccupation with the rational, 2) critiques and extensions of the rational tradition, 3) creation of fully articulated alternatives to the rational and, finally, 4) a multi-perspective view of decision making. In the early 1950's the decision-making literature was preoccupied with rationality--either in the form of a political "single-actor" rational organization or as a rational economic man. This view saw that "decision is a deliberate act of selection by the mind, of an alternative from a set of competing alternatives in the hope, expectation or belief that the actions envisioned in carrying out the selected alternative will accomplish certain goals."⁴ The decision maker was seen as having the capability of looking at all possible choices and outcomes, weighing each, and then making an optimal decision based upon these deliberations.

Critiques and extensions of the rational tradition began to appear in the next phase of decision -making literature as scholars realized that neither man nor his organizations were capable of making decisions which took into account all possible alternatives, assessed all possible outcomes, and selected the optimal among such alternatives. Herbert A. Simon, for example, in Models of Man: Social and Rational, collected his essays which were "concerned with laying foundations for a science of man that will accommodate comfortably his dual nature as a social and as a rational animal."⁵ He aimed to "set forth a consistent body of theory of the rational and nonrational aspects of human behavior in a social setting."⁶ Although

not totally rejecting the rational point of view, he extended his ideas to include man as a social as well as a rational being.

In the next stage of decision-making literature, there was the preliminary articulation of full-fledged alternative views to the classical rational tradition. Some of the extensions of rational theory had moved so far away from the original concept of rationality that they could no longer be considered modifications--they were entirely new views. Richard Cyert and James March, for example, introduced an organizational theory of decision making in A Behavioral Theory of the Firm that was to replace the neo-classical economic theory of the firm.⁷ Synder, Bruck and Sapin posited an alternative political science theory of international decision making in Foreign Policy Decision Making: An Approach to the Study of International Politics.⁸ The rational theory was either totally put aside in favor of these other views, or modified so substantially as to no longer be a purely rational view. Several decidedly non-rational views of the decision-making process grew out of the literature of cognitive and perceptual psychology.⁹

As these alternate views of the decision-making process began to emerge several attempts were made to integrate them. Finding a sense of fragmentation in multiple theories of decision making, scholars wished to reunite the field. One method of doing just this was to produce a reader which brought together articles of various schools of theory.¹⁰ Another method was to create a review article which would survey the field, showing the various theories which were in the literature.¹¹ Finally, other writers produced monographs which attempted to produce an integrated whole. However, these works appeared to promote integration more by a unified writing style

emphasizing some points of tangency rather than by a genuine unification of the multiple perspectives.¹²

Finally, in 1969 Graham T. Allison articulated a multiple perspective approach to the study of decision making. It seemed too premature to bring all the ideas together; instead each of the competing schools of thought should be more thoroughly examined in its own right. More time had to be spent looking at each of the theories and their assumptions. The various theories needed to be empirically tested on the same case to see exactly what differences were implied by each of the separate perspectives. He proffered the idea that "different analysts, relying predominantly on different models, produce quite different explanations which should encourage the analyst's self-consciousness about the nets he employs."¹³ In other words, there is not one theory, the theory, but decision making is multi-dimensional and the analyst needs multiple lenses, or points of view, in order to better understand the many complexly intertwined dimensions of the decision-making process.

In 1971 Allison made an explicit elaboration of the multiple perspectives idea in The Essence of Decision: Explaining the Cuban Missile Crisis.¹⁴ The notion of explicit and contrasting theories or models of decision making began to receive attention in several fields of inquiry. John D. Steinbruner in The Cybernetic Theory of Decision also employed and elaborated upon this multiple perspective idea.¹⁵

The notion of a multi-perspective approach to decision making is attractive on several levels. At the theoretical level, besides encouraging analysts to be self-conscious about the nets they employ, the consideration

of multiple perspectives leads quite naturally to considerations of overlap and gaps between several views. The implicit comparisons and dialogue between various perspectives lead to a sort of cross-theory tension that can serve to enrich the individual theories by highlighting points not covered or points of conflict between several perspectives. Eventually, the co-existence of multiple perspectives can serve to catalyze careful integration across the several perspectives.

At the empirical level, the use of a multi-perspective approach provides an interesting variation on traditional research methodology. The traditional approach to theory building is to take a single theoretical perspective and to examine it under as many different cases as possible. A multi-perspective approach opens the possibility of concentrating on fewer cases but using several different theoretical lenses to gain many different views of those cases. Such an approach draws closer attention to the empirical methods being used in the investigation since each uses different and often disjoint bodies of evidence in support of its premises. It is difficult to avoid the observation that one theory explains one body of evidence quite well but can not explain other bodies of evidence as well as another perspective. The incompleteness and overlap between the various perspectives, so apparent at the theoretical level, also reappears in the different types of evidence that can be well explained or covered by each perspective.

Finally, at the normative level, the multi-perspective approach exposes the often implicit normative content of the individual theories. For example, the rational theory is rather blatant in inferring what constitutes

good and bad decisions and what one should or should not do to attain good ones. On the other hand, the organizational perspective appears on the surface to be descriptive, avoiding assertions about what constitutes good and bad decisions. However, by comparing a rational analysis with an organizational analysis of the same decision sequence, it is difficult to escape the realization that the organizational theory does lay down subtle definitions of what constitutes better decisions. We shall return to this rather thorny question of the normative implications of the various perspectives later.

2.3 METHODOLOGICAL PRIORS

Having decided on a multi-perspective approach to theories of decision making, we are left with the problem of theoretically characterizing how mathematical models interact with the decision-making process. We need some theoretical notions that will allow us to distinguish model-based policy analysis from policy analysis based on clear thinking alone. This distinction is not an easy one to make.

Mathematical policy-making models are similar to non-quantitative analyses in many ways. The success of both types of policy analyses will very much depend on the creativity, organizational insight, and the composition of the policy generating team. Both types of analyses may be based upon theories drawn from several disciplines. For example, a quantitative as well as a qualitative analysis may be based in economic, political, organizational, or "systems" theory. The impact of both types of analyses will depend upon factors such as the importance of the problem being addressed, the timeliness and incisiveness of the policy conclusions, the means by which conclusions are communicated within the organization, and the ability of the organization to implement policy changes. In fact, in most aspects, quantitative and qualitative analyses are similar.

Quantitative analyses differ from qualitative analyses in that the former represent social realities in the form of mathematical expressions as opposed to less rigorous verbal expressions. These mathematical expressions may take on many forms, such as a closed functional form, a set of logical propositions, or a computer program. In general, it is possible to express a highly abstract functional form that summarizes the generic

form of a given methodology. For example, the generic least-squares regression problem would be formulated as

$$\text{Min}_{\text{all } \underline{\theta}} (\hat{\underline{Y}} - \underline{Y})^2$$

$$\hat{\underline{Y}} = \underline{F}(\underline{\theta}, \underline{X})$$

where one searches for the parameter vector, $\underline{\theta}$, that minimizes the squared residuals between the predicted value of \underline{Y} , denoted $\hat{\underline{Y}}$, and the observed \underline{Y} . The predicted $\hat{\underline{Y}}$ is computed as a function, \underline{F} , of the parameters, $\underline{\theta}$, and the observed independent variables, \underline{X} . Likewise, the generic system dynamics problem could be formulated as:

$$\underline{R} = \dot{\underline{L}} = \underline{F}(\underline{L}, \underline{\lambda})$$

where \underline{R} is a vector of rates associated with each level. These rates, in turn, are some nonlinear function, \underline{F} , of the levels, \underline{L} , and a vector of parameters, $\underline{\lambda}$ ($\underline{\lambda}$ may include the parameterization of table functions).

The analyst who sets out to complete a study within the framework of a given methodology knows in advance that his final product will conform to a certain generic form such as those sketched above. These "known in advance" aspects of mathematical policy analyses techniques are also known as the methodology's priors.¹⁶

The use of priors within quantitative social models is at once their principal strength and a major limitation. Strong prior notions concerning social structure allow the mathematical analyst to construct penetrating and holistic images of social reality. Guided by a theory of social structure (or other methodological priors) he is led quickly and easily to discern important and novel relationships that may have escaped the non-quantita-

tive, intuitive analyst.

The precision, clarity, and ease of conceptual manipulation of mathematical models also allows the analyst to logically scrutinize and present his policy recommendations in an unambiguous manner. However, this insight, analytic power, and precision of presentation is bought at a price. The mathematical model presents an image of reality that is strongly colored by the methodological priors of the technique employed.¹⁷

The research begins with the premise that mathematical policy models are distinguished from non-quantitative analyses by their strong reliance on methodological priors. Later on, this sharp distinction between the formal modeling aspects of policy design and the ordinary clear thinking aspects of policy design will have to be relaxed. For in reality, the model building activities of analysts blur indistinguishably into the more informal analyses of managers who must make decisions based upon intuitions and hunches, constrained by numerous organizational and psychological factors. However, for now we shall retain this crisp characterization of mathematical modeling both because it highlights the distinctions between quantitative and non-quantitative analyses and is an accurate reflection of the theoretical predispositions that guided the research as it entered the empirical phases. By presenting the original perspective of the research as a baseline, it will be possible to more accurately judge how the original theoretical notions guiding the research have been modified and enriched through interaction with the case study.

Although methodological priors may be understood by a mathematician in terms of the generic form of the methodology's equations as outlined

above, it is useful to elaborate the priors in less general terms. For example, several of the specific priors of the system dynamics methodology are presented below.¹⁸ The purpose of this section is not to fully articulate all of system dynamics' methodological priors. Instead the purpose is to present several examples of the more commonly agreed upon priors as they appear in the literature.

System dynamics models deal with crisply defined problems. System dynamics modeling consists of isolating the dynamic structure that causes a certain problem behavior within a system. Without a well-defined problem, it is not possible to decide which elements of structure to include or exclude from the study.¹⁹

The System Boundary is drawn large enough to include all of the structure causing the problem behavior. No exogenous inputs will be necessary in order for the final system structure to replicate the observed problem behavior.²⁰

System structure is composed of a finite (and small) set of aggregate system levels, the levels' rates of change, and precisely specified feedback relationships between the levels and rates. System dynamics is based upon a theory of social structure that posits information feedback between system levels and rates as the underlying cause of system behavior over time.²¹

Every variable, parameter, or constant in a system dynamics model corresponds to observable phenomena. In a well-constructed system dynamics model, arbitrarily defined variables and constants do not appear.²²

(The above listing of priors is not meant to be exhaustive but rather illustrative of what is here referred to as methodological priors.)

2.4 THREE VIEWS OF MODELS AND DECISION MAKING

The particulars of each of the three perspectives serving to guide the empirical investigation were developed in three steps. First, based on an assessment of the case under study, three perspectives were chosen (rational, organizational, and cognitive). This choice was based upon both the characteristics of the case as well as the properties of the theories chosen. After the three perspectives have been presented and more fully discussed, the justification for their selection will be discussed further.

Second, a synopsis of each of the chosen perspectives in the form of a set of linked propositions was crystallized from the literature. To some degree, this summarizing process must create a caricature, reducing a richly elaborated body of theory to a few summary propositions. However, such a procedure also highlights the few concepts that shall form our focus of attention. At a later time and if the evidence warrants it, the original theory may be enriched and enlarged.

Finally, a second set of theoretical propositions were derived. These propositions, based upon the summary of the perspective as well as the statement of methodological priors, give a first approximation of how model fit into the decision-making processes depicted by the chosen perspectives. Since these propositions are based only on careful thinking about the literature and methodological priors and do not reflect any exposure to evidence, we call these "naive" propositions. These naive propositions will be modified and enriched based upon the case study, eventually leading to normative suggestions concerning how to better manage modeling projects in bureaucracies.

Since we expect these naive propositions to be substantially modified, we shall limit them to only a simple few, thereby gaining a set of clear guideposts for directing the research.

The Rational Perspective

The first theory of decision making to be presented will be the rational one. This theory is the dominant view within the literature and has been succinctly summarized many times.²³ A brief caricature of some of the dominant aspects of the rational theory follows:

Alternatives. The rational theory usually begins with an explicit articulation of the range of alternatives under consideration. Usually, the alternatives are imagined to be exhaustive, but recent modifications of the theory allow for the range of alternatives considered to be constrained by the cost of seeking information.²⁴ Specification of the complete range of alternatives is nearly equivalent to specifying the boundary of the problem under consideration.

Consequences. Some assessment must be made of the consequences of various alternative policies. Many techniques for assessing consequences exist, ranging from simple subjective estimates of probable outcomes to complex system simulation exercises. All of these techniques attempt to eliminate uncertainty in the estimation of alternative outcomes.²⁵

Goals and Objectives. Alternatives and their consequences must be measured against some goals or objectives that imply an underlying set of values. Notions of utility theory treat many of the thorny problems of value explicitly.²⁶ Other analytic techniques concentrate on the explication of alternatives and consequences and leave the value question implicit

within the analysis. All techniques tend to force commensurability between conflicting goals and objectives. Either implicitly or explicitly an attempt is made to reduce various alternatives involving trade-offs to one or more common metrics.

Choice. Rational decision making consists of choosing between the universe of possible alternatives given a comprehensive analysis of outcomes and values. Choice mechanisms tend to force trade-offs. They may be explicit (such as optimizing routines) or they may be left to the informed discretion of the decision maker.

Collective Decisions. Within the analytic paradigm, organizations are viewed as a single rational actor. Joint decisions are made through the consensus of reasonable men agreeing on a common definition of alternatives, outcomes, and, hopefully, values. Explicit public calculations aid in arriving at public consensus.

Problem Boundary. An important aspect in the selection of alternatives is the precise articulation of the common problem under study. The universe of alternatives is constrained to those that address a specific problem. If rational solutions fail, this is often due to an inappropriate selection of problem definition or boundary. Analysis proceeds as an iterative process whereby experience gained in the past attempts at solutions leads to a more sharply defined problem or a more inclusive boundary of alternatives.

Given even such a brief description of the analytic paradigm, it becomes apparent how mathematical models in most all of their forms tend to directly support all of the decision-making processes. In fact, if one examines the methodological priors of mathematical modeling, it becomes

clear that the modeling process is none other than a formalization of the decision-making process as articulated within the rational paradigm.

To be sure, practitioners of different analytic paradigms claim that certain of the decision-making functions are more crucial than others and that their techniques, which address themselves to those crucial functions, are most germane for certain problems. For example, system dynamicists assert that the articulation of consequences must rest upon an understanding of a system's feedback structure and the system's characteristic behavior that is a function of that structure. On the other hand, regression analysts would argue that the specification of consequences should be based upon relationships derived from measurable variables. Even with these open differences concerning how outcomes should be assessed, practitioners of both methodologies subscribe to the view that alternatives should be exhaustively explored before policy decisions are made.

Math Models and the Rational Theory

Based upon the above brief summarization of the rational perspective and the discussion of methodological priors, it is possible to deduce a set of naive propositions detailing how a strategic system dynamics model can support rational decision making. These propositions will guide the rational telling of the case story.

Highlights Problem Definition. The system dynamics modeling process begins with explicit hypotheses concerning a system's behavior and its causes. These initial definitions of reference mode (behavioral hypotheses) and dynamic hypotheses (structural hypotheses) lead to a crisp definition of the system's boundary. Great care must be taken to include all of the

variables that might cause the problem behavior within the boundary of the system under study. These explicit prior rules concerning boundary selection make system dynamics well suited to help organizations isolate specific problems and the forces that are causing those problems.

Evaluates Consequences of Alternate Policies. Alternative policies may be explicitly represented in the formulation of system rates. The system dynamics theory of social structure insures that all such policy points will be embedded in a complex web of feedback relations. One of the relative strengths of the system dynamics methodology is its ability to clearly show the impact of policy alternatives on a system's behavior over time.

Explicitly Presents Trade-offs. A frequent property of complex feedback systems is that improvements in one variable's performance result in deterioration of another variable. Because system dynamics models treat all of the feedback believed to cause a system's behavior, these trade-offs will be captured explicitly and easily by the system dynamics prior rules of structure.

Forum for Collective Decision Making. Because of system dynamics's a priori emphasis on making all variables observable, decision makers can quickly grasp the intuitive meaning of the model's equations. Decision makers can then modify aspects of the model's structure so that it more closely conforms to their own intuition concerning system structure. Consequently a system dynamics model provides an excellent forum for the articulation of decision makers' otherwise implicit mental models.

If organizations do indeed set social policy according to the rational model of decision making, then there can be little theoretical doubt that

mathematical models in general and system dynamics models in specific would be of great value in policy making. The near congruence between principles of model building as embodied in methodological priors and rational decision making all but insure the implementation and use of formal mathematical models in the setting of social policy.

Unfortunately, much empirical work casts doubt upon the validity of the rational theory as an explainer of bureaucratic decision making. Alternative theories of decision making outline process and functions quite dissimilar from the simple alternative, consequences, value and choice defining functions of the rational model. As theories of decision making vary from the rational, theoretical descriptions of what one should expect from mathematical models become less obvious, more subtle, and indirect.

The Organizational Perspective

The organizational theory of decision making provides the most coherently articulated alternative to the rational theory. The recent antecedents to this body of thought are found in the early works of Chester Barnard²⁷ and Herbert Simon.²⁸ The theory received continuing development at the Carnegie School in the late 50's and early 60's.²⁹ The first complete expression of the theory is contained in Cyert and March's Behavioral Theory of the Firm.³⁰ Subsequent theoretical work has expanded the theory from private firms to the public sector.³¹ Recently, the theory has received much empirical corroboration. Most recently, Steinbruner has explicitly linked the organizational paradigm with feedback concepts under the rubric of "cybernetic decision theory".³²

A summary of the major principles of the organizational or cybernetic

paradigm of decision making is presented below:

Multiple Actors and Parochial Interests. Policy is set by a coalition of organizational actors all of whom are pursuing a parochial set of interests and priorities.³³ The fracturing of organizational responsibility and interests inherent in this model stands in sharp contrast to the single rational actor or collective decisions of the analytic paradigm.

Goals as Constraints. Organizations do not form goals that are in some sense commensurable. Instead, they tend to monitor a few key variables and take corrective action when the performance of these variables differs from some desired state. In essence, organizational goals are a series of "don't go below or above" constraints.³⁴ As long as the organization's performance rests within acceptable limits, the organization continues to function on an even keel. Constraints associated with a particular organizational actor may be "active" or "passive" depending upon a number of factors.

Sequential Attention to Goals. Since goals are really a set of more or less independent constraints, organizations will tend to pay attention to goals one at a time.³⁵ That is, organizations will pursue a "grease the squeaky wheel" theory of management. Since goals are not considered simultaneously, trade-offs between goals will not receive explicit attention.

Standard Operating Procedures. Each organizational component is only capable of executing a limited number of standard procedures or programs. The range of possible policy options is usually defined by the narrow range of policy responses available to the organization.³⁶ In general, standard procedures respond to only a few variables and cannot adapt to a wide variety of circumstances.

Decomposable Environments. Ordinarily, the organization functions by assigning one sub-unit to monitor some single aspect of its environment. Since each sub-unit is dealing with only one or two factors in the organization's environment, it can afford to develop stable procedures and programs to deal with the limited variability in its sector of this environment.³⁷ Of course, if the organization's environment is highly inter-coupled or changes rapidly then stable organizational procedures will be dysfunctional.

Problem Directed Search. When an organizational sub-unit deviates from a constraint goal, it will initiate a search for solutions. In general, the search for alternatives tends to be simple minded, usually searching those alternatives nearest to current policies. The search sequence does not attempt to be complete nor to value the various alternatives. Instead a limited number of satisfactory alternatives are uncovered and simple choices are made.³⁸ Within this "satisficing" model of search, the order in which alternatives are generated strongly influences which alternative is chosen.

Information Screening. Nearly all aspects of the policy setting process are in part determined by how information flows through the organization. Goal attention and problem search mechanisms are critically sensitive to what information is available to key actors when. Hence, how information is channeled becomes critical to how policy becomes formulated.³⁹

Negotiated Environment. Organizations do not attempt to predict the consequences of their actions far into the future. Instead they tend to take short run actions and then make corrections based on feedback from the environment. Long range policy shifts result from the accumulation of

rapid incremental shifts in goals as organizational sub-units interact with a relatively narrow portion of the environment according to relatively fixed operating procedures.⁴⁰

Limited Flexibility. Because organizations adapt to their environments incrementally through slight modifications in their standard operating procedures, they will only be capable of slow adjustments with limited flexibility. Policy alternatives that recommend changes that differ widely from existing routines or require co-ordination of several organizational sub-units are not likely to be successfully implemented.⁴¹

Math Models and the Organizational Theory

The math modeler working within a cybernetic organization finds that his analyses are used to support policy making in much less direct and more subtle ways. Several key policy-making functions are not directly treated at all by his analysis. For these functions, he must supplement his analysis with a good portion of his own non-quantitative intuition concerning organizational processes. There is an uneasy lack of congruence between the fractured and parochial world of the cybernetic bureaucracy and the more detached and well-ordered view of that world taken by the math modeler. A set of propositions outlining how a system dynamics model should be expected to support organizational policy making is presented below. These naive propositions will guide the telling of the organizational story in Chapter 5.

Focus Attention on Inactive Goals. Organizational goals, or the constraints recognized by the organization, may be either active or passive. Which constraints are being actively pursued will depend upon the particular

focus of the policy setting coalition. By focusing explicitly on a cluster of well defined problems (and presumably these problems are key problems) a system dynamics modeler can keep the organization aware of some more long range goals. Normally these goals may be perceived to be less urgent because the organization is working in a short-run time frame, or because some of the long range negative effects of policies have not yet fed back through the whole system.

Sequence of Goal Attention Ignored. One of the most important aspects of policy making involves how management divides its time and attention between several competing constraints. These constraints may be high level strategic considerations, lower level snags in operational routines, or unanticipated "crises". Because a system dynamics model focuses on a cluster of well-defined problems, it can give no explicit help to managers who must intuitively decide on how to divide their attention between multiple competing constraints.⁴²

Provides Guidelines for Problem Directed Search. When a problem arises, organizations search for alternative policy solutions in close proximity to existing policy solutions. Once a policy is discovered that is satisfactory (but not necessarily optimal), the search ends. Hence, the order in which alternatives are generated becomes an important determinant of the "goodness" of the final policy. System dynamics models provide explicit causal explanation of the causes of problem behavior. If problem directed search starts with a problem treated within a model, the model should be useful in discovering best policy solutions.

Aids Organizational Processing of Information. The availability of information is important to determining how organizations set policy. The content, timeliness, and routing of information are all important variables in determining how an organization focuses its attention and searches for alternatives. Because system simulations contain explicit information flows, they can isolate which streams of information are critical to policy-setting functions by simulating policies based upon differing information flows that may have been biased, delayed, or distorted. The results of such policy simulation should be helpful in defining new programs and procedures for the routine routing of information through the organization.

Ignores Short-Run Feedbacks. A strategic model that can capture the underlying long-term causal feedbacks causing system behavior will characteristically ignore short-run effects whose behavior can change three, four, or more times more quickly than the problem behavior. This neglect of short-run effects is justified by the modeler's prior knowledge of how system structure determines system behavior.⁴³ As noted above, one of the primary functions of organizational policy setting is the negotiation of uncertainty in the organization's environment via short-run feedback. A strategic model will characteristically be unable to explicitly aid in negotiating uncertainty in the environment. Conversely, a model designed to simulate short-run adaptive behaviors will not be useful in analyzing strategic options.

Aids Development of Inter-Agency Policies. A model that includes all of the structure necessary to generate problem behavior will often draw its boundaries large enough to encompass the activities of several agencies.

Such models will tend to generate policy solutions that transcend the responsibility of any single agency.

Tends to Develop Infeasible Policies. Models whose boundaries contain all problem generating structures will tend to generate infeasible policy recommendations because they require coordination of multiple agencies.⁴⁴ Furthermore, since strategic policy models often contain aggregate formulations of standard operating rules and procedures, the analyst may unwittingly formulate apparently reasonable policies that strain the organization's ability to adapt.⁴⁵

The preceding examples and propositions present a more complex and puzzling image of what one should expect from strategic system dynamics models. The technique's methodological priors lead the analyst to build models that should be useful to an organization by focusing on important but inactive goals, guiding problem directed search, aiding in organizational information processing, and aiding in the development of inter-agency policies. However, these same methodological priors will tend to produce analyses that are ill-adapted to aiding in certain key policy-making functions. Specifically, the models will tend to ignore how managers split their time among all of the concerns facing them or how managers negotiate uncertain environments through short-run feedbacks. Furthermore, the model will have a tendency to generate infeasible policy solutions.

All of these relative strengths and weaknesses have been generated by examining only the methodological priors of the system dynamics technique as they interact with the cybernetic theory of decision making. Presumably a similar pattern of pluses and minuses would emerge had the prior of a

different method been used as the basis for discussion. An interesting topic might entail the relative trade-offs that occur between two or more methodologies. However, such an undertaking is beyond the scope of this research effort.

Finally, it should be emphasized that all of the tendencies noted above are just that -- tendencies. The positive tendency to provide guidelines for problem directed search might be negated by non-insightful modeling practice, improper positioning of a model within the organization, or a host of other factors. Likewise a tendency to generate infeasible policies needs not be fatal. A skilled modeler working with a well-constructed policy task force will know how to compensate for these tendencies toward infeasibility.⁴⁶ Hence, by taking an organizational view of the policy-making process, it should be possible to generate some rules of thumb that will be useful in better managing model-based policy design projects.

The Cognitive Perspective

A third theory of decision making focuses on how individual decision makers think and how they interact in small groups. This third theory is based upon several independent bodies of loosely interwoven experimental and theoretical evidence. Three threads of evidence will be tapped to synthesize a cognitive theory of decision making. The first body of evidence investigates how the human mind responds to choice situations and recalls information under conditions of uncertainty. Although these experiments were conducted under laboratory conditions, many of their results are compelling enough to allow generalizations showing how decision makers process information and choose among alternatives in more complex bureaucratic

environments. Steinbruner has succinctly summarized the implications of experimental cognitive psychology for organizational decision making.⁴⁷

The second body of evidence examines differences between individual decision makers with respect to their styles of decision making and information processing. Key concepts within this body of theory are cognitive styles and the cognitive filtering of information available to decision makers. Keen has outlined the importance of cognitive style on the design of MIS decision support systems.⁴⁸ Steinbruner has also suggested that much of the experimental cognitive evidence may be summarized by three archetypical styles of bureaucratic decision making.⁴⁹

The final body of evidence investigates certain key interactions between individuals and their peers as well as the impacts of these interactions on the decision-making process. This body of theory argues that small groups tend to construct idiosyncratic and simplified images of reality that become the basis for collective decision making.⁵⁰ The existence of socially constructed and shared realities reduces the cognitive strain on individual decision makers who must face complex and uncertain situations. Shared perceptions of reality reduce a sense of uncertainty. Furthermore, mutual reinforcement within the group allows individual decision makers to pursue less than certain alternatives with conviction.⁵¹

Several key traits of the cognitive theory of decision making are presented below. These key points serve to outline the scope and specific focus guiding the initial empirical research.

Limited Information Processing Ability. A recurring result of experimental cognitive psychology is the limited ability of the human mind to

process simultaneous bits of information. After reviewing the experimental evidence, Miller concludes that seven pieces of information (plus or minus two) seems to be about the limit to human information processing capacity.⁵² Decision makers who must weigh multiple alternatives, probabilities, and consequences in a complex and uncertain environment will quickly saturate their minds' ability to process information and decide. Yet decision makers routinely do make decisions under immense amounts of complexity and uncertainty. The cognitive theory describes many of the techniques that our minds use to simplify alternatives and streamline the flow of information so that decisions can be made within the limited confines of human thought.

Inferential Memory. Cognitive experiments have demonstrated that our minds neither store nor recall information in a passive fashion. The human mind continually strives to impose stable and consistent patterns upon experiences of all sorts. Information that is incongruent with our prior cognitive maps will tend to be filtered out of our perceptions or selectively eliminated from recall. Steinbruner has outlined three principles that influence patterns of concept formation: consistency of memory and recall; simplicity and stability of memory and recall; and a principle of reality that checks recalled patterns against current perceptions.⁵³ That is, the human mind's tendency to store and recall images that are consistent with past experiences is a powerful and adaptive cognitive tool that allows the human mind to deal with complexity.

Choice Based on Focusing, not Scanning. Bruner has identified two distinct methods that experimental subjects use in identifying fixed color or number patterns from long sequences of playing cards presented in some

order.⁵⁴ The first method, scanning, involves an attempt to be comprehensive and to scan all or most of the items in the series before attempting to infer a pattern. The second method, focusing, involves rapid focusing on a hypothesis concerning the pattern in the series. Subjects then jump from one focus to the next until the correct pattern is uncovered. Some subjects employed combinations of scanning and focusing strategies, and some subjects tended to focus in a random, disconnected pattern.

In general, scanning strategies tended to be inefficient. Attempts to comprehensively scan broke down quickly as the length of the series increased. The more effective strategies usually involved rapid and simple-minded inferences concerning patterns with frequent marginal changes in these guesses based upon the last few draws of cards.

Extrapolating from Bruner's experiments to more complex decision-making situations, one would expect that decision makers would not tend to make full use of repeated and patterned series of events via a comprehensive, scanning process. Instead decision makers would tend to focus on relatively simplistic hypotheses concerning the process at work and adjust these focuses only incrementally. Furthermore, one should expect that the particular focus chosen will be consistent with the decision maker's past experience and that hypothetical inferences will tend to be cognitively simple and fairly stable.

Steinbruner has suggested three simple mechanisms that decision makers often use to focus in inconsistent and uncertain situations--arguments based upon simple (and usually favorable) extrapolations of current events, arguments based upon vivid images and analogies, and arguments based on a strong

desire to avoid a negative outcome.⁵⁵

The four key concepts described above--limited information processing ability, inferential memory, separation of values, and focus based choice--depict the workings of human cognitive processes that continually strive to impose simplicity and stability upon complex situations so that they become tractable for treatment by human minds. A theory of bureaucratic decision based upon these cognitive principles would argue that the key functions of organizational decision making must be understood in terms of these principles that guide decisions at the individual level. A theory that attempts to delineate how mathematical models may be used to support organizational decision making must assess how policy models tend to reinforce, negate, or modify the cognitive process of key decision makers. Before proceeding to outline such a cognitive theory of how mathematical models support organizational decision making, we must first examine several additional factors that appear crucial to explaining how individuals make decisions under uncertainty.

Small Group Interactions. Steinbruner has identified reinforcements from peers as one of the key factors contributing to the stability of perceptions and the ability to resolve uncertainty in a complex environment.⁵⁶ In fact, strategies for organizational change or even brainwashing often involve the separation of individuals from familiar peer group reinforcements in an attempt to change stable cognitive patterns thereby "unfreezing" ordinary decision-making mechanisms.⁵⁷

The importance of small group functions as a key element in organizational decision can hardly be underestimated. The creation of a task force

to deal with a specified problem creates a solidified perception of the reality of that problem that would not have been possible had various individuals attempted to tackle the same problem in isolation.

Reality Socially Constructed. Berger and Luckman have further extended the importance of small group interactions by arguing that group interactions can actually construct the images of reality that will become the bases for decision making. To a large extent, the alternatives, consequences, and values weighed in the decision-making process will be determined by how group interactions structure or create their images of the decision-making environment. That is, once a social group creates a shared definition of what is important and relevant to a given task or decision, this socially constructed reality takes on an "objective reality" of its own.⁵⁸ In turn, the socially constructed, now objectified, perceptions of alternatives, consequences, and values feed back to reinforce the cognitive maps of individual decision makers. Warren has examined how the commonly constructed and shared images of urban reform have interacted to severely limit the range of options considered possible in the design of the Model Cities program in the late sixties.⁵⁹

Math Models and the Cognitive Theory

If cognitive processes, small group interactions, and socially constructed images of reality do in fact serve important functions in bureaucratic decision making, then a theory of how mathematical models support organizational policy making should examine how the models tend to reinforce, modify, or work against these cognitive and small group processes. Several propositions outlining how system dynamics models should be ex-

pected to support a cognitive theory of decision making are presented below:

Expands information Processing Abilities. One of the principal features of a system dynamics model is its ability to simultaneously track myriad relationships between a large number of variables. This is precisely the area where human information processing is most limited. Skillful use of system dynamics models should allow the decision maker to consider more simultaneous interactions as summarized by the computer's output.

Aids Formation of Images and Analogies. Decision makers often make inferences based upon rather simple analogies. For example, much thinking concerning American foreign policy in Southeast Asia seems to have been dominated by the so-called "domino theory" of communist expansion. System dynamics models provide a rich set of images and analogies centering around the concepts of feedback and accumulations for the comprehension of social phenomena. One would expect that the incorporation of concepts such as time behavior, modes of behavior, and structural causes into decision makers' patterns of thought would be an important result of a system dynamics modeling project.

Counteracts Simple Extrapolations. As discussed above, one of the primary attributes of cognitive decision making is the tendency to focus on simple extrapolations of current trends to understand why events occur as they do or to understand what the implications of proposed policies will be. By arguing that system behavior depends upon causal structure rather than past behavior of the system, the system dynamicist is led to a more sophisticated understanding of what causes system behavior.

Forces Value Trade-offs. Under conditions of uncertainty, the system dynamics methodology forces decision makers to explicitly postulate their best estimates of the causal structure causing the system's performance. Once these best estimates of cause have been made, the model clearly and unequivocally explicates the trade-offs involved in such a structure. Hence, by forcing explicit causal hypotheses, the model counteracts the cognitive tendency to deny the existence of trade-offs associated with a given alternative.

Although forcing trade-offs is a function of the model under both the rational and cognitive theories of decision, there is a subtle difference between the two cases. With respect to the rational theory, the system dynamics model aids the natural organizational process of articulating alternatives. With respect to the cognitive theory, the system dynamics model works to counteract the natural organizational process of denying the importance or even existence of trade-offs.

Impact Depends Upon Social Positioning of Model (and Modeler). By focusing on the importance of social interactions upon the decision-making process, the cognitive theory points to several factors that may enhance or delimit the usefulness of system dynamics models. On the one hand, the model may be used to present a novel set of images, analogies, and trade-offs that may enhance the organization's ability to make decisions that are responsive to an uncertain environment. On the other hand, models that present images of reality that are too far from the stable and persistent shared realities of organizational sub groups will tend not to be used. Such models will face resistance from strong social pressures to maintain shared definitions of social reality.

2.5 REFLECTIONS ON PERSPECTIVES CHOSEN

Before proceeding to describe the case of fiscal policy design within the Division of Special Education, Massachusetts State Department of Education, we pause briefly to reflect on several of the salient features of the theoretical perspective chosen.

Justifying the Three Perspectives Chosen

The number of perspectives chosen--three--was based upon practical considerations of the amount of time and effort necessary to analyze the case from multiple points of view. One perspective could give none of the intriguing sense of overlap between views that motivated much of the study. Two perspectives would allow comparisons and contrasting, but such comparisons seemed rather flat, lacking the third dimension provided by an additional point of view. Adding yet a fourth theory would have enriched the story even more, but the task of drawing four-way comparisons and contrasts can become overly involved and even confusing. The pay-offs gained by considering a fourth perspective did not seem to warrant the added effort necessary.

Given a prior preference for three perspectives, why were the rational, organizational, and cognitive ones chosen? The rational theory is the predominant analytic view of decision making taken in the literature. It is not possible or desirable to ignore the pervasive influence of rational thinking on all studies of decision making. Furthermore, mathematical models approach problems in a decidedly rational fashion. It seemed logical to expect that a rational framework would have good explaining power when exploring the roles of models in bureaucracies.

The study's emphasis on policy making within public sector bureaucracies justifies the selection of an organizational perspective. Furthermore, before the study was undertaken, the author was aware of the fractured responsibility for fiscal decision making within the Department of Education. Many bureaus had some responsibility, but no bureau had overall responsibility for ultimately settling fiscal policy questions. The organizationally fractured nature of the problem area further reinforced the choice of an organizational perspective.

There was some question concerning what the third perspective should be. The most active candidates for the third slot were a bureaucratic politics model as articulated by Allison,⁶⁰ a purely political model, or a form of a cognitive model. The details of the case study helped to make this choice. The author's initial impression was that the needed changes in the funding of special education was not a point of conflict within the Department of Education. The Division of Special Education as well as all other divisions within the department wanted to see the fiscal growth of special education checked. There was no essential disagreement among the varying divisions concerning the desired direction for future special education fiscal policies. That is, by tightening fiscal controls, everyone would win. Because of the "win-win" nature of the fiscal policy area, various versions of a political model did not appear to be especially germane. Furthermore, the literature on mathematical modeling is filled with discussion of the impacts of formal models on the "mental models" of key managers. To investigate these claims, a cognitive model would be especially appropriate.

Unfortunately, the choice of a cognitive perspective on decision making turns out to be a bit tricky. The cognitive perspective is the least well-articulated of the three chosen. As Jervis has noted, there is a tendency among cognitive policy analysts to conduct a few laboratory experiments and then to generalize liberally to situations where top level managers and administrators are engaged in substantial and prolonged decision-making processes with non-trivial pay-offs.⁶¹ Furthermore, many different strands blend together under the rubric of "cognitive decision making" and they have not yet been fully integrated. The naive propositions sketched above certainly contain an unsure tension between three rather distinct views of cognitive processes. As we shall see later, the ultimate emphasis of the cognitive case in this research rests on the concepts of socially constructed and shared realities. The other two strands dealing with small group interactions and the tendency of human minds to simplify complex situations and avoid trade-offs have been considerably deemphasized.

Empirical and Theoretical Overlap Between the Three Theories

As we enter the case study, we should expect to find considerable overlap between the three theories as well as incompleteness within each theory. Each perspective highlights different aspects of the decision-making process and draws upon different bodies of evidence to support its point of view.

For example, at the theoretical level, the rational policy setting bureaucracy is characterized by bounded omniscience. With respect to a given problem the organization considers the universe of alternatives and measures their outcomes before selecting an optimal strategy. The cybernetic policy setting bureaucracy is a multi-headed automaton that displays

amazing virtuosity in responding to a small number of constraining variables. The amazing variability of its responses results from a surprisingly small set of rigid standard operating procedures. The cognitive policy setting bureaucracy is inhabited by decision makers who view the world through strongly colored filters. By continually impressing their own prior cognitive structure on the organization and its environment, they reduce complexity to manageable proportion. The reality of shared cognitive maps are continually reinforced through small group interactions.

For each of these theories, one should expect a system dynamics model to perform quite different functions. Within the rational tradition, the model's function is unambiguous. In fact, modeling is seen to be a formalization of the decision-making process itself. The model explicitly evaluates consequences, presents trade-offs, and provides a forum for collective decision making. Usually, system dynamics models do not explicitly treat values nor present explicit choice mechanisms.

The expected functions of mathematical policy models within the organizational theory are less straightforward. Model building aids decision makers in some not so obvious ways. For example, system dynamics models should aid policy making by focusing attention on active goals, by aiding in the design of information channels, and by helping to develop inter-agency coordination of policies. On the other hand, system dynamic models tend to ignore critical decision-making functions such as sequential attention to goals or short-run feedback tactics designed to negotiate uncertain environments.

From the point of view of cognitive theory, mathematical models should

be most useful when serving as an antidote to over-simplified filterings of reality that arise from the natural propensities of human thought. The model is used to adjust the images, concepts, and analogies that decision makers use to filter experience and make decisions. For example, system dynamics models should help by expanding the mind's information processing ability, by forcing value trade-offs, or by counteracting tendencies to use simple extrapolations. The modeling process is seen to be as much a sociological process as a scientific process. The model will only be useful if it can alter the social processes that construct and maintain the organization's images of reality.

At the empirical level, evidence taken to be crucial corroboration of one viewpoint may be only marginally relevant or even unimportant to another point of view. For example, detailed discussions of how complaints should be routed through the organization may be critical for understanding how routine operating procedures determine policy outcomes. On the other hand, such evidence gives little direct information concerning how alternative policy options are formulated, evaluated, and a choice made between them.

Before the rational, organizational, and cognitive stories about fiscal policy development are told, Chapter 3 presents the background of the special education law and the implementing bureaucracy in the State of Massachusetts. Some of the initial problems with the financing of the law are also explained as background to the case study.

2.6 NOTES FOR CHAPTER TWO

1. See: Jay W. Forrester. "Confidence in Models of Social Behavior With Emphasis on System Dynamics Models," System Dynamics Working Paper D-1967. Cambridge, Massachusetts: M.I.T., 1973 and John Little. "Models and Managers: The Concept of a Decision Calculus." Management Science (April 1970) pp. B466-B485.
2. Michael Jay Ginzberg. A Process Approach to Management Science Implementation, unpublished Ph.D. dissertation. Cambridge, Massachusetts: M.I.T., Alfred P. Sloan School of Management, May 1975, chapters 1 and 2.
3. This section is a somewhat modified and expanded version of the same topic contained in D.L. Andersen and D.F. Andersen. "Theories of Decision Making: An Annotated Bibliography." pp. 3-6.
4. Peter C. Fishburn. "Personalistic Decision Theory: Exposition and Critique" in Henry S. Brinkers, ed. Decision-Making: Creativity, Judgement and Systems. Columbus: Ohio State University Press, 1972, p. 19.
5. Herbert A. Simon. Models of Man: Social and Rational, Mathematical Essays on Rational Human Behavior in a Social Setting. New York: John Wiley and Sons, Inc., 1957, p. vii.
6. Ibid.
7. Richard M. Cyert and James G. March. A Behavioral Theory of the Firm. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963.
8. Richard C. Snyder, H.W. Bruck and Burton Sapin, eds. Foreign Policy Decision-Making: An Approach to the Study of International Politics. New York: Free Press of Glencoe, 1962.
9. See: Robert Jervis. Perception and Misperception in International Politics. Princeton, N.J.: Princeton University Press, 1976.
10. See: Marcus Alexis and Charles Z. Wilson, eds. Organizational Decision Making. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1967.
11. See: Martin Shubik. "Approaches to the Study of Decision Making Relevant to the Firm." Journal of Business 34 (April 1961) pp. 101-118.
12. See: Ronald J. Ebert and Terence R. Mitchell. Organizational Decision Processes: Concepts and Analysis. New York: Crane, Russak, 1975.
13. Graham T. Allison. "Conceptual Models and the Cuban Missile Crisis." Political Science Review 63 (September 1969) p. 715.

14. Graham T. Allison. The Essence of Decision: Explaining the Cuban Missile Crisis. Boston: Little, Brown and Company, 1971.

15. John D. Steinbruner. The Cybernetic Theory of Decision: New Dimensions of Political Analysis. Princeton, N.J.: Princeton University Press, 1974.

16. Glen L. Urban. "An Emerging Process of Building Models for Management Decision Makers," Sloan School Working Paper 591-72, Cambridge, Massachusetts: M.I.T., March 1975, p. 5.

17. For a discussion of how methodological priors can color the conclusions of a policy study, see: David F. Andersen. "How Differences in Analytic Paradigms Can Lead to Differences in Policy Conclusions--Two Case Studies," Proceedings of the Fifth International Conference on System Dynamics. Geilo, Norway, 1976, (forthcoming).

18. For an explicit discussion of system dynamics priors, see: Jorgen Randers. Conceptualizing Dynamic Models of Social Systems: Lessons from a Study of Social Change, unpublished Ph.D. dissertation. Cambridge, Massachusetts: M.I.T., Alfred P. Sloan School of Management, 1973, pp. 43-47. Other statements of priors are scattered throughout the literature.

19. Jay W. Forrester. "Market Growth as Influenced by Capital Investment" Industrial Management Review (Winter 1968) p. 84.

20. Jay W. Forrester. Industrial Dynamics. Cambridge, Massachusetts: M.I.T. Press, 1961, pp. 112-114.

21. Jay W. Forrester. "Market Growth as Influenced by Capital Investment." Industrial Management Review (Winter 1968) pp. 85-86.

22. Alan Graham. "Non-Statistical Methods of Selecting Parameter Values in System Dynamics Models," Proceedings of the 1976 Summer Computer Simulation Conference, (forthcoming).

23. The summary presented below is indebted to the summary chapters in Graham Allison. The Essence of Decision: Explaining the Cuban Missile Crisis. Boston: Little Brown and Co., 1971, pp. 32-38 and John D. Steinbruner. The Cybernetic Theory of Decision. Princeton, New Jersey: Princeton University Press, 1974, pp. 25-46.

24. David Braybrooke and Charles Lindblom. A Strategy of Decision: Policy Evaluation as a Social Process. New York: The Free Press, 1970, p. 40.

25. Alison, op. cit.

26. For example, see: Howard Raiffa. Decision Analysis: Introductory Lectures on Choices under Uncertainty. Reading Massachusetts: Addison Wesley, 1970, Chapter 4.
27. Chester I. Barnard. The Functions of the Executive. Cambridge, Massachusetts: Harvard University Press, 1938.
28. Herbert A. Simon. Administrative Behavior: A Study of Decision Making Processes in Administrative Organizations. New York: Macmillan, 1965.
29. Especially, James March and Herbert Simon. Organizations. New York: John Wiley and Sons, Inc., 1958.
30. Cyert and March, op. cit.
31. For a review of some of the governmental application of the Cyert and March article see Allison, op. cit., p. 78.
32. Steinbruner, op. cit.
33. Cyert and March, op. cit., pp. 26-40.
34. Herbert Simon on "The Concept of Organizational Goal." Administrative Science Quarterly 9 (June 1964) pp. 1-22.
35. Cyert and March, op. cit., p. 113 and Allison, op. cit., p. 82.
36. Ibid., pp. 103-112.
37. Steinbruner, op. cit., pp. 56-62.
38. The first articulation of the problem-directed "satisficing" model is associated with Simon. See: Herbert Simon. Models of Man. New York: John Wiley and Sons, pp. 270-272.
39. Allison, op. cit., p. 90.
40. Cyert and March, op. cit., pp. 118-120 or Steinbruner, op. cit., pp. 65-66.
41. Alison, op. cit., p. 94.
42. A model may normally be thought of as concerned with endogenous, exogenous, or excluded variables. Variables not excluded are selected because they are germane to the model's purpose. This proposition merely states that a model constructed to address a well posed problem can not aid the decision maker in splitting his attention between included and excluded variables.

43. See: Jay Forrester. Principles of Systems. Cambridge Massachusetts: Wright-Allen Press, 1968, principles 10.2-2 (p. 10-9), 10.2-3 (p. 10-14), and 10.3-1 (p. 10-20).

44. Allison notes, "Projects that demand that existing organizational units depart from their established programs to perform unprogrammed tasks are rarely accomplished in their designed form" and "Projects that require coordination of several organizations are rarely accomplished as designed" op. cit., pp. 93-94. Hence, policies requiring inter-organizational coordination tend to be organizationally infeasible.

45. This tendency is appreciated by experienced modelers who self-consciously compensate for it. Roberts notes, "The model may say that policy X is good, but if independent of the model you are able to say that the organization cannot accept so drastic a change, then you must contemplate and come up with some policy Y" (emphasis added), Edward B. Roberts. "Strategies for Effective Implementation of Complex Corporate Models," Paper presented at the International Symposium on Model-and-Computer-Based Corporate Planning, Germany: University of Cologne, March 14-16, 1972, p. 7.

46. Ibid., Roberts outlines implementation strategies whereby the modeler's organizational skill and sensitivity can complement several of the limiting tendencies of policy modeling within bureaucracies.

47. Steinbruner, op. cit., chapter 4.

48. Peter G.W. Keen. "The Implications of Cognitive Style for the Design of Computer Systems," Harvard Business School Working Paper Harvard Business School 72-43. November 19, 1972.

49. Steinbruner, op. cit., pp. 125-135.

50. A general theory of small group interactions leading to self-reinforcing images of reality is found in Peter Berger and Thomas Luckman. The Social Construction of Reality. Garden City, New York: Doubleday and Co., 1967, pp. 138-146.

51. Steinbruner, op. cit., pp. 121-122.

52. G. Miller. "The Magic Number 7 ± 2 : Some Limits on Our Capacity for Processing Information." The Psychology of Communication (1967) pp. 14-44.

53. Steinbruner, op. cit., pp. 95-103.

54. J.S. Bruner, J.J. Goodnow and G.A. Austin. A Study of Thinking. New York: John Wiley and Sons, 1956, chapters 4 and 5.

55. Steinbruner, op. cit., pp. 114-120.

56. Ibid., p. 121.

57. For the seminal work in this field, see: Edgar H. Schein. "The Chinese Indoctrination Program for Prisoners of War: A Study of Attempted 'Brainwashing'" Psychiatry XIX (1956) pp. 149-172.

58. Berger and Luckman, op. cit., pp. 147-173.

59. Roland L. Warren. "The Sociology of Knowledge and the Problem of the Inner Cities." Social Science Quarterly 52 (December, 1971).

60. Graham T. Allison and Morton H. Halperin. "Bureaucratic Politics: A Paradigm and Some Policy Implications." World Politics 24 (Supplement 1972) pp. 40-79.

61. Jervis, op. cit.

CHAPTER THREE

BACKGROUND TO THE CASE STUDY

The case study reported here is concerned with the implementation of Chapter 766, a comprehensive reform of the education of children in the state of Massachusetts. Chapter 766 first passed the state legislature in 1972 and was implemented in local school districts in the fall of 1974. Even while the program was first being guided through legislative committees, it was beset by questions of how it would be funded--would the state mandate increase services and then not fund the program? In December of 1975, many of these accumulating fiscal problems came to a head within the Department of Education when the department found itself unable to accurately compute the reimbursements due localities for the first year of the law. A host of technical, organizational, and political problems were at the root of this "fiscal crisis." Within the Department of Education, several streams of corrective action were initiated. One of these was housed in the Division of Special Education, the division within the department responsible for the program components of the Chapter 766 reform.

As one part of the fiscal policy effort within the Division of Special Education, a system dynamics simulation model was built to analyze the causes of the fiscal problems and to help frame viable solutions to these problems. This research examines the impact of that model on bureaucratic decision making especially within the Division of Special Education.

Since this research focuses on the role of the model in decision making, there will be a tendency to produce a model-centric view of the policy-

making process. In fact, the model was not the center of the policy-making world, it was one of several tools being used to solve a complex problem. In this section, the background to the whole case is broadly sketched so that the reader may more accurately assess what the role of the model was. The discussion of background is organized in five parts: 1) a discussion of the major components of the Chapter 766 legislation, 2) an overview of the implementing organizations, 3) a brief sketch of the causes of the so-called fiscal crisis, 4) a discussion of the modeling component of the greater fiscal policy project, and finally, 5) an assessment of the successes and failures of the overall fiscal policy project.

3.1 CHAPTER 766 SPECIAL EDUCATION LEGISLATION

Program Components of the Law¹

Prior to the passage of Chapter 766, the education of children with special needs in Massachusetts had been covered under several separate pieces of legislation. Children were identified by type of handicap and often placed in institutions or segregated classrooms to be treated for these handicaps. The intent of Chapter 766 was to move children with special needs as close as possible to normal "regular day" activities. Responsibility for designing programs for children would ultimately rest with localities rather than with a cumbersome and often impersonal state bureaucracy. Parents were to be involved in the design of the "educational plan" for their children as much as possible. Elaborate precautions were written into the law assuring parental rights and that each child would receive an individualized education plan through a mandated "core evaluation

process." The major program intent of the law is summarized in five component principles below:

Mainstreaming. The law established various kinds of "program prototypes" into which a child could be referred by a core evaluation team. The primary defining characteristic of various program prototypes was the amount of time that each child spent out of the regular day stream of activity. A major thrust of the law was to insure that each student was placed in the "least restrictive" prototype possible; that is, the prototype closest to regular day possible for that child. This policy of placing children in the last restrictive prototype was also referred to as "mainstreaming."

Consolidated Treatment--No Labeling. Chapter 766 eliminated legally-defined labels for children such as "multiply handicapped," "learning disabled," or "emotionally disturbed." The intent of this procedure was to insure that each child's needs would be considered on an individual basis by the core evaluation team, with no convenient pigeon-holes available for labeling children. All children would pass through the same core evaluation process before entering a special needs program of any sort. Parents had extensive rights of review and refusal for all programs being designed for their children. Every attempt was made in the law to prevent labels from being attached to children in a stigmatizing fashion.

Maximum Parental Involvement. Parents were involved in all steps of the core evaluation process and they had the right to reject an evaluation and request a new one if they were not satisfied with the findings of the

original core. An elaborate review and appeals process was established with parents having the right to appeal any decision made concerning their children. Local school districts did not have similar comprehensive appeal rights.

Local Responsibility Post 1974. After the date of implementation, local school districts would retain full program and fiscal responsibility for educating children with special needs residing within their boundaries. The intent of this aspect of the law was to move responsibility for children closer to their parents and the local community. An intended side effect would be the eventual dismantling of state institutions for children with special needs. Eventually, it was hoped that these state institutions would be replaced by community-based schools and homes, providing treatment for children in a more nearly "regular day" setting. In a complex funding arrangement described below, the state agreed to reimburse localities for most of the "excess cost" that they may incur in educating children with special needs. Ever since the law's beginning, fear of the local school districts was that the state would not fully reimburse them for all costs incurred, thereby "dumping" the cost of educating children formerly in state institutions and private schools on to the local communities.

Grandfathered Populations. To alleviate the fear of local districts that they would immediately become responsible for children who were currently state wards, either in state institutions or having tuition paid to private institutions, the law explicitly stated that the state would continue to pay the tuition of a population of "grandfathered" children who were already state wards at the time of the law's implementation. If a

grandfathered child moved out of his current placement with the consent of his or her parents, he would then lose his privileged status and his future education would become the responsibility of local districts.

Fiscal Components of the Law²

Perhaps the most controversial aspect of Chapter 766 was the method that the state chose to reimburse cities and towns for the "excess costs" incurred educating children with special needs. The notion of reimbursing after-the-fact for excess costs proved to be quite difficult for a host of technical, organizational, and political reasons. The bulk of this research is devoted to a study of the decision making within the Division of Special Education centering on how to make fiscal components of the law "work" properly.

The "Excess Cost" formula. The basic principle underlying the excess cost (or differential cost, as some factions within the department prefer to call it) formula is quite simple. Compute how much it costs to educate a single regular day pupil and single special needs pupil in a given prototype. Then reimburse the locality one hundred percent of the difference between regular day and special needs pupils. However, this excess cost was not unlimited. For each prototype, a state-wide excess cost was computed and no city or town could collect more than 110 percent of the state-wide excess cost. That is, if a given locality became unusually extravagant in its expenditures, the state would only reimburse up to 110 percent of what all other local districts were paying for presumably similar services.

Although the basic principle seems rather clear, the major technical

problem arises when one tries to precisely define what is meant by a "pupil with special needs" and what it costs to educate such a pupil. For example, if a pupil spends 90% of his time in a regular day class, and only 10% of his time in a special classroom (perhaps dealing with a special speech problem) then that pupil, on a full-time-equivalent basis, is .9 of a regular day student and .1 of a special needs student. Furthermore, all of the costs associated with educating that one student must be divided into two parts, one part that is regular and one part that is special so that the per-pupil costs of educating each part of that student can be accurately assessed. Most local school districts do not find it easy to think in terms of splitting students apart into component parts, and the accounting problems associated with attaching a dollar figure to each portion of a student are immense.

The Department of Education had not fully anticipated how difficult it would be for localities to compute these special education full-time equivalencies (FTEs) and to allocate costs to special and regular day categories. With not enough guidance from the state, localities tried to solve these technical problems as best they could. Confusion abounded.

"Off the Top" Funding. The state added to the potential confusion by including a curious twist in the overall funding scheme. To assure that special needs were paid for throughout the state, the legislature stipulated that reimbursements for special education would be paid in full to localities before any regular day reimbursements were made. That is, the legislature would appropriate a fixed pool of money for both regular and special education. Special education would be fully funded "off the top" of this

fixed pool, with the remaining portion being pro-rated and allocated for regular day. Hence special education and regular day education were in direct competition for shares of a pie of fixed size. Some localities were quick to perceive this fact, and, lacking specific guidelines from the state, proceeded to "maximize" their reimbursements under special education. Interestingly enough, the richer communities, which had larger special education budgets to begin with and usually received a smaller percentage under regular day (because of an equalizing formula giving more reimbursements to poorer towns) had a greater incentive to spend (or at least make it look as if they were spending) more on special education.

In retrospect it seems easy to see that the funding package contained in the Chapter 766 legislation was riddled with potential problems. However, there were so many other complicated aspects of the law needing attention during its implementation that concerned and conscientious managers, not blessed with our advantage of hindsight, could not anticipate and adequately deal with all of the potential funding problems before they reached crisis proportions. The problems with implementing this complex funding formula were further confounded by the nature of the organizations implementing the legislation.

3.2 THE IMPLEMENTING ORGANIZATIONS

Figure 3.1 displays the three major layers of organizations responsible for implementing Chapter 766. Primary implementation responsibility rested with local education associations (LEAS). Responsibility for amplifying the law with guidelines and regulations and defining broad policy rested with the State Department of Education's central office. In addition, the Department of Education had recently completed a move toward regionalization. Representatives for most all Bureaus in the central office were located in each of the regions. The regions were intended to act as the "field arm" of the department, interacting closely with the localities. However, for many functions, localities continued to interact directly with the central office, the force of habit being greater than the power of reorganization:

Local Education Associations

In Massachusetts, local school districts have historically enjoyed an amazing degree of autonomy. The majority of the local school budget is raised by local property taxes and an elected school committee controls local educational policy. There is wide variance in the quality of education within the state. Traditionally, the state has provided only loose guidelines for localities, mostly in the fields of curriculum, teacher certification, and standards for buildings.

However, in the decade between 1965 and 1975, the state had begun to mandate more and more programs to be implemented by localities. The state mandated bi-lingual educational programs, a comprehensive special education act, and most recently a prohibition on discrimination in

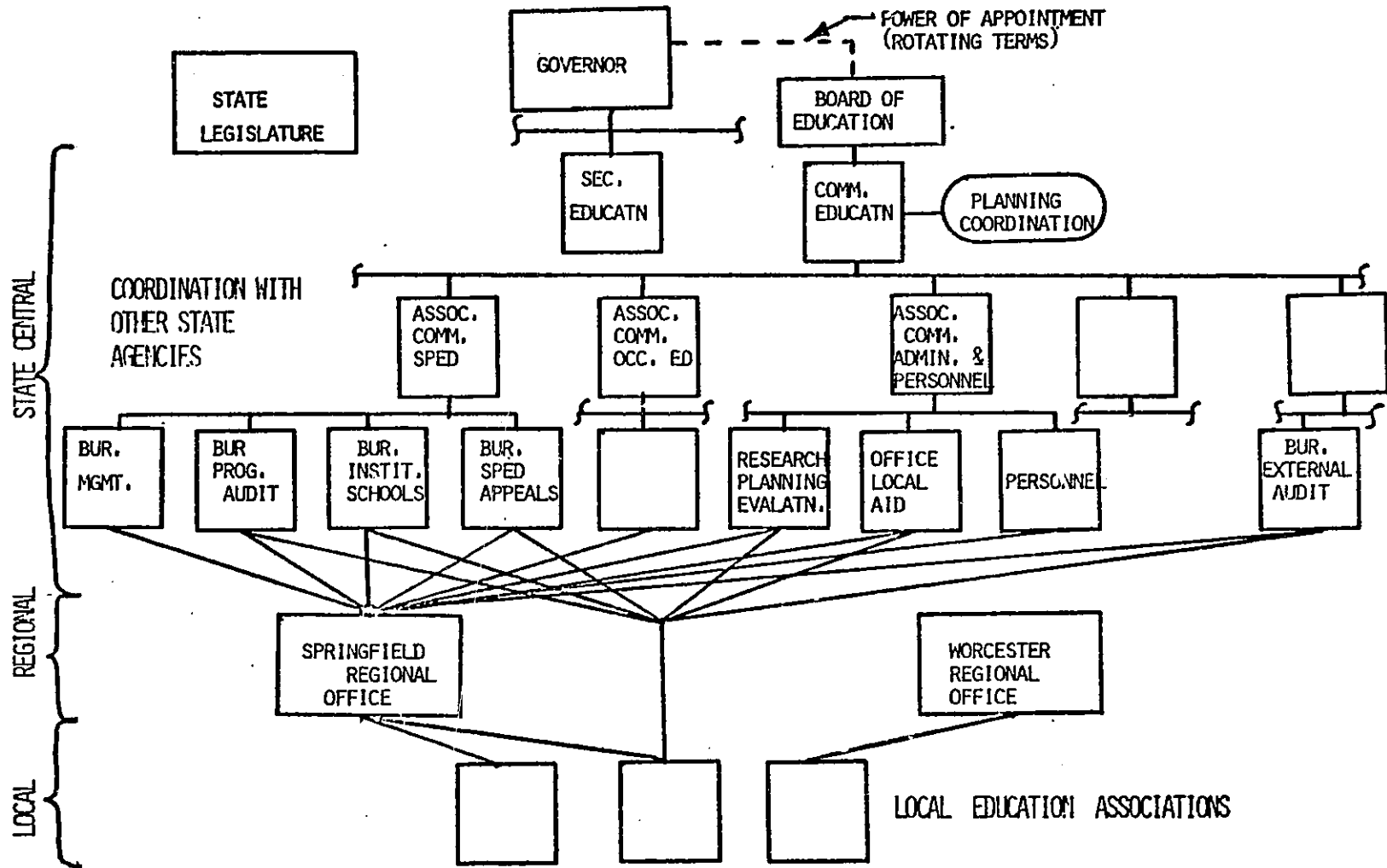


FIGURE 3.1: Three Levels of Organization Responsible for the Implementation of Chapter 766

programs because of a pupil's sex. Although the state has begun to take a more aggressive leadership role around these programs, to a large degree localities retained broad latitude in defining and interpreting these mandates and deciding how they would be implemented. The state has yet to deny a locality its reimbursement for non-compliance with one of these mandates and until fiscal year 1974, the state had not even closely audited any localities (at which time the state did retroactively adjust some reimbursement claims based upon unreliable, inaccurate, or non-standard reporting procedures). To a large degree, the primary responsibility for interpreting and implementing state-wide mandates within the guidelines set down by the Department of Education rests with the local education associations.

The State Department of Education: Central Office

As shown in Figure 3.1, the State Department of Education was formally organized on a "matrix" pattern. That is, each professional person held a functional responsibility (Bureau of Special Education Appeals, Bureau of External Audit, etc.) as well as a position in a certain office (central office, Springfield regional office, etc.). Hence, there were two major types of organizational cleavages possible within the department--horizontal and vertical. The horizontal cleavage between the various regional offices and between the regional offices as a group and the central office centered around the orientation of the department toward the localities. The regions saw themselves principally as providing support and technical assistance to localities whereas the central office was increasingly seeing itself in the role of monitoring

for compliance with mandates. The implications of this distinction for the fiscal policy projects will be discussed in more detail later.

However, for the fiscal policy project, the more problematic organizational cleavage was the vertical one between different functional units, especially within the central office. Specifically, functional responsibility for all of the program components of Chapter 766 rested with the Division of Special Education. In 1975, there were four principal bureaus within that Division: the Bureau of Management, the Bureau of Program Audit, the Bureau of Institutional Schools, and the Bureau of Special Education Appeals. In 1975, responsibility for collecting fiscal data and computing the special education reimbursements due localities rested with the Bureau of Research, Planning, and Evaluation. Toward the end of 1975, the Office of Local Aid was created to oversee many of these same reimbursement activities. Both of these units were housed within the Division of Administration and Personnel.

Prior to 1976, there were sparse ties between the fiscal and program units responsible for implementing Chapter 766. The fiscal people did not have a thorough appreciation of all of the subtle program aspects of the law. In turn, the program people lacked an understanding of even the most basic concepts used in the funding of Chapter 766. Responsibility for maintaining contact between the fiscal and program arms rested with one or two education specialists within the Division of Special Education. This informal pattern of interaction accomplished an amazing amount of coordination, but it was not sufficient to provide the detailed communication that was needed between top level managers in both the fiscal and program

units.

To add to the complexity, yet a third bureau, the Bureau of External Audit, was responsible for validating the accuracy of reported special education claims by localities. This Bureau fell within a third separate Division, further compounding the problem of fiscal-program coordination.

To a large degree, the fiscal crisis of December 1976, can be traced to the deep schisms that existed between the fiscal and program functions within the Department of Education and the resulting lack of communication between fiscal and program units within the Division.

The State Department of Education: Regional Offices

The third level of organizational complexity surrounding the implementation of Chapter 766 can be traced to a recent thrust on the part of the department to "make regionalization work." In this move, a large fraction of the department's personnel had been moved out to the regional offices putting them in closer contact with localities. Many benefits, principally stemming from increased contact between the department and local education associations, resulted from this move. However, in the interim, before regionalization was fully complete, several problems did exist. Several of these problems were directly germane to the problems surrounding the reimbursement of special education expenditures.

First, prior to regionalization, an informal cadre of individuals drawn from many program and fiscal divisions within the department existed in the central office who understood reimbursement questions. With regionalization, this cadre of knowledgeable persons was sprinkled throughout

the regional offices, dissipating the informal network that had formerly handled fiscal matters. No organizational unit had been built, spanning regional lines, to bring this cadre of persons back together as a functioning unit. Unless a school business manager knew who these various fiscal "experts" were, he had to call the central office for advice on reimbursement. Hence the remaining central office personnel were overloaded with questions from the localities. What fiscal capabilities and coordination between fiscal and program divisions there had been had been dissipated by the recent move toward regionalization.

Second, business managers with much experience within the state did know who to call in each of the regional offices for advice on reimbursement. However, since the so-called fiscal experts within each of the regional offices no longer had close associations with each other, they each tended to interpret reimbursement questions (especially around a new law like Chapter 766) differently. Hence, a clever school business manager could "shop around" between the various regional offices until he obtained a policy interpretation that he found most convenient. Since there was much confusion in the localities in the first place over how to file special education reimbursement requests, the availability of different opinions from different regional offices led to large variances in how localities filled out the end of year report. To a large degree, the department's inability to accurately compute the reimbursements for special education after the Chapter 766's first year of implementation can be traced to the non-uniformity of reporting between various localities.

3.3 THE "FISCAL CRISIS"

By December, 1975, top level managers within the Department of Education were becoming aware that the data being reported on the special education reimbursement requests were so inconsistent and poorly reported that the department could not accurately compute the amounts to be reimbursed to cities and towns. For example, the reimbursement formula relied heavily on the notion of "state-wide average costs" for educating a special education student within a certain prototype. In fact, this state-wide average was to be used to compute the maximum allowable reimbursement for each prototype. However, the variance in the state-wide average cost was immense, rendering the whole notion of a state-wide average meaningless and making the maximum allowable reimbursement more an arithmetic accident rather than a consistent pattern occurring across the state.

To begin to understand why this data was so poorly reported, we look first to the timing of budgeting, expenditures, and reimbursements on the part of localities.

The "Crisis" Seen Over Time

Figure 3.2 presents a time-line summarizing some of the major events surrounding the funding of Chapter 766 to occur between 1972 and 1977. The figure is arranged by fiscal years (fiscal years run from July 1 through June 30). Chapter 766 was passed in 1972, leaving two years until the fall of 1974 for the state and localities to prepare for the law's implementation. Fiscal year 1974-1975 was the first year during which localities would make expenditures under the new law.

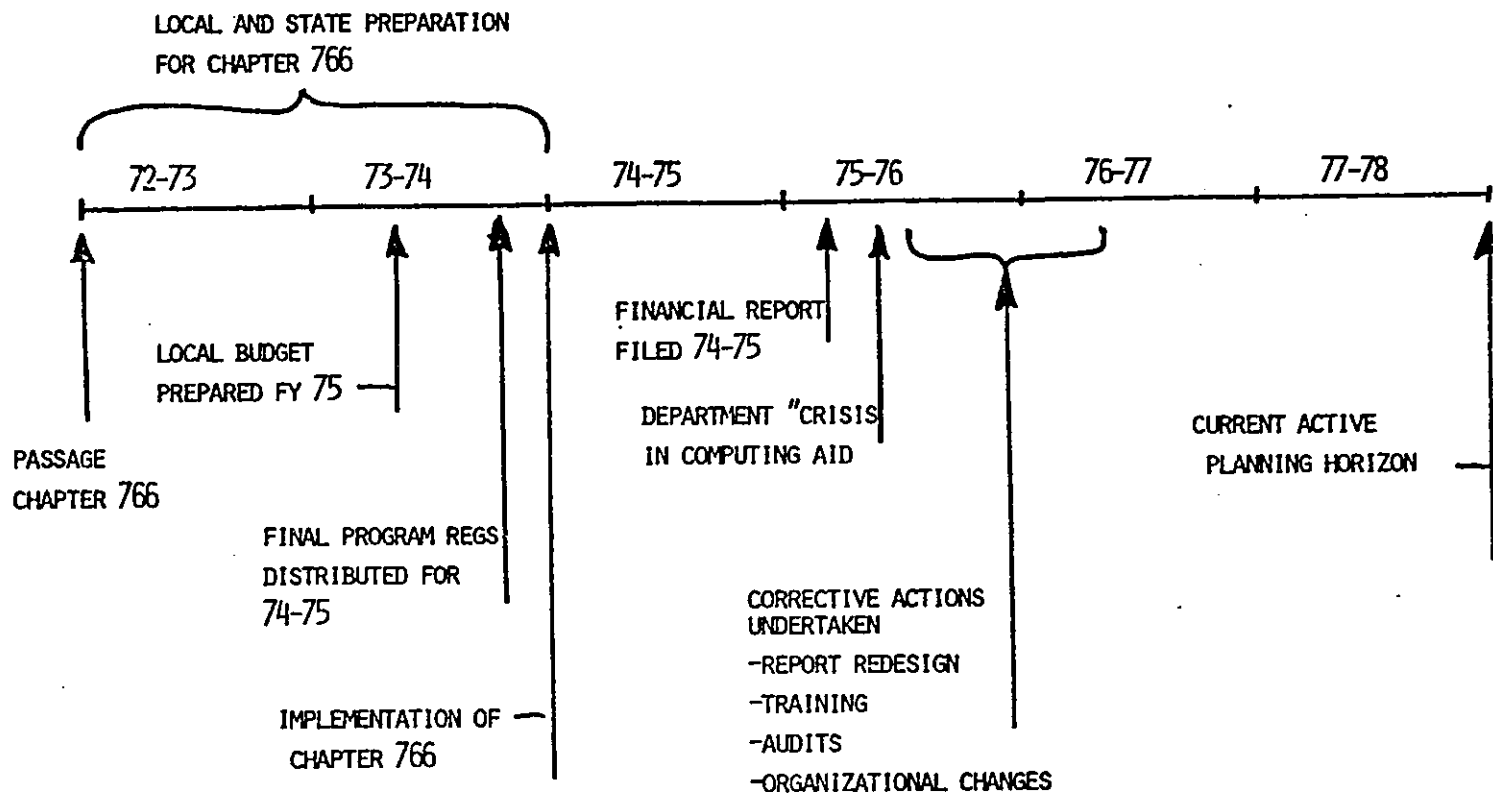


FIGURE 3.2: Timeline (1972-1978) of Major Events Surrounding Fiscal "Crisis" of December 1976

School committees typically begin to budget for an upcoming fiscal year in the preceeding December, allowing approximately six months for the final budget to be examined and approved by the town or city. In December of 1973, it was extremely difficult to budget for special education because the Division of Special Education did not release a final copy of the program regulations guiding the implementation of the law until August of 1974. Furthermore, localities were not given the final format that they were to use in reporting their FY1975 special education expenditures until well after they had set up their books and begun making expenditures. So, after the budgets had been set, the department delivered the final program regulations. After expenditures had begun, the department delivered the final reporting format.

Localities began filing their expenditure claims between August and November of 1975 (several months after the fiscal year had closed). By December of 1975, the department began to realize the full impact of the reporting and reimbursement crisis that they had on their hands. Within the department, there were about as many different perceptions of the causes of the reporting and reimbursement problem as there were persons to examine the problem.

Various Perceptions of the Problem

The fiscal crisis in special education would have been an analyst's playground. No matter how the "fundamental causes" of the problem were defined, it was possible to find some faction within the department that would agree with that definition of the problem. A brief summary of the dozen most important definitions of the problem actually pursued by

the departmental managers is presented below.

1) We don't have a problem--they have a problem. Perhaps the most common strategy in the beginning was to deny that the problem existed. Program managers could note that the so-called problem was with reimbursement--the problem must be with the fiscal people. Similarly, the data people would lament that if the program categories had been more clearly defined, localities would not have such difficulty reporting under these categories. These "head-in-the-sand" definitions of the problem quickly gave way to more substantive insights.

2) Lack of training on the part of the regional staff. From this point of view, the problem arose from the fact that the regional personnel did not understand fiscal matters in any depth and could not provide adequate technical assistance to the localities in filling out the end-of-year report. The solution to the problem lay in assembling teams of fiscal experts in each of the regional offices.

3) Cumbersome reporting to guidelines and format. The end-of-year report had emerged incrementally over time. It was long and involved, reflecting the complexity of educational finance that had evolved in the state of Massachusetts. Some managers believed that if only the length of the report could be reduced and its format simplified, then localities would be better able to follow the logic of the report and produce better data.

4) Work flow in data processing. The amount of effort needed to check, key-punch, and process the hundreds of reimbursement reports was immense. The data processing units lacked the necessary personnel to conduct the routing screenings that would have caught many of the reporting

errors early on.

5) Need of improved management of data base in departmental M.I.S.

Even as far as the reporting document had evolved in an incremental fashion, the computerized management information system (M.I.S.) necessary to support the processing of the report had evolved gradually and was not as simple and elegant as might be desirable. If only the department could more readily manipulate its own data bases, it would have the necessary information to clean up the reporting process.

6) Lack of coordination between fiscal and program units. As

opposed to many of the problem definitions that focused on a "technical fix," this definition of the problem argued that the root of the fiscal crisis lay in the puzzling and often contradictory cues given to localities by program and fiscal units. Localities were thoroughly confused by a lack of coordination between these two separate functional arms of the department.

7) Vigorous program audit of local schools lacking. The department

had failed to establish a capability to monitor the performance of local schools in complying programmatically with the mandates of Chapter 766. Localities were operating with little monitoring and feedback from the state; hence, there was little wonder that they were reporting their activities using widely varying standards for reporting.

8) Program decision makers lack fiscal training. This view of the

problem centered on making program managers more familiar with the mechanisms used to fund special education. With this added knowledge, program managers would be able to define more fiscally sensible program

categories and constructively participate in the details of the design of reimbursement documents.

9) Lack of clear guidelines concerning what costs are allowable.

Localities were relatively free to interpret how to allocate various costs to special education. The broad guidelines promulgated by the department left considerable latitude for interpretation by local districts. This "slippage" in fiscal guidelines was primarily responsible for the wide variance in reporting practices observed across the state.

10) Scapegoat Strategies. One rather pernicious strategy was to lay the blame for the fiscal crisis on a single unit or several individuals. Under this view, greater dilligence or foresight on the part of these units or individuals could have averted the fiscal crisis. Such simplistic scapegoat strategies were based upon near-sighted misperceptions of the complexity of the causes of the fiscal crisis.

11) Lack of clear post-audit guidelines. The establishment of rigorous fiscal audit guidelines was proposed as yet another method for clarifying how costs were to be allocated to special education. Local business managers would appreciate the precision of a set of post-audit standards for allocating costs to special education, and if such standards were available, they would be better able to report in a consistent manner.

12) Reformulation of reimbursement formula needed. A final perception was that the fundamental problem lay in the formula that had been written into Chapter 766 by the legislature. The formula established strong incentives for localities to misreport and as such was essentially

unmanageable. From this point of view, the answer to the fiscal crisis lay in comprehensive school finance reform legislation.

3.4 THE MODELING COMPONENT OF THE FISCAL POLICY PROJECT

Several different units within the Department of Education took corrective actions to alleviate the fiscal crisis arising in December 1975. One of these streams of corrective action was housed within the Division of Special Education. As part of that stream of activity, the project reported in this research was undertaken. During the last portion of the overall project, a system dynamics model was constructed and analyzed to help in the fiscal policy redesign taking place in special education. First we characterize three phases of the author's involvement in the Division of Special Education. Then, a brief characterization of the modeling effort that occurred during the third phase will be presented.

Three Phases of Involvement in the Division of Special Education

Phase I: The Management Improvement Project. Between June and December 1975, before the fiscal crisis appeared, the author was involved in a project designed to support and upgrade the internal management skills within the Division of Special Education. In this project, the author focused on paperwork flows and accounting procedures within the division's Bureau of Management. This prior entry into the division proved serendipitous as it allowed many of the early problem-formulating and question-asking activities surrounding the fiscal crisis to be closely observed and reported in this research.

Phase II: Fiscal Training and Organizational Development. The second phase of involvement within the division ran from January to August of 1976. During this period, the division formed a Fiscal Policy Group, for the first time providing an organizational audience for fiscal concerns

within the Division. Divisional managers became more aware of fiscal matters and began to understand better the many and often complex linkages between program and fiscal policy. During this second phase, much of the groundwork was laid for the substantive examination and redesign of fiscal policies that was to occur during the third phase of the project.

Phase III: Designing the Policy Solutions. The third phase of involvement, beginning September of 1976, and formally ending in April of 1977, could be characterized as the time when the substantive fiscal policy work was completed. Building upon the foundation laid in the earlier phases, this phase saw the formulation of a set of fiscal policy guidelines for fiscal year 1977 and the active involvement of divisional managers in fiscal decision making throughout the department. As part of this third phase, a system dynamics model was constructed and analyzed. The final model (reproduced in Appendix A of this report) culminated several earlier versions of a model that had been built during an earlier phase of the effort.

The Role of the Model in the Third Phase

The tendency to make the three case stories that follow look overly model-centric is great since they are stories about model use within a bureaucracy. We have already noted that the fiscal policy effort launched within the Division of Special Education was one of three such major efforts undertaken. Furthermore, the author's involvement within the Division was not strictly limited to model-building activities. Five principal components of the author's involvement with the division during the third phase of his involvement are briefly sketched below:

Support and Technical Assistance to the Fiscal Policy Group. The Fiscal Policy Group was the unit within the Division having major responsibility for implementing concrete policy changes concerning fiscal issues. The Fiscal Policy Group had first come into existence in April of 1976. The author attended all of the meetings of the Fiscal Policy Group and actively participated in its activities on all levels. During the third phase of the overall project, involvement with the Fiscal Policy Group took more of the author's time and attention than any of the other five components reported here.

Coordination with Other Units within the Department. In addition to participating directly in the activities of the Fiscal Policy Group, the author participated in meetings with the units elsewhere in the department also pursuing the development of fiscal policy related to special education. In these coordination meetings, the author would attend a meeting as one of several representatives from the Fiscal Policy Group or just as often these meetings would be informal "scouting" meetings with managers actively working on fiscal policy within other units.

Drafting Discussion Papers. The author spent considerable time drafting working papers designed to frame a set of issues either for the Fiscal Policy Group or for one of the external groups with which the Fiscal Policy Group interacted. These discussion papers were a blend of the insights that the author had gained from working with the Fiscal Policy Group and the insights that the author had gained while working on a system dynamics model of the fiscal policy system.

Seminar Series with Associate Commissioner. The author spent some

time working with the Associate Commissioner of Special Education trying to more precisely formulate many of the fiscal issues facing the division as well as viable responses to the issues thus framed. Much of this policy examination exercise was carried on within a system dynamics frame of reference. That is, the purpose of the meetings with the Associate Commissioner became to cast the fiscal problems facing the Division into a system dynamics framework and then to work out policy solutions within the abstracted vision created by the model. Finally, the seminar sessions concentrated on making the broad model-based policy solutions more concrete in the form of specific suggestions. As a product of these meetings, the system dynamics model presented in Appendix A was constructed and analyzed. Furthermore, based upon that model, the Associate Commissioner drafted a position paper of his own that became the basis for a series of specific policy suggestions.³

Formulation of the System Dynamics Model. Between September 1976, and March 1977, only fifteen percent of the author's total time allocated to the overall project dealt directly with the business of formulating, analyzing, and writing up a formal system dynamics model (this estimate does not however include time spent in the seminars with the Associate Commissioner nor time cogitating over the model structure and its possible implications). The formal modeling component was not the most time-consuming activity of the project. However, it did provide key structuring insights that were later operationalized both within the Fiscal Policy Group and in other meetings throughout the department.

Overview of the Model

The formal system dynamics model may be briefly summarized in terms of its audience, reference mode, purposes and a review of its conclusions and results.

Audience. The audience for the model was intended to be decision makers within the Massachusetts State Department of Education. Specifically, the issues would be framed so as to be most interesting to the managers within the Division of Special Education.

Reference Mode. The model's reference mode was designed to duplicate the rapid initial growth of special education reimbursements and to trace their continued growth or decline over the first ten years of the law's implementation.

Purposes. The purposes of the model were first to simulate the responses of local school districts to the fiscal incentives being established by the policies mandated at the state level. As a result of this exercise, many of the structural causes of the continuing growth in the 766 budget could be isolated and better understood. Finally, based upon analyses completed within the model, it would be possible to generate "best" policies to control the growth of 766 reimbursement requests on a state-wide level.

Results and Conclusions. The model concluded that the Chapter 766 legislation coupled with the department's method of administering the law created strong incentives encouraging localities to "maximize" their special education expenditures. The model examined a set of "fiscal control policies" and found these to be the most effective instruments

available to the department for controlling the growth of special education reimbursement requests.

Translated into more concrete terms, the position paper reproduced in Appendix A recommended six specific actions:

- 1) Establish fiscal guidelines for fiscal year 1977 that say exactly what costs may and may not be charged off to special education.
- 2) Establish similar and perhaps more stringent guidelines for fiscal year 1978.
- 3) Revise the end-of-year report format to insure that the guidelines can be effectively implemented.
- 4) Coordinate the guideline development with the Bureau of External Audit to insure that the guidelines can form the basis for field audits of local expenditures.
- 5) Insure that aggressive and timely audits of the 1977 special education reimbursement claims do occur.
- 6) Spearhead the training of regional and local personnel in the guidelines.

The above specific recommendations were drawn up as a blend of insights gained from working with the system dynamics model and experiences accumulated within the Fiscal Policy Group. Actions were taken on these recommendations through the efforts of the Fiscal Policy Group.

3.5 SUCCESSES AND FAILURES IN THE FISCAL POLICY PROJECT

To complete this discussion of the overall fiscal policy project, one more piece of critical information is needed. Did the project work? What components of the project appeared to be clearly successful? Which components have not yet proved successful? Which ones show little chance of ever being successful?

As with most policy design projects involving complicated organizational and political decision making, an assessment of the final pluses and minuses of the whole project may vary from observer to observer. The following assessment is the author's personal view of what worked and what are the major remaining tasks.

Successes

Five events may be pointed to as rather clear-cut examples of the successful components of the overall project.

1) Formation of Fiscal Policy Group. In April of 1976, the division's Fiscal Policy Group first came into existence. For the first time the division had an identifiable group to deal with fiscal affairs. Most of the remaining benefits to be enumerated below could not have been accomplished if such a group had not existed.

2) Full-Time Equivalency Issue Settled. In May of 1976, the Fiscal Policy Group established its first policy guideline. It settled the question of how localities should compute full-time equivalents for the special education pupil count and laid down a broad principle for how costs should be allocated to special education. By making this first

important decision, the Fiscal Policy Group took its first step toward being a policy-making group in practice as well as on paper.

3) Fiscal Policy Guidelines Developed. The Fiscal Policy Group developed an extended set of guidelines specifying in some detail exactly what costs may and may not be allowed as special education costs. These guidelines, distributed to local school districts, for the first time allowed a program division to define how the funding of its program should occur.

4) Coordination with Auditors. The Fiscal Policy Group reviewed and approved the standards being used by the Bureau of External Audit to audit FY 1976 special education reimbursement requests. In turn, the Bureau of External Audit reviewed and approved the guidelines developed by the Fiscal Policy Group. Again for the first time, standards being developed directly by a program division were directly approved for use by the fiscal auditors.

5) Assist in Redesign of the End-of-Year Report. By cooperating with the Office of Local Aid and a group of external consultants, the Fiscal Policy Group was able to insure that the guidelines it had developed were reflected in the design of the end-of-year report.

In addition to these five concrete events, the major success of the overall effort was that the managers within the Division of Special Education began to conceive of themselves as capable of managing fiscal as well as program matters. They had a heightened awareness of and sensitivity to fiscal questions. It seems reasonable to expect that in the near future the management of the Division of Special Education will

remain active in defining the fiscal components of special education policy in the Commonwealth of Massachusetts.

Remaining Problems

The overall project was by no means an unmitigated success. Several technical, organizational, and political problems still remain.

Technical Questions. The most immediate technical question is did the increased fiscal controls have any effect in controlling the cost of special education reimbursement requests? By November 1977, when the final returns for FY 1977 have been processed, it will be possible to know if special education reimbursement requests have continued to grow at an astronomical pace (averaging approximately 50 percent per year for the first three years of the law's implementation) or have they slowed, perhaps to the growth rate of overall educational expenditures due to inflation. Even if a marked decrease in expenditure growth does occur, it will be necessary to complete a detailed analysis of the decrease to know whether the increased fiscal controls applied by the department had any appreciable effect in achieving that decrease in the growth of costs.

At a longer time horizon, the basic formula being used to fund special education in the Commonwealth is untenable. By directly pitting special education costs against regular day costs, and by reimbursing according to an overly complex "excess cost" formula, the current scheme sets up incentives that virtually insure that special education costs will continue to grow at the expense of regular day education. Such a situation, in the long run, is not politically tenable. Associate Commissioner

Audette attempted to address this longer run question in his position paper on funding special education in Massachusetts,⁴ but as of yet, the department has taken little corrective action to avert the inevitable and much larger fiscal crisis that will soon engulf special education in Massachusetts.

Organizational Questions. A host of unresolved organizational questions still surround the funding of special education in Massachusetts. The most severe of these is the still remaining cleavage between fiscal and program decision makers within the Department of Education. The Fiscal Policy Group has not bridged this cleavage. Instead, this group has created a competing fiscal expertise on the program side. As of present, there is no permanent joint program-fiscal decision-making body within the Department of Education. Unless attempts are made to bridge this gap, it would appear that the Fiscal Policy Group would have to continue to fight for its own existence, being perceived as an uninvited program-based intruder on fiscal decision-making turf. Unless the Fiscal Policy Group can learn to enter into long run cooperative relationships with other fiscal decision-making groups, there is a strong danger that it will cease to function effectively and the building fiscal capacity within the Division of Special Education will be dissipated.

A second organizational problem centers on the regional-central office split. To a large degree, the Fiscal Policy Group failed to achieve any active input from the regional offices in the course of developing the fiscal policy guidelines. The Fiscal Policy Group must concentrate on finding ways to bridge the regional-central office gap.

Political Questions. Finally, educational finance in the Commonwealth of Massachusetts is a highly political process and several important political questions still remain concerning the work begun within the Division.

Most immediately, local superintendents and special education directors had not been actively involved in the division's work during the 1976 to 1977 school year. If the division wishes to remain active in the field of fiscal policy development, it must pay more attention to the possible inputs from local constituencies.

At a broader, but perhaps more fundamental level, are the important questions of finding a new way to fund special education in Massachusetts. If the Division of Special Education or the department does not soon frame feasible alternatives to the current funding schemes, they will lose any ability that they might currently have to shape how special education will be funded in the future. Ultimately, how the state chooses to fund special education is a political question. Before the current scheme becomes exposed as totally inadequate, the department will retain some leverage in terms of defining new options for consideration. As the funding of special education becomes more and more of a crisis question, more and more actors may become involved in the redefinition of possible funding schemes and the department may lose some of the leverage that it currently has.

3.6 NOTES FOR CHAPTER THREE

1. The synopsis of major points given here obviously omits many of the salient program features of the 766 legislation. For a more complete description of the program see: Chapter 766 Regulations, available from the Department of Education, 31 St. James Avenue, Boston, Massachusetts.

2. Unfortunately, no detailed explanation of how Chapter 766 is funded (other than the original enabling legislation) exists. Several presentations have been assembled, but these take on the form of charts with no explanatory text. See for example, "Special Education Fiscal Overview--Chapter 766 Reimbursements" (22 charts), presentation prepared by the Division of Special Education, May 1977.

3. R.H. Audette. "A Proposal to Eliminate Fiscal Instability within the Educational Reimbursement System," internal working memo, Division of Special Education, Massachusetts Department of Education, January 1977.

4. Ibid.

CHAPTER FOUR:

THE RATIONAL STORY

4.1 DEVELOPMENT OF THE RATIONAL THEORY

This section reviews and extends the basic theory of rational decision making and its implications for system dynamics modeling efforts as developed in Chapter 2. The original body of rational theory presented in Chapter 2 and its implications for model building were derived totally from the literature and considerations of the methodological priors of the system dynamics method. Based upon the evidence gathered in the case study within the Division of Special Education, these original naive propositions have been revised to produce a set of modified, empirically grounded propositions. These modified propositions form the basis for the case story told in this chapter.

Summary of Basic Theory and Naive Propositions

Table 4.1 presents a brief synopsis of the rational theory of decision making used as the basis for this study. The theory embedded within Table 4.1 prescribes how one should conduct a rational analysis. All possible alternatives should be considered. Some assessment of the outcome of each of the alternatives should be made. Based upon an explicit set of values, each of these final outcomes resulting from various alternatives should be assessed. The chosen alternative will be that one that provides the best outcome as assessed by the explicit set of values or objective function.

This simplified version of the rational perspective assumes that the

TABLE 4.1: Propositions Summarizing Basic Rational Theory of Decision Making (Propositions summarized from Chapter 2)

- 1) Alternatives. The rational theory begins with an explicit articulation of the range of alternatives under consideration.
- 2) Consequences. Some assessment must be made of the consequences of various alternative policies.
- 3) Goals and Objectives. Alternatives and their consequences must be measured against some goals or objectives that imply an underlying set of values.
- 4) Choice. Rational decision making consists of choosing between the universe of possible alternatives given a comprehensive analysis of outcomes and values.
- 5) Collective Decisions. Joint decisions are made through the consensus of reasonable men agreeing on a common definition of alternatives, outcomes, and hopefully, values.
- 6) Problem Boundary. An important aspect in the selection of alternatives is the precise articulation of the common problem under study.

various interest groups within an agency should be able to reach a collective decision based upon open discussions of alternatives, outcomes, and values. Such discussions rest upon reasoned discourse among rational men. This vision of decision making is highly idealized. It prescribes the norm towards which decisions should aspire, ignoring for the moment the many practical obstacles that might prevent an organization or an individual from attaining this rational ideal.

Based upon this summary of rational decision making and an examination of system dynamics' methodological priors, the propositions presented in Table 4.2 were derived. These propositions outline how system dynamics models can aid rational decision making-processes. The process of building a system model is in fact an exercise in precise rationalistic thinking. The process of building a model is a formalization of rational decision making. It is difficult to clearly define where the model-building process leaves off and where rational decision making picks up. The process of building a model aids the assessment of outcomes, and it presents possible trade-offs in outcomes clearly to decision makers. The definition of the boundary of the formal model is closely tied to the rational process of problem definition. Finally, discussions centering on the model can serve to promote the reasoned discourse among rational men so necessary for rational decision making. If the propositions summarized in Table 4.2 were correct, one would expect to find a close mapping of the rational decision-making process into the formal model-building process.

The propositions presented in Table 4.2 served to guide the initial

TABLE 4.2 Original (Naive) Propositions Summarizing How System Dynamics Models Aid in Rational Decision Making (Propositions summarized from Chapter 2)

- 1) Highlights Problem Definition. The system dynamics modeling process begins with explicit hypotheses concerning a system's behavior and its causes. These initial definitions lead to a crisp definition of the system's boundary.
- 2) Evaluates Consequences of Alternate Policies. Alternative policies may be explicitly represented in the formulation of system rates. A relative strength of the system dynamics methodology is its ability to clearly show the impact of policy alternatives on a system's behavior over time.
- 3) Explicitly Presents Trade-Offs. Because system dynamics models treat all of the feedback believed to cause a system's behavior, trade-offs will be captured explicitly and easily by the system dynamics prior rules of structure.
- 4) Forum for Collective Decision Making. Because of system dynamic's a priori emphasis on making all variables observable, decision makers can quickly grasp the intuitive meaning of the model's equations. Decision makers can then modify aspects of the model's structure so that it more closely conforms to their own intuition concerning system structure.

empirical stages of the case study. They were the initial working hypotheses. By the end of the case study, these original and naive propositions needed modification in light of the experiences gained in the case study.

New Distinctions Needed to Adapt Naive Theory to the Case

The case highlighted two important aspects of rational model-aided decision making that were not captured in the naive theory. The first important problem with the naive theory is that it focuses almost exclusively on the process of problem solving or question answering. The case study has suggested that problem-forming and question-asking activities constitute a critical and largely unexamined portion of rational analysis. As shown in Figure 4.3, there are at least two crucial steps leading up to the definition of the problem. These two steps are summarized in the box at the upper right. Beginning with the universe of possible concerns facing the manager, he must first select which of a host of areas of possible activity will occupy his time and attention (this assumes that we are discussing a middle manager or above who has some latitude in defining his own areas of interest). Within a given area, one or more questions of interest may be defined. Some questions will be more important, tractable, and insight-generating than others. The special education case suggests that system dynamics models may be most useful in the first two steps of defining areas of interest and posing problems. The bottom left-hand box schematically presents the stages normally considered in the problem-solving process. A given question leads to a (hopefully exhaustive) definition of alternative courses of action. Outcomes of these actions are assessed and, based upon a set of well-articulated

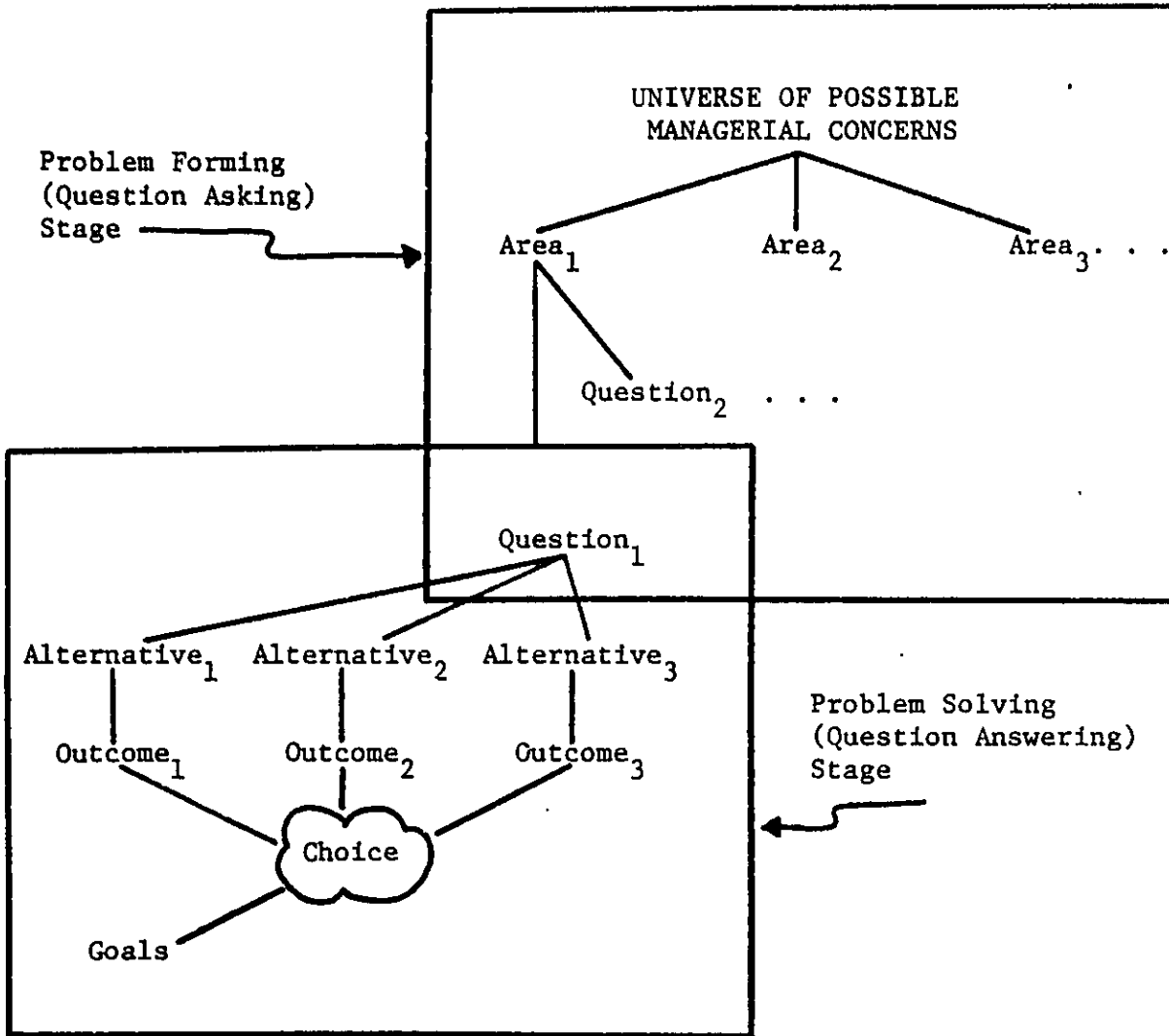


Figure 4.3: Hierarchical Stages in Rational Decision Making

goals, a choice is made.

This division of the complete rational decision-making process into two broad phases leads to the first modified proposition.

* Proposition 4.1 *

* Problem formulation and Problem solution. The complete *

* course of rational analysis may be divided into two phases, *

* problem formulation (question asking) and problem solution *

* (question answering). The first phase of problem formulation *

* may be the more critical of the two, but it receives the least *

* attention in the literature.

The case study suggests that the problem formulation phase within an organization consists of three important functions. First, there must be a common awareness among a critical body of managers that a certain area of difficulty is worthy of further analysis. Obviously without this base-line awareness that there might be a problem, no action can be taken toward solving a problem. Second, there must be an organizationally defined audience before any active problem solving can occur. Even if several managers are aware that an area is worthy of further examination, little will happen unless some group, unit, or coalition within the organization considers the area to be within its bailiwick. Finally, the right question must be posed. A good question has the property of leading the organizational audience down fruitful paths in its search for a solution through rational analysis. The problem formulation phase is often complete well before an analyst is called in to build a model. To summarize:

* Proposition 4.1.A *

* Three Problem Formulation Functions. Three critical func- *

* tions in the problem formulation phase within rational decision *

* making are 1) common awareness of difficulty among managers; *

* 2) creation of an organizational audience; and 3) asking the *

* right question. *

The problem-solving stage has already been well described in the decision-making literature. For summary purposes we delineate four basic functions within the problem solving phase: 1) delineation of alternatives (exhaustive); 2) assessment of outcomes of those alternatives; 3) establishment of goals and values (assess an objective function); and 4) choice based upon value maximization.

* Proposition 4.1.B *

* Four Problem-Solving Functions. The problem-solving phase, *
 * commonly examined in the literature consists of four major func- *
 * tions: 1) delineation of alternatives; 2) assessment of outcomes *
 * of those alternatives; 3) establishment of goals and values; and *
 * 4) choice based upon value maximization. *

The second major aspect of rational model-aided decision making missed by the naive theory centers on a rather obvious but critical distinction between the reality portrayed within a model and the reality to which managers refer when forced with difficult choices.

Model reality is crisp and unambiguous. It has a well-formed boundary and a completely thought through internal logic and structure. It is rather stiff, artifactual, unbending, and not so subtle. Model reality has sharp edges on it.

Decision-making reality is more subtle, less logical and structured.

It has been slowly constructed over time through prolonged social and intellectual interaction. It is not quick to change, but it is forever in a state of flux. Its structure and logic is constrained by the information-processing abilities of the human mind. Its richness of detail is constrained only by the diversity of human experience--its creativity by the limits of imagination.

At each stage of the decision-making process, choices are based upon the decision maker's reality (would any rational person ever trust the blunted approximations of mathematical equations over the richness of human experience?). However, a formal model-based reality does have some useful and interesting properties that can make it useful when managers try to find truth (or at least good policy options) as they travel through the richly complex world of decision makers' reality.

First, formal models create a policy reality that is miniature and abstract. Cognitively, such a miniaturized and abstracted reality is much easier to understand. This miniature reality is created through a process of simplification. Because the model reality is organized around a relatively clearly defined purpose and the world of real policy is not, managers can more clearly "see the point" when examining policy questions within the context of a model reality. Managers gain new insights into the world of policy because the simplified and abstracted miniaturization within the model gives them some additional distance between the daily flurry of events and the more cleanly delineated structures within the model. Finally, the model reality is highly plastic. Managers can manipulate policy options easily within the model. Because

the model reality is so simple, abstract, and hence easy to manipulate, they can "experiment" on the model reality in an attempt to better understand the world of real policy decisions.

We are distinguishing quite sharply between the model reality and the decision-making reality because this distinction highlights two quite separate functions played by models in rational decision-making exercises. On the one hand, models are a creative vehicle producing a miniaturized, abstract, and highly manipulable view of reality that is useful for generating insights. The normative theory of social structure built into the system dynamics methodology helps analysts and managers alike to sort out a flurry of detail and produce a coherent view of the policy area clearly structured around one or two well-defined policy problems.

But insights generated in the model reality are, strictly speaking, only well-defined within the context of the model. These insights have little concrete meaning and are of only intellectual interest unless the insights created within the model reality can somehow be transferred to the decision-making reality.

Insights created within the model reality are transferred to the decision-making reality by a process of projection. Managers project their prior beliefs and intuitions on to the structures, insights, and conclusions generated within the model reality and subjectively interpret model-based insights in terms of the decision-making reality. Whereas the processes of model abstraction and insight generation are rather tightly controlled and "objective" processes, the process of projecting intuitions and beliefs on to model conclusions is a relatively loose and

subjective one. The process of projection presupposes that managers have a large body of unconnected insights into the decision-making reality. When presented with a formal model, they project their prior insights and beliefs on to the bare bones structure presented within the model. In their own minds, managers "fill in" the areas not explicitly treated in the model reality and make inferences based partially upon model-based insights and partially upon their own intuition and hunches.

The process of projection is an important one for models to perform. Projection serves three major purposes. First, projection causes managers to be explicit. Many insights that managers may have have not been fully articulated. When managers articulate their own prior beliefs in terms of the logical structure presented within the formal model, they are forced to be explicit about the nature of their prior beliefs and intuitions. Second, projection facilitates the synthesis of ideas. Even as prior intuitions were largely implicit, they were also bits and pieces of a larger puzzle. By projecting all of these pieces on to the structure created by the model, managers are able to visualize new connections within their own patterns of thought thereby creating a synthesized view of a policy area. Finally, projection legitimizes prior beliefs and intuitions. To say that a certain policy action should be taken because one believes in it or has a strong intuition concerning its efficacy is not to say much in a society that is dominated by a rational ethos. Reasonable men have little room for unsubstantiated beliefs and subjective best guesses. However, if a manager can express these same beliefs and intuitions within the very rational-looking frame of a formal modeling

* modeling process is that models help to generate insights through *
 * this generalized process of abstraction. *

However, the process whereby managers project their beliefs and intuitions on to the model reality is a much less explicit, precise, and scientific process. In this rather subjective process, managers loosely interpret their own experiences. Via the process of projection, managers can explicate, synthesize, and legitimate otherwise implicit, unconnected intuitions and beliefs.

* Proposition 4.2.B *

* Projection. Projection is a subjective process whereby *
 * managers interpret model-based insights in terms of their own *
 * experiences. Projecting beliefs and intuitions on to models is *
 * helpful because it helps managers to explicate, synthesize, and *
 * legitimize otherwise implicit, unconnected intuitions and beliefs. *

For the most part, the literature on model use to support rational decision making has concentrated on the abstracting and insight-generating properties of formal models in the problem-solving phase of rational decision making. As shown in Figure 4.4, the use of models to aid in the process of abstraction and insight generation in the problem-solving phase is only one of four possible broad areas in which models may be used. On the one hand we have noted distinction between the problem-forming and

problem-solving phases of rational decision making. On the other hand, models may serve the dual functions of abstraction and insight generation or of projection. Taken together, these two broad distinctions define four broad quadrants of possible model use as illustrated in Figure 4.4.

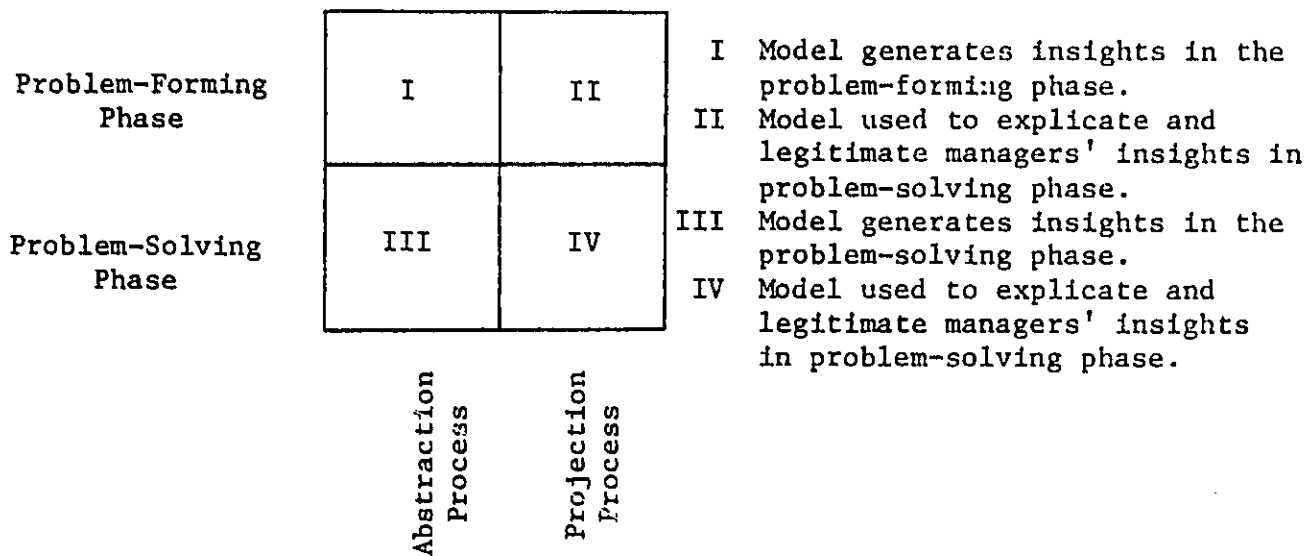


FIGURE 4.4: Four Quadrants of Model Use in Rational Decision-Making Processes.

In the first quadrant, formal models can help to generate insights into what are the important questions to be asked. The prior theory of structure implicit in a formal modeling methodology helps managers and analysts alike to frame initial questions and to search for interesting questions. In the second quadrant shown in Figure 4.4, models can serve a quite different purpose in and problem formation phase. Here we see that models are not used directly as vehicles for creating new insights; instead they provide a focusing activity that allows managers to explicate their own intuitions and beliefs as they attempt to structure their

vaguely aware that a certain area of difficulty is worthy of more attention, but one may not know how big the problem is, what are its causes. In these early stages a formal methodology can be most helpful to a skilled analyst.

A methodology's prior theory of structure gives the analyst explicit hints concerning where to look for important clues or significant events. For example, the system dynamics methodology explicitly directs its practitioners to look for behavior occurring over time. One begins to look almost immediately for the structural causes of this time-related problem. Questions of system boundary quickly arise forcing the analyst to explicitly puzzle about how big the basic problem is. How wide must the system boundary be drawn so that all of the behavior causing the problem can be included within the boundary? Hence the analyst relying upon the system dynamics methodology is obliged to think in terms of problems unfolding over time, their causes, and the scope of the problem-causing structures. Similarly, other methodologies would direct practitioners to other phenomena and would provide them with different heuristics for sorting out the important from the extraneous.

* Proposition 4.4 *

* Highlights Problem Definition. Formal methodologies with *

* their prior theories of structure provide practitioners with *

* valuable heuristics for sorting important events from extraneous *

* detail. Because of a method's prior structure, it can be a helpful *

* guide in the early question-asking phases of a rational decision- *

* making process. *

* the model to structure their own thinking about what alternatives *
 * should be considered. Different managers with different prior *
 * experiences may define different alternatives based upon identical- *
 * ly the same model analysis. *

In a similar fashion, a rational decision-making story often glosses over exactly how decision makers evaluate consequences of alternative policies. A formal model may be helpful because the simulations show explicitly how alternative sets of policy produce different system behavior over time. However, the case study suggests that the policies simulated in the model reality are often abstract representations of the alternatives that managers actually perceive as open to them. Hence the analysis of outcomes completed within the model reality has mostly symbolic significance for managers. There is still much room for individual interpretation of what the simulation results mean in more concrete decision-making reality. Managers use their own prior experiences to "fill in" the gaps between their understanding of the model reality and their understanding of the real decision-making reality. As they project their own private world of experiences on to the model, there will be considerable latitude for interpreting what the simulations mean in the real world.

* Proposition 4.7 *

* Evaluates Consequences of Alternative Policies. A formal model *

* evaluates the consequences of alternative policies in two ways: *

* 1) Model output explicitly evaluates the consequences of alter- *
 * natives that are well defined within the model reality. 2) Managers *
 * interpret these abstract results in terms of their own prior *
 * experiences. The model can assist managers in the structuring of *
 * their intuitions concerning what are the consequences of various *
 * policy options. *

The possibility of "slippage" between precisely defined analysis of policy outcomes in the model reality and managers' interpretations of these outcomes in terms of their own experiences is both a useful and disturbing feature of formal modeling efforts. It is a useful feature because if managers are kindly disposed toward the modeling effort, they will fill in many gaps not explicitly treated by the model and read as much as possible into the model. The feature of slippage between precise results in the model reality and looser interpretations in decision makers' reality is disturbing because it raises the possibility that managers can selectively agree with or disagree with various portions of the analysis and interpret the model's results in a distorted and bizarre fashion. For example, if a model presents one alternative that is perceived to be advantageous, but points to a clear danger that must be risked or trade-off that must be made to reach that advantage, managers can selectively focus on the advantages and neglect to seriously consider the dangers or trade-offs that had clearly emerged within the model reality.

* Proposition 4.9 *

* Heavily Dependent on Collective Decision Making. To say that *

* effective modeling efforts promote collective decision making is a *

* half-truth. Modeling efforts will be effective precisely because *

* they are based upon collective decision-making activities. Inter- *

* actions between analysts and managers are critical for insuring *

* that insights created within the model reality take on concrete *

* meaning in terms of the prior experiences of key decision makers. *

A Note on Differences Between Naive and Modified Propositions

Table 4.5 presents a comparison of the original naive propositions and the modified propositions. Since these sets of propositions are a "before" and "after" snapshot of our theory of policy modeling within rational bureaucracies, a close examination of how these propositions have changed reveals what was learned during the course of the case study. Each of the four original propositions has a close counterpart in the final modified propositions. However, the intent of each of the propositions has been slightly altered by the introduction of new distinctions. For example, the original proposition, "evaluates consequences of alternative policies," has an exact counterpart in proposition 4.7. However, as we have just seen, in the modified propositions the model helps to evaluate consequences in the problem-solving phase both by giving managers insight into the dynamics of the model reality and by providing them with an opportunity to project their

otherwise disconnected experiences on to a coherent framework. The original naive proposition ignored how insights generated in the model reality were transferred to the decision-making reality.

In broad terms, the naive theory is characterized by two general themes:

1) Rational decision making is problem solving. The implicit focus within the naive theory (following much of the focus in the literature on rational decision making) was on the problem-solving phase of decision making. Four broad functions characterized problem solving -- articulating alternatives, assessing the outcomes of these alternatives, establishing goals and values, and making a choice based upon a criterion of value maximization.

2) Models are useful for generating novel insights. Because models create an abstract, miniaturized, and simplified view of a policy problem, they are most useful for generating insights into the causes and possible cures for policy problems. The process of building a model was viewed as a formalization of a rational decision-making process. The steps in building a model mapped nicely on to the steps in completing a rational policy analysis.

Working with the case study sharply highlighted two major distinctions that are reflected in the modified propositions but missing in the naive. First, the complete rational decision-making process occurs in two phases -- problem formulation and problem solution. The emphasis within the modified propositions (and within the literature on rational decision making in general) on problem solving alone does not appear warranted.

TABLE 4.5: Comparison of Original Naive Propositions and Modified Propositions

<u>Original Propositions</u>	<u>Modified Propositions</u>
	4.1 Problem Formulation and Problem Solution
	4.1.A Three Problem Formulation Functions
	4.1.B Four Problem-Solving Functions
	4.2 Abstraction and Projection
	4.2.A Abstraction
	4.2.B Projection
	4.3 Four Quadrants of Model Use
Highlights Problem Definition	4.4 Highlights Problem Definition
	4.5 Useful Insights Require Audience
	4.6 Structures Alternatives
Evaluates Consequences of Alternative Policies	4.7 Evaluates Consequences of Alternative Policies
Explicitly Presents Trade-offs	4.8 Potentially Useful in Highlighting Trade-offs
Forum for Collective Decision Making	4.9 Heavily Dependent on Collective Decision Making

Second, the process of model building does not blur indistinguishably into the process of rational decision making. Quite the contrary, formal modeling occurs in a quite separate well-ordered model reality. Decisions are made within a vaguely understood decision-making reality. Models are not used directly in choices made within decision-making realities. Instead, via a vague process having complex cognitive and organizational dimensions, managers project their prior experiences, beliefs, and intuitions on to the model, using the model's structure and outputs as a tool to explicate, synthesize, and legitimize their own thinking.

To a large degree, successful use of a model in support of rational decision making involves managing and facilitating this process of projection -- a fuzzy and subjective process whereby managers bridge the gap between the sharp precision and abstraction of the model reality and the vaguely understood complexities of the decision-making reality.

4.2 PHASE III: DETAILED PROBLEM SOLVING

The rational story is divided into three phases, the same three phases presented in Chapter 3. The first two phases consist mostly of problem formulation. During these phases, attempts were made to assemble an organizational unit capable of addressing fiscal questions, getting key managers to agree on the importance of addressing fiscal questions within a program division, and asking the right insight-generating questions.

In telling the rational story, we shall first concentrate on the third phase of detailed problem solving. During the third phase, the system dynamics model was built. The problem-solving behaviors within the division most nearly approximated the rational ideal. As we shall soon see, the process of building the model is often indistinguishable from the process of rational decision making. Following a recounting of the third phase, we shall "flash back" to look at some of the earlier problem formulation activities that led up to the rational-looking activities of the problem-solving phase.

Project Background

By August of 1976, the Division of Special Education had come to realize that more time and effort was needed in the management of fiscal affairs. It was becoming apparent to division managers that currently existing fiscal procedures were working against the program goals established by the division.

Many forces were at work. Due to the richer reimbursements possible for local schools under special education as opposed to regular education, the division suspected that many services formerly delivered as regular day services were being reclassified as special education services. Students

who normally receive regular day services would now have to be classified as special--thereby working against the division's stated goals of mainstreaming. Furthermore, as more and more services were being defined as special, the total cost for special education in the State was growing at an amazing pace (averaging over 50 percent per year between 1973 and 1976). These cost overruns were sure to produce adverse scrutiny on the part of the state legislature. Also, as more and more money was disbursed for special education, less and less of the total reimbursement pot was left for regular education. Since regular education aid was paid out on an equalizing basis (relatively more reimbursements to the relatively poorer towns and less to the richer towns) and special education aid was not, another effect of the current fiscal arrangements was to promote a disequalizing distribution of funds.

In August, the division contracted with an external analyst to address some of the fiscal problems facing the division:

"The focus of this project will be to aid in the designing of fiscal policies that can realign fiscal realities with Divisional program priorities. The approach will involve the construction of a system dynamics computer simulation of the major features of the current 766 fiscal-program system. Alternative fiscal policies will then be tested on the simulation model to determine which package of fiscal policies can best allow the Division to realize its program objectives.

The output of the project will be a set of policy statements to be implemented through the Division's fiscal policy group, the school management services group, or the local aid task force.

The project will involve close collaboration with the Division's Bureau of Management in order to implement the redesigned fiscal policies (especially the oncoming Director of the Bureau of Management). Close coordination and communication will be maintained with the Division's fiscal policy group, the school management services group, the local aid task force, and other fiscal consultants within the Department to insure that policy recommendations can be as fully implemented as possible."¹

In the ensuing six months the system dynamics model was constructed and analyzed. A set of six specific policy recommendations based upon the policy analysis were presented. By February of 1977, five of the six policy recommendations had been substantially implemented. The sixth recommendation required the execution of fiscal audits on the 1977 end-of-year reports, but of course such audits would not have been possible until at least December of 1977.

The system dynamics model was constructed primarily during a series of working sessions involving Associate Commissioner Audette and one or two key staff assistants. Additional analysis was completed by the analyst between these working sessions. For purposes of discussion, these sessions could be divided into several phases: Specification of Goals and Alternatives, Choice of Alternatives, and Design and Implementation of Concrete Policy Innovations. Of course, these phases are not entirely distinct--there was considerable overlap between the various stages of decision making at any one point in time. The specific steps involved in the analysis, redesign, and implementation of fiscal policies as seen from the rational framework are presented below.

Specification of Goals and Alternatives

The meetings with Associate Commissioner Audette were specifically set up to deal with the development of fiscal policy. The atmosphere of the meetings was a "think tank," or brainstorming, one. At the first meeting, the Associate Commissioner made a point of setting down on paper the major goals for the overall special education system that should guide the overall development of fiscal policy. The following were listed as "goals for

system relevant to fiscal policy considerations":

- "1) The system is open to all children with no exclusions or barriers. Service is available for a complete range of children.
- 2) Nothing is considered 'abnormal.' The environment of the system is all inclusive ('normal' includes everyone). The concept of deviance does not exist. Many different methods can co-exist.
- 3) The system should support varying speeds of learning. Children should be able to easily by-pass certain areas within a curriculum. There is no lockstep progression.
- 4) Self-evaluation by children is often and continuous. This should be a non-competitive evaluation.
- 5) The School Committee can evaluate the overall program.
- 6) In general, maximum flexibility is provided for administrators, teachers, and kids. A measure of success for the whole system is how many choice options are open to students upon completion of any part of the system.
- 7) There should be a single, inter-agency 'intake' into the system. Services would rarely be delivered beyond the local level (through local educational agencies or collaboratives).
- 8) IN GENERAL, THE GOAL IS TO PRODUCE A SYSTEM THAT IS KID-CENTERED AND CHARACTERIZED BY FLUIDITY, MOBILITY, AND MORE CHOICE." 2

During subsequent sessions, the discussion began to focus on the forces causing rapid growth in special education reimbursements, and the impacts of such rapid growth on the balance between regular and special education service delivery in the state. The focus of the discussion can be best understood by looking at the concepts and variables explicitly treated in those discussions. For example:

Amount of Special Education Reimbursement

Amount of Regular Day Reimbursement

Number of students being served under special education

Number of students being served under regular education
 Rate of flow between regular and special education
 Propensity to exaggerate special education budgets
 Neutrality of special education funding
 Size of local special education establishments
 Sloppiness of State Fiscal Management
 Probability of being "caught" with an unjustified claim
 Clarity of definition of distinctions between regular and
 special education
 Vigorousness of state auditing procedures.³

Clearly, these initial discussions were beginning to focus clearly upon the distinctions between special and regular education and the broadly defined policy mechanisms (better fiscal management, clear definition of standards, more neutral (providing less incentives) special education funding that could help attain a better balance between special and regular education in the state.

The analyst attempted to focus the discussion in these meetings on the basic cause-and-effect links that connected the various variables. During this phase of the discussion, the analyst was clearly relying upon notions of system structure implicit in the system dynamics methodology. Through previous discussions with the analyst, the Associate Commissioner had become familiar with much of the basic vocabulary of the system dynamics methodology (he had read Principles of Systems and "The Counter-Intuitive Behavior of Social Systems" by Jay Forrester and had reviewed earlier memoranda describing the fiscal management of special education in system dynamics terms.⁴

He was excited about actively participating in the development of a systems view of the fiscal policy issues facing the Division of Special Education.

From this point on, the telling of the rational story becomes closely intertwined with the process of model construction. Much of the analysis of alternatives and assessment of outcomes presented here is closely tied to the process of model building. That is, the focus for the first part of the rational story is on how the process of system abstraction and insight generation came to define various well-defined policy options within the model reality. Later, as we look at how these policy options that were well-defined within the model came to be translated into concrete real world policy alternatives, we shall see that decision makers projected their own insights and intuitions on to the model in an attempt to understand the real world implications of the abstract policies emanating from the system dynamics model.

Figure 4.6 is a replication of one of the diagrams of causal influence derived during a session spanning most of an afternoon.⁵ Even in these earliest discussion diagrams, we can see the analyst attempting to mold the analysis into a system dynamics framework. These diagrams look remarkably like the "causal loop" diagrams used in the system dynamics methodology. The quantities presented in circles or ovals represent important items that were assumed to be interacting over time. The items presented in boxes are those policy levers available to the State Department of Education for making an impact upon the network of inter-connected causal events.

The diagram implies that cities and towns had become aware of the richer percentage reimbursement available through special as opposed to regular day

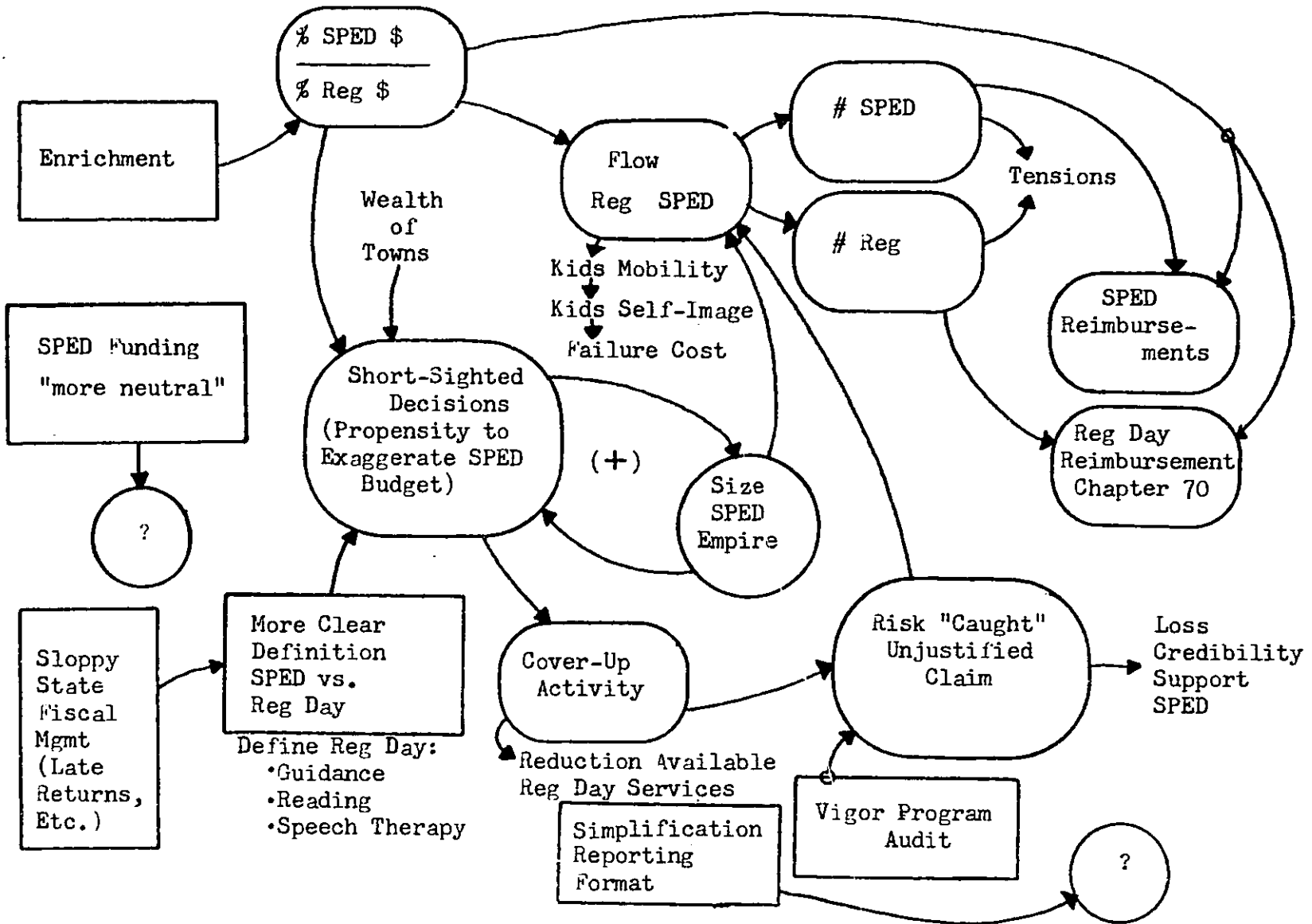


FIGURE 4.6: Preliminary Sketches of Causal Influences in Special Education Financing (Reproduced from meeting of think tank, October 15, 1976)

programs. Localities were then making (short-sighted) decisions so that special education expenditures look as large as possible in an attempt to maximize local reimbursements from the state. These decisions were deemed short-sighted because in the long run, monies paid out as special education reimbursements would not be available for regular day reimbursements and the ultimate impact of the action would be to "Rob Peter in order to pay Paul." A detrimental side effect of this vicious cycle would be that over time, more and more students and staff would be moved over into the special education category, thereby creating a special education "empire" of sorts. Ultimately, services normally delivered under regular day programs (such as guidance, reading, and speech therapy services) would become defined as special, and then students needing such services would become locked into a special category thereby decreasing the sense of mobility within the over-all educational system.

About one week later, the analyst returned with a simplification and reexplication of the discussion that had been set to paper in Figure 4.6. Here the analyst was further attempting to make the reimbursement problem "fit" within a system dynamics framework. As shown in Figure 4.7, the overall fiscal policy system was viewed in terms of broadly defined interactions between the numbers of special education staff, students, dollars allocated in the budget, and the percentage of those dollars reimbursed by the state. The special education staffing levels and student population were mutually defined. Too many students screened into the program would generate pressures to increase staff size. On the other hand, if the staff in special education became too large with respect to the current student

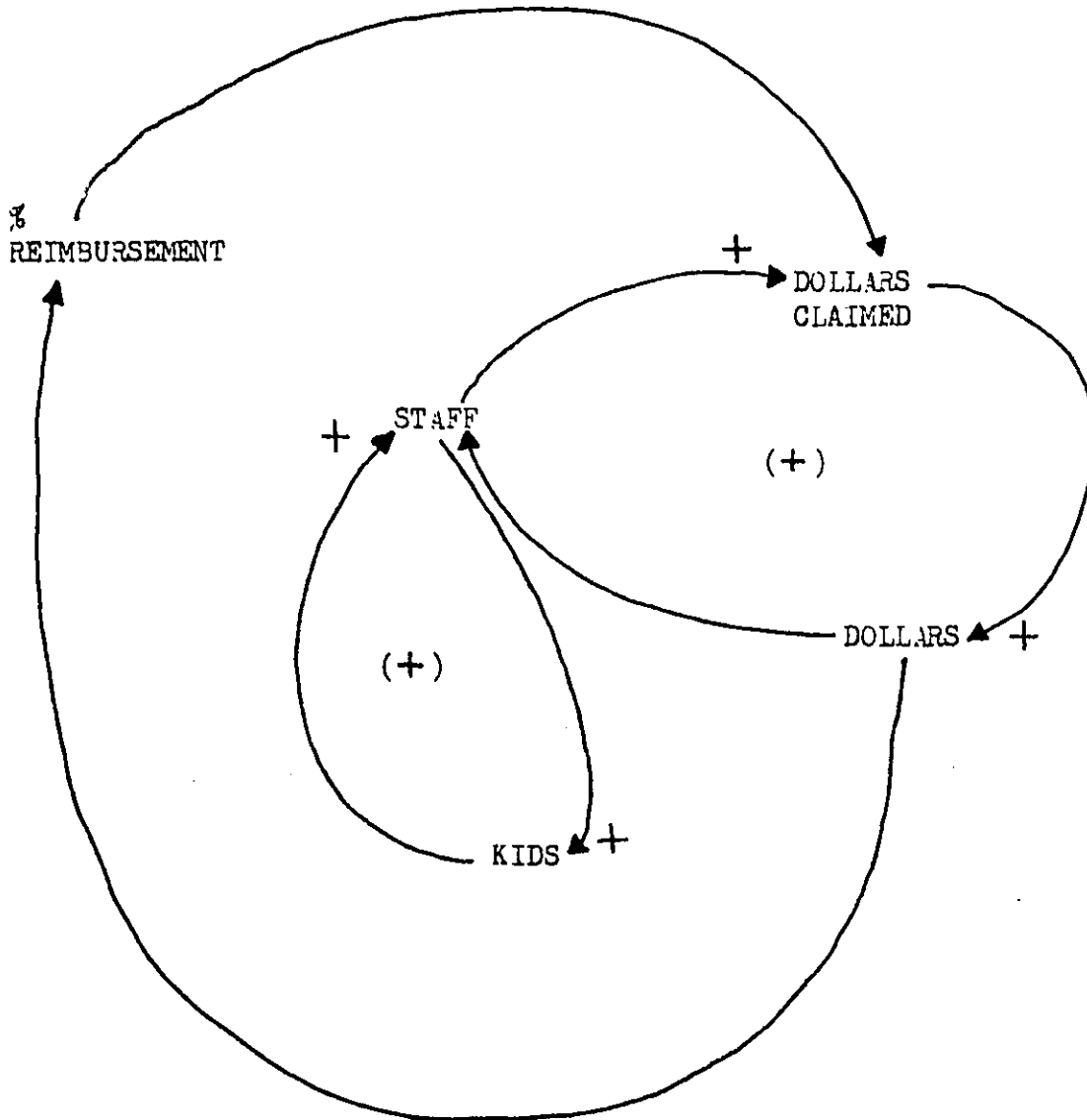


FIGURE 4.7: SIMPLE REIMBURSEMENT MODEL WITH SECOND-ORDER EFFECTS
 (Reproduced from discussions in the think tank, October 1976)

population, they would undoubtedly identify more children in need of the special services that they provided.

Staff allocation was the primary determinant of dollars claimed in the special education budget. However, if special education reimbursements were exceptionally "rich" with respect to regular day reimbursements, there would be a tendency to define more and more dollars as special educational. The greater nominal special education budgets would eventually lead to growing staff allocations into special education (for example, if a building principal had a choice between adding a regular day resource room and a special education resource room, the greater availability of dollars would mitigate in favor of adding the special as opposed to the regular day facility). To close the loop, greater dollars spent in special education would reinforce the trend toward richer special education reimbursements (because money reimbursed through special education was subtracted off the top of the total amount of dollars available for regular day). At this point, the causes of the undue growth of special education reimbursement claims had been cast within a system dynamics framework. Soon policy options could be examined within this modeled image of fiscal reality.

To further refine the analysis of the structure presented in the above causal loop diagram, the analyst explicitly represented the same system in terms of the major levels and rates operating within the system. Figure 4.8 gives a schematic representation of the principal stocks and flows that were believed to interact to cause the problem behaviors sketched in the earlier discussions.⁶ The rectangular symbols represent stocks of the quantities under question, and the small valvelike symbols represent the

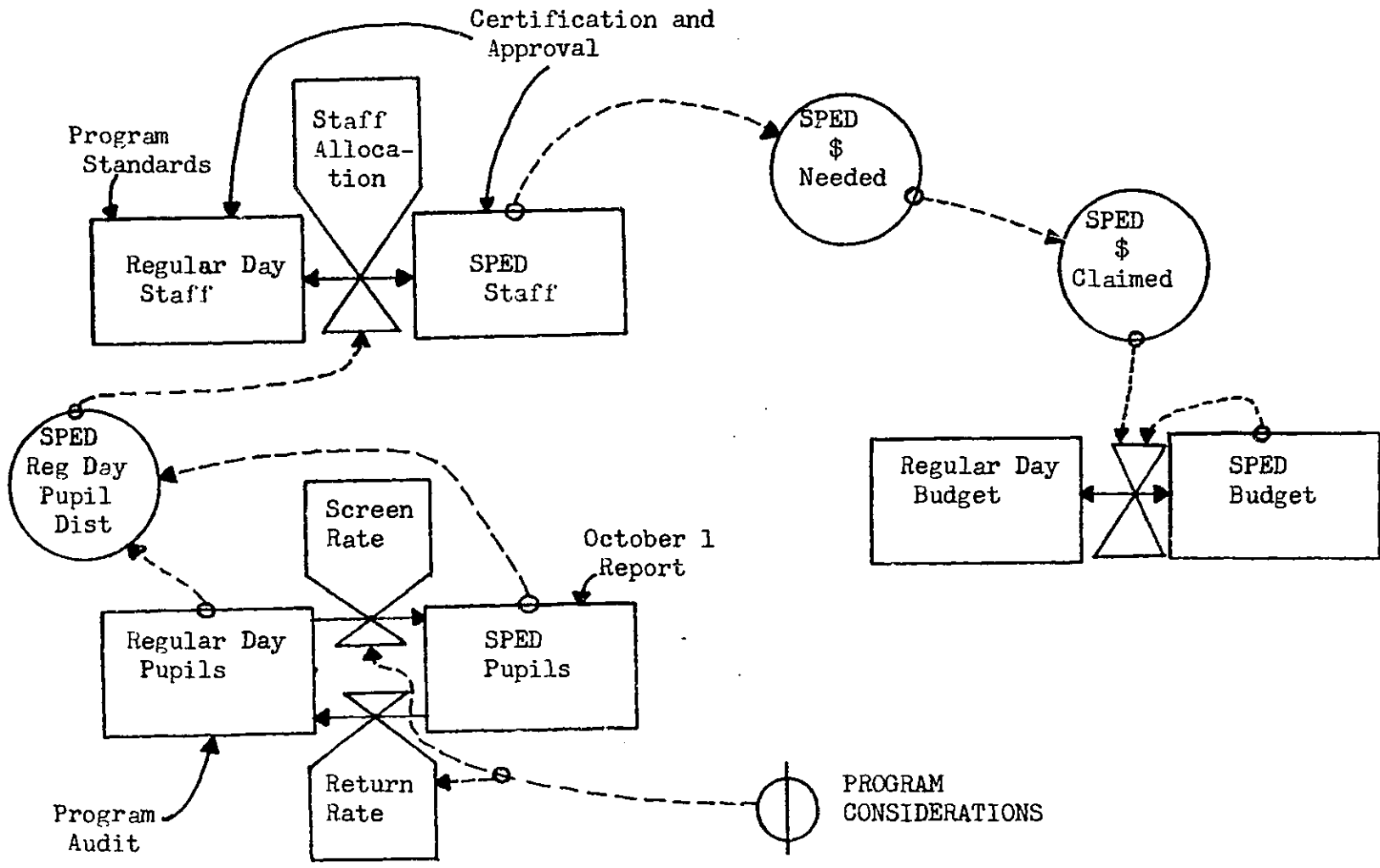


FIGURE 4.8: NAIVE SPECIAL EDUCATION "COSTING OUT" MODEL
 (Reproduced from discussion in think tank, October 1976)

flows of pupils, staff, or budget dollars between the stocks. The problem thus portrayed clearly became one of controlling the allocation of staff, pupils, and dollars between regular day and special education.

The same causal influences defined in Figure 4.7 could then be discussed in terms of the impact of that causal structure on the major stocks and flow rates within the system. In the meeting of October 15, considerable attention was given to what the major stock variables would look like if plotted against time over the first five or ten years of implementation of Chapter 766. In the jargon of the system dynamics profession, these preliminary meetings were isolating the principal levels and rates, specifying the major causal influences within the system, and detailing the base-line reference mode time behavior that one should expect to arise from such a system--a well-posed problem, and its implications were being explored within a crisply-defined model reality.

During these meetings, the analyst used his background in system dynamics more and more as a tool for structuring the discussion. The first meetings focused broadly on goals and lists of relevant variables. These meetings were fairly free-form and open-ended. The next set of meetings focused more exclusively on the circular causal connections that linked the various types of variables being considered. At this point, the analyst pressed for the "discovery" of closed loop effects that would lead to self-regulating and stable types of behavior over time or other effects that would tend to be destabilizing--leading to a continued growth in reimbursement mechanisms over time. By the end of the October 8 meeting, the analyst had become fairly well convinced that the incentive system set up through

the reimbursement cycle was one of the most important forces that would lead to a continuing growth in special education reimbursements. The subsequent meetings that introduced the formalities of levels, rates, and modes of time behavior served to more clearly focus on the various aspects of the reimbursement cycle.

By the end of the October 15 meeting, most of the conceptual groundwork for the formulation of a system dynamics model had been laid. Two weeks later, the analyst presented a formalized version of the model, complete with simulations, for review by the Associate Commissioner and other members of the think-tank group.⁷

A more-polished version of the system dynamics model was completed by mid November. This version contained a complete description of the system, analysis of the behavior of the system, a description of the major policy areas that should be considered and their relative importance, a specific set of concrete policy recommendations derived from the broad structure of the model, and complete documentation of the model used for analysis. The model reality had been crisply defined and its policy implications rather exhaustively explored. A complete copy of the final memorandum to Associate Commissioner and the Fiscal Policy Work Group is included in Appendix A. The salient features of that rather lengthy memorandum are described in several excerpts below.

The memorandum outlined the major variables treated within the model and several of the more important feedback effects that were causing continuing and dramatic growth in special education budgets:

PROGRAM SECTOR	BUDGET SECTOR	REIMBURSEMENT SECTOR
Pupils in Regular Day	Budget in Regular Day	Per Pupil Costs Regular Day
Pupils in Special Ed.	Budget in Special Ed.	Per Pupil Costs SPED
Pupil Adjustment Rate	Budget Adjustment Rate	SPED Excess Cost Per Pupil
Total Pupils	Total Budget	SPED Total Excess Costs
Distribution of Pupils	Distribution of Budget	Total Reimbursement Available
Effect of Staff Availability on Pupil Adjustment	Claimed Budgets	Reimbursement Remaining for Regular Day
Effect of Budget Availability on Pupil Adjustment	Perceived Reimbursement from Special Education	Total Claims for Regular Day
Department Pupil Standards	Perceived Reimbursement from Regular Day	Fraction Reimbursed under Regular Day Claims
Traditional Pupil Standards	Relative Attractiveness of Special Ed. Claims	Fraction Reimbursed under SPED Claims
Operating Standards for Screening Pupils	Inflation Effect from at- tractiveness of SPED Claims	
Staff in Regular Day	Departmental Control of Budget Allocation Process	
Staff in Special Ed.	Fraction Budget "Jammed"	
Staff Adjustment Rate		
Total Staff		
Distribution of Staff		
Effect of Budget Available on Staff Adjustment		
Staff Required to Meet Current Pupil Load		
Time to Adjust Staff		
Staff Adequacy Index		
Departmental Control Staff Allocation		

Table 4.9: Major Variables Appearing in Each Sector of SPED2 Model

"Table 4.9 briefly summarizes the variables that are assumed to be important in determining the causal relations between the major variables in each of the three sectors....

All of these variables are interconnected through a structural web of mutual causation. Changes in one variable have effects upon other variables that in turn have effects on yet other variables. In many cases, these chains of causality are structured in such a way that changes in a given variable eventually feed back through several other variables to reeffect the original variable.

Figure 4.10 illustrates several important feedback loops within the SPED2 model. Claimed Special Education budgets are determined by three factors. Actual SPED budgets reflect the Special Education budget that would obtain if LEAs claimed only dollars spent under the strictest definitions of what are allowable costs. Inflated budgets reflect the LEAs attempts to make Special Education budgets look larger because of the attractiveness of SPED claims due to the larger percentage reimbursements given for special educational expenditures. The third fiscal control variable represents the department's ability to have claimed costs reflect actual expenses incurred rather than inflated claims of expenses incurred. If claimed SPED budgets go up, then SPED reimbursements will also rise given current reimbursement policies. This rise in SPED reimbursements further increases the attractiveness of filing SPED claims because the number of dollars returning through SPED claims is rising and the number of dollars returning through regular day claims is on the decline. The increased attractiveness of SPED claims further reinforces the propensity of LEAs to inflate special education budgets--thereby completing the feedback loop.

Similarly, increased Special Education budgets reinforce the ability of Special Education administrators to maintain large Special Education staffs. In some cases, the increased availability of Special Education budgets will even allow Special Educational staff to expand relative to regular day staff. Completing the feedback loop, the growth in Special Education staff can further reinforce the growth in claimed budgets through increases in both the actual and inflated versions of the Special Education budget."⁸

A series of simulations were then executed using the completed model.

The time paths of all of the major variables determining the growth of special education reimbursements over a ten-year period were computed and

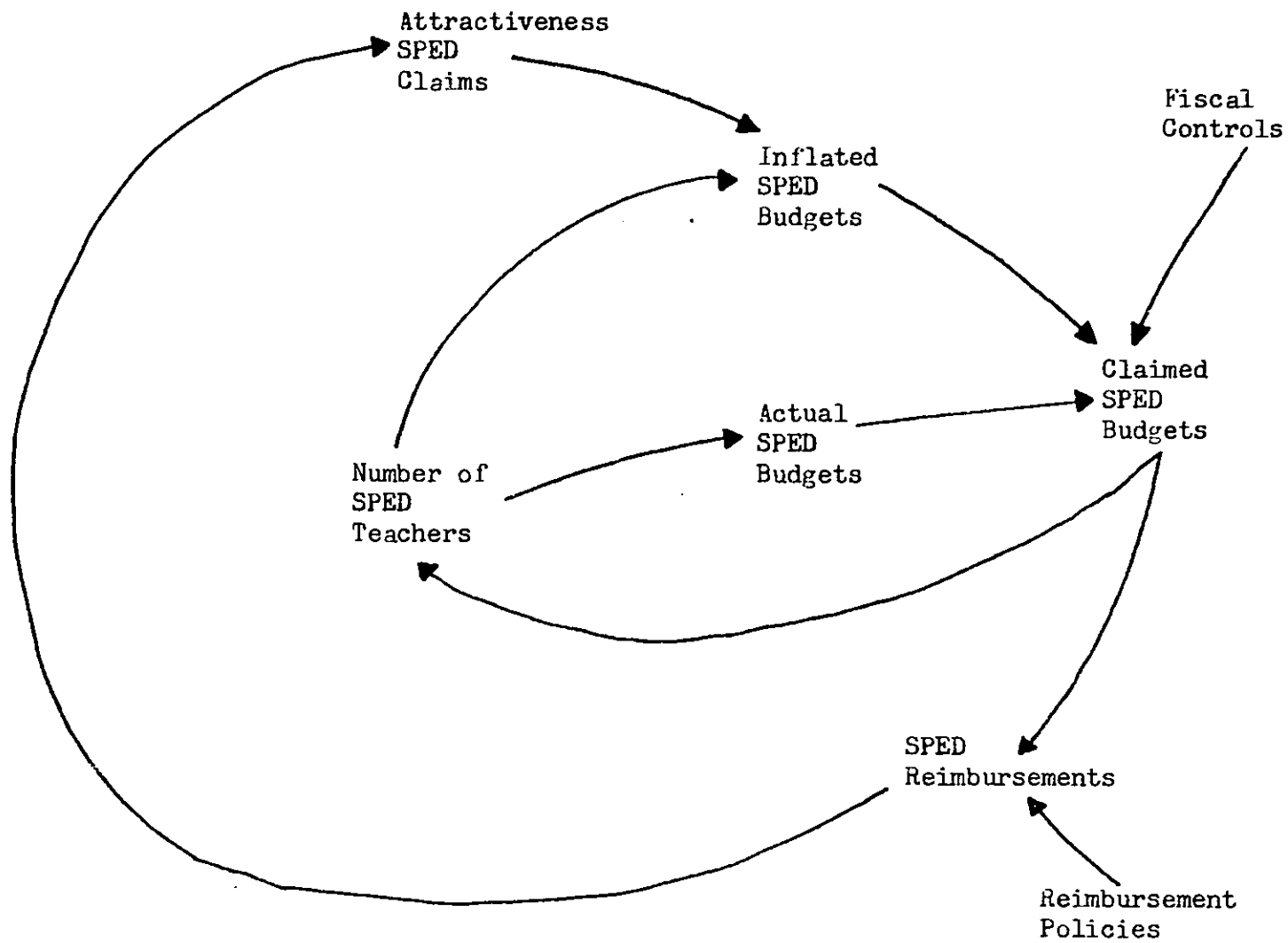


FIGURE 4.10: Several Important Feedback Loops Within SPED2 Model

plotted. The standard run of the model indicated a strong and unchecked growth in special education budgets that was primarily attributable to the strong fiscal incentives through the reimbursement loop. Three types of policies for controlling this growth were tested: program standards (e.g., promulgating 766 program regulations, establishing standards for special education teachers); program controls (e.g., review and certification of local school system implementation plans, review of individual educational plans, system-wide program audits, and other activities to insure local school system compliance with program standards); and fiscal controls (e.g., specification of allowable special education costs, aggressive and timely audits of local special education reimbursement claims).

The level of each type of control was adjusted in the simulations by substituting control parameters which varied from 0 percent to 100 percent, with 100 percent representing complete department control over school system actions with regard to the issues under consideration. By varying these control parameters, it was possible to determine which type of activity would be most effective in helping the division to control growth in costs. Presumably, once the most effective alternative could be determined, the rational division would allocate a commensurate portion of resources to that control channel in order to realize the desired stabilization of costs. The results of these policy tests were succinctly summarized by Audette in his own subsequent analysis of the fiscal policy system (for a more detailed summary of the simulation results, see Appendix A):

- "1. Program standards, even at the 100% level, were not sufficient to halt the growth of cost inflation and unstable budgets (with higher program standards actually accelerating such growth);

2. Program controls, even at the 100% level, were not sufficient to halt the growth of cost inflation and unstable budgets (though such controls were successful in eliminating the smaller "empire building" component of cost inflation);
3. Fiscal controls, applied at the 90% level two years after initial implementation of Chapter 766 resulted in a stabilization of program costs nine years after implementation, with the leanest special education budgets ever appearing approximately six years after the law's implementation. The best system performance was obtained when 90% fiscal control, 80% program control, and 80% control over program standards were instituted after the second year of implementation."⁹

The process of analysis had isolated three specific types of broadly defined control policies, policies working through program standards, program controls, and fiscal controls. An analysis of the consequences of each type of control policy as summarized in the analyst's model write-up indicated that fiscal controls appeared to be most effective in achieving the goal of stabilization of special education reimbursements. However, this definition of alternatives and analysis of outcomes was rather abstract and broadly defined--it had precise meaning only within the model reality. The additional task of choosing concrete policy recommendations based upon the model's analysis remained ahead.

Choice of Alternatives

The articulation of alternatives and their outcomes within the model-defined reality had been relatively unambiguous. However, making sense out of these abstract policy recommendations in the world of real policy design was no trivial task. The precise meanings of the aggregate system variables relating to program controls, program standards, and fiscal control were not well defined within the Division of Special Education. Different observers,

based upon their experiences and intuition, could project different significance upon those same concepts. That is, two managers could agree on the relative validity or adequacy of the model's description of fiscal affairs, yet differ in their conceptions of what should be done based upon the analysis presented within the model. During the choice of alternative stage, the precision and clarity possible when working almost totally within a model-based reality gave way to a more intuitive projection of insights and hunches onto the model's structure as different managers attempted to sort out the practical implications of the model's analysis in the not-so-clear world of fiscal policy within the Division of Special Education.

The analyst, based on an intuitive assessment of what the division could actually expect to accomplish within the time frame of six months to a year, decided that a broad strategy of enforcing tighter fiscal controls should be pursued. The analyst had been working extensively with the division's fiscal policy group and had come to believe that the fiscal policy group within the division was capable of instituting such fiscal controls, having significant impacts on the total reimbursement requests, within the next year. Another interesting story in and of itself would examine how the analyst came to believe that the fiscal policy group was capable of enforcing strengthened fiscal controls. We leave that story for later. For now, it is only necessary to note that based upon the analysis completed within the system dynamics model and his understanding of what the division could and could not accomplish within a time frame of under one year, the analyst recommended that the following concrete steps be taken:

"1) Promulgate guidelines for fiscal year 1977 that detail (for all expenditure function codes) exactly what costs may and may not be charged off to special education. A preliminary draft of such guidelines must be prepared by January to be included in the Peat-Marwick revision of the End-of-Year report to be distributed next March.

2) Promulgate policy for fiscal year 1978 that details (for all expenditure function codes) exactly what costs may and may not be charged off to special education. Clearly, this policy will be a revision of the guidelines for fiscal year 1977.

3) Revise format of the End-of-Year report to insure that items #1 and #2 can be effectively implemented.

4) Coordinate the guideline development with the Bureau of External Audit to insure that such guidelines can form the basis for field audits of LEA reports. (A clear, program-based set of such guidelines do not currently exist.)

5) Insure the occurrence of aggressive and timely audits of the Fy 77 special education reimbursement claims.

6) Spearhead the training of R.E.C. personnel and LEA SPED directors (as well as LEA business agents and superintendents) in the guidelines." 10

Although Associate Commissioner Audette agreed with the articulation of alternatives and analysis of outcomes presented in the write-up of the system dynamics model, he did not believe that the analysis had been taken far enough. Audette brought a different set of intuitions and insights to the fiscal policy project, and when he projected these on the results emerging within the model reality he chose alternatives quite different from those chosen by the analyst. He took exception to the analyst's choice of strong fiscal controls as the most effective means of stabilizing reimbursement costs. Based upon a thorough grasp of the dynamics outlined within the system dynamics model, Audette argued that the important thing was to control the reimbursement loop in some way. Fiscal controls were only

one mechanism for doing this. Another way to control that same loop would be to intervene through legislative activity and change the manner in which reimbursements were calculated. If the strong incentives that made special education dollars more richly reimbursed than regular day could be removed, then the fundamental forces driving the growth in claimed dollars would be eliminated. In order to test this hypothesis, Associate Commissioner Audette requested that computer simulations be performed to test the effects of "neutralizing" the reimbursement of Chapter 766.

"When state education aid to localities was completely neutralized (i.e., all fiscal incentives within the Department were removed) at year 4 in the simulation with high (80%) program standards and controls, the following effects were observed:

1. Budget inflation was reduced to "zero" by year 5, actually going negative after that point.
2. The size of staffs grew compatibly with special education budgets through year 10, with a consistently favorable staff adequacy index demonstrated throughout the entire period.
3. The number of special needs students served increased in an orderly manner, reaching a plateau at year 6 which was maintained through year 10.

When the same simulation was repeated, but with low (25%) program standards and controls, the following were observed:

1. Budget inflation was again reduced to "zero," but not until year 7.
2. The size of staffs did not become compatible with special education budgets until year 8, with the staff adequacy index considerably less favorable throughout the period than that indicated in the first simulation.
3. The number of special needs students served increased in an orderly manner, but at a slower rate, and by year 10 approximately 30% fewer students were being served than were being served at year 10 in the first simulation." ¹¹

The simulations pointed to the clear promise and dangers contained within the neutral funding alternative. Neutralized funding could work if program standards were maintained at a high level, but if program standards were allowed to deteriorate, the whole special education system could suffer greatly.

Audette concluded that the most effective way to deal with unstable growth in special education budgets was to combine neutralized funding with strong programmatic controls:

"These findings suggest that the most effective method of controlling the growth of special education budgets and bringing fiscal stability to the reimbursement system is to combine the neutralization of state educational aid to localities with extensive Departmental program controls."¹²

In order to implement this broadly defined plan, a series of more concrete proposals were outlined. These proposals were a complex mixture of Audette's understanding of the model reality and his prior beliefs and understands concerning special education and its funding. Three alternate strategies were proposed--the first being the most comprehensive and sweeping, the second being a less comprehensive "fall-back" position from the first, and the third being an extension of current divisional activity similar to the proposals outlined by the analyst. The core of the first, most comprehensive, strategy, consisted of five interconnected components, the first two of which required legislative action:

- "1) Removal of all Department of Education internal fiscal incentives in distributing local aid money.
- 2) Mandate a local school system program budget system to replace the prevailing line-item budget system.

- 3) Require each local school system to submit a program plan to the Department each October of the subsequent year.
- 4) Require each local school system to submit a consolidated fiscal/program plan to the Department each Spring for the subsequent year.
- 5) Institute at the regional level a system for monitoring individual issues, conducting investigations, and carrying out program audits that cross all program lines." 13

Nine "ancillary actions" were proposed to support the five points of the core strategy. Strategies two and three were motivated by the same principles as the first, but they were much less comprehensive in scope.

Design and Implementation of Concrete Policy Innovations

The system dynamics model designed for this study was (as are most mathematical policy models) a highly abstract representation of a policy system. The model dealt with "control parameters" that have a well-defined meaning only in terms of the equations of the model. There is a gap (the omnipresent validity gap) that separates aggregate model variables from real world policy actions. The analyst had jumped this gap by presenting a series of policy recommendations that had more concrete meaning in terms of the vocabulary of the organization. The Associate Commissioner had jumped the same gap between model reality and policy reality and had arrived at a different set of concrete recommendations. Each person had projected a different set of intuitions and beliefs on the analysis completed within the model reality.

However, even these so-called concrete policy recommendations exist only in the realm of ideas. Recommendations are not actions. A second gap

(the implementation gap) divides policy ideas from policy actions. Although the rational frame is rather vague on how good ideas become translated into action (somehow the optimal outcome just happens--or should happen), it is worth spending some time tracing out what happened to the various chosen alternatives.

The Fiscal Control Recommendations. The first set of recommendations based upon the analyst's reading of the causes and cures for fiscal instability were much more narrowly based than the Associate Commissioner's sweeping changes. The bulk of the recommendations centering on increasing fiscal control mechanisms (such as writing improved fiscal guidelines) could be implemented within the Fiscal Policy Group, a newly formed group within the Division of Special Education charged with the development of fiscal policy. In fact, the six rather narrowly based policy reforms had been selected precisely because they appeared capable of being launched and coordinated effectively from the division's own policy-making groups.

Three days after the final discussion within the think tank of how dynamic behavior resulted from the proposed system structure and three days before the first computer simulations of the system dynamics model were made, the analyst made a presentation within the Fiscal Policy Work Group (the work group being the working core of the larger Fiscal Policy Group). During that informal presentation, the analyst laid out the same structure of levels and rates that had been developed in discussions within the think tank group (see Figure 4.8) and discussed how the fiscal pressure point within the fiscal system was embedded in the reimbursement cycle. No mention was made of a formal model, equations, or structure--the presentation was meant

to stand on the logic of its own presentation. At that point, the analyst laid out his estimate (based purely upon subjective impressions) of what would be the most effective actions that the Fiscal Policy Group could undertake to control the reimbursement loop. Four specific activities were proposed:

- 1) Create explicit guidelines and standards outlining how the local school systems should fill out the end-of-year report.
- 2) Create a finer-grained breakout of the classification of teachers on the end-of-year report so that closer attention could be paid to what types of teachers were being charged off to special education.
- 3) For purposes of reimbursement, group four of the eleven program prototypes into a single category.
- 4) Work out a formula so that reimbursements could be based upon an easily verifiable head count rather than upon a more artificially constructed "full time equivalency" count that was harder to audit and verify.¹⁴

Responsibility for following through on each of these tasks was assigned to one or several members of the work group.

Within a week, Hal Gibber and Gene Thayer had completed a first draft of the guidelines and standards document.¹⁵ The other three activities rested inert and half-dead on the vine. A sense of importance and "doability" seemed to surround the guideline development activity. This strong sense of feasibility and importance remained for three months and through numerous prolonged working sessions. It provided much of the momentum necessary to sustain the Fiscal Policy Group's activities.¹⁶

A week and a half later when the analyst wrote his formal policy recommendations, he was forearmed with a knowledge of the excitement that the

guideline development package had caused within the work group. He recommended guideline and standards development as the cornerstone of the fiscal policy package.

By December 10, a substantially complete version of the guidelines and standards was completed by the Fiscal Policy Group. Following a series of polishing and finalization meetings during the month of January, the final package of guidelines was available to be written into the draft of the end-of-year report being developed for fiscal year 1976-77.

Neutral Funding Recommendations. The two "neutral money" strategies discussed by Audette were much less conservative than the fiscal control strategies eventually implemented through the Fiscal Policy Work Group. These more broadly based strategies could not be effectively managed through efforts centered within the division or even the department alone. The neutral money strategies all required some degree of legislative changes in how Chapter 766 was funded.

Before going to the legislature with these proposed changes, the strategies needed to be checked with the department's Executive Committee. The Executive Committee consists of the Commissioner, Associate Commissioner, and several other key managers within the department. When Associate Commissioner Audette presented the think tank's recommendations to the Executive Committee, members of that committee, especially Commissioner Anrig, expressed reservations about the feasibility of the proposed changes. Anrig was concerned over the same trade-off that had been isolated in the latter simulations of the model--namely that fiscal neutralization without

strict program controls could lead to the early demise of special education in the state. Furthermore, there were numerous political problems with having the Department of Education advocating a change in the funding of the law, thereby opening up the possibility of changing the funding but not providing the added support within the Department of Education to effectively implement a strong plan of program monitoring and standards enforcement.¹⁷

The proposal to link neutral funding was deemed too "sophisticated and politically subtle" to get through the legislative process intact.¹⁸ Furthermore, without additional legislative support, the department probably did not have the organizational capacity to carry out complete and effective program monitoring.

In sum, the presentation of strategies number one and two to the Executive Committee raised an intriguing set of issues, but it was judged imprudent to pursue the proposed changes at that time for several political and organizational reasons as outlined above. The division continued to pursue the goals of developing tighter fiscal controls.

Assessment of the Rational Framework

The rational framework is a normative one. It describes the stages of decision making that should occur in a "good" decision or policy-making process. To a large degree, the fiscal policy development efforts between September 1976 and February 1977 can be seen as fitting into the rational actor frame.

The model appeared to play a significant role in promoting a rational decision-making process. Especially in the think tank group involving the

Associate Commissioner, the model provided an explicit focus for the elaboration of alternatives, their outcomes, and a basis for choice among policy alternatives.

The analyst through his participation in the Fiscal Policy Group translated the model's recommendations into active agenda items. This clear focus of agenda helped the Fiscal Policy Group to attain its goals during the course of the overall effort.¹⁹

However, the rational actor model leads to some tantalizing and only half-answered questions. Because of its normative emphasis, the rational frame only partially considers many of the interesting forces and counterpressures that lead to the ultimate articulation of specific alternatives and choice mechanisms. For example: Where did the alternatives come from? To what degree can the issues raised within the model be seen as arising from specific model-building activities on the part of the analyst or to other non model-building activities? How are outcomes assessed and choices made? How does model output or model-building activity influence choice processes? How do model-building activities promote group consensus and the solidification of a unified rational perspective within the organization? To a large degree, we have seen that these questions can be answered only if our view of model building as an abstract process occurring within the model reality, is expanded to include managers' projection of their own intuition and beliefs on to the model reality. We need to return to these questions later.

Last and perhaps most important, where does the initial question being

answered come from? The rational frame implicitly assumes that the organization is setting out to solve some more or less well-defined problem. A critical question is, How and why did the initial problem area become defined as interesting? A more thorough analysis of the problem-formulation stage is needed before the rational story is complete.

The rational story just told begins as of August 1976 with the division's solid interest in more actively pursuing fiscal policy. At that time a formal group, the Fiscal Policy Group, was already in place to address fiscal policy issues. Energy and interest were in latent readiness. The analyst was brought in to catalyze these forces.

A year and a half earlier, the division showed little interest in fiscal matters. It had no formal group that dealt with fiscal matters, and in general it was unknowledgeable and unsophisticated in fiscal affairs. The rational story is not complete until the activities occurring over the prior year and a half and culminating in the definition of fiscal policy as a priority are more fully described.

We return to phases I and II of the rational story to trace the process of problem formulation.

4.3 PHASE I: ROOTS OF THE MODELING PROJECT

We now return to the earlier phases of the overall fiscal policy project. In these earlier phases, the problems solved in the final phase were first formulated. These earlier phases defined the roots of the later problem-solving effort.

The overall fiscal policy effort began with an earlier, more broadly based management intervention activity known as the "management improvement project" within the Division of Special Education. This project began in May 1975 with the letting of a contract to Pugh-Roberts Associates, a Cambridge-based consulting firm. The project formally ended in January 1976. Although this initial project (referred to here as "phase I") did not make use of a system dynamics model nor did it make great inroads into the fiscal policy problems facing the division, it did provide the initial entry into the organization and framed many of the issues that were to be studied over the next several years. Phase I was important to the problem formulation stage of the overall fiscal project. The salient features of the initial effort are described below with particular emphasis on the genesis of a model-based analysis of fiscal policy.

Two consultant analysts were involved in the original project. The senior of the two was skilled in organizational development and processes. He had had significant prior involvement with the Department of Education in several earlier projects. The junior analyst was skilled in "systems analysis." He had had no prior contact with the department. For this project, his initial endeavor was to examine the flows of information and paper-

work within the division's accounting department. It was the junior analyst who later on became involved in the construction of a system dynamics model.

Defining Alternative Courses of Action

A rational view of decision making asserts that policy development begins with a definition of the alternative courses of action open to the bureau. The management improvement project was a broadly defined problem-finding and process-development effort. For the first several months, both of the consultants spent considerable time and effort "scouting" the organization and attempting to more precisely define what areas of concern should become the focus of activity for the later stages of the project. The Director of the Bureau of Management, a key point of contact between the consultants and the organization, had identified accounting procedures and paper flow surrounding the disbursement of Federal Grant monies and record keeping for a population of some two thousand state wards with special needs as two of several initial areas for concern.

By mid September, five major areas of focus had clearly emerged: Each of these areas was addressed to a clearly stated set of goals and objectives and contained several projects designed to reach the attainment of those goals. The five areas were:²⁰

Divisional Planning Area. The Division of Special Education had been in a rather hectic crisis response mode since the implementation of Chapter 760. This area of activity was designed to articulate specific short and long-run goals so that the division's management team could orchestrate their efforts toward these goals.

Organizational Development Area. The goal of this second area of activity was "to develop, implement and maintain appropriate systems and procedures for the purpose of facilitating organizational development." This area included activities such as the establishment of in-service training, the implementation of a personnel selection system, and an attempt to improve the division's internal "organizational climate."

Private School Registry and Placement Area. Prior to the passage of Chapter 766, the Division of Special Education had assumed responsibility for a population of several thousand students with special needs. Under a grandfathering clause within the law, these students were to remain state wards until they terminated their schooling or returned to the public schools. Most of these students were being served within private schools, with their tuition being paid by the state. Immediately before 766 was implemented, there was a large influx of children into this grandfathered status as parents across the state tried to have their children placed in private schools at state expense. Divisional managers felt a need to concentrate some action on "cleaning up" the operations within the Private School Registry (a project team within the Bureau of Management, Division of Special Education).

External Constituencies Area. The division, especially through the efforts of the office of the Associate Commissioner, remained in touch with a host of special interest groups in special education both in Massachusetts and nationally. This area was designed to systematize the process of interaction with external constituencies.

Fiscal Management Systems Area. The final area identified for attention was later to develop into the larger fiscal policy development effort that

forms the bulk of this story. The goal of this area was "to develop the division's competencies in the fiscal management of 766 and to insure responsible state-wide program planning and reporting. In September 1975, this whole area was only vaguely understood. There were only two persons within the division who even began to understand the substantive issues involved. One of them worked only half time for the division (the other half time being spent working on a dissertation), and he was stationed in a regional office on the other end of the state. The second person was responsible for supervising several million dollars of transportation contracts let through a complex bidding procedure to approximately twenty vendors throughout the state. In addition, he spent much of his time coordinating the division's program activity with the Bureau of Research, Planning and Evaluation (the Bureau primarily responsible for the development of reimbursement procedures for the department). During the fall of 1975, extreme time pressures prevented both of these persons from devoting a substantial portion of their time to developing the fiscal management area. Three broad-gauged projects were defined, but no specific action steps were attached to any of these projects:

- "1) Division staff training in fiscal systems.
- 2) Fiscal policy and program development.
- 3) Compilation and analysis of the priorities of the Massachusetts Department of Education, Division of Special Education (both Central Office and Regional Centers, and Local Educational Associations for statewide planning and budgeting purposes." 21

These five areas of activity do not represent all the alternative activities that were possible candidates for the division's time and atten-

tion. In the course of arriving at this list, other possible alternatives were raised and then dropped from further consideration. Instead, the five areas represent a preselected menu containing many implicit evaluations on the part of key decision makers of what were the important next areas for targeted activity.

Evaluating Outcomes and Choice

A rational understanding of the decision-making process would argue that the mechanisms for evaluating the consequences of various alternatives (whether implicitly or explicitly) are mechanisms central to the decision-making process. In the first phase of the overall project being reported, two types of mechanisms, one fairly explicit and one implicit, were used to evaluate and choose among alternatives. Since these mechanisms represent a base-line description of how evaluation and choice occurred before the introduction of the system dynamics, it is useful to describe them briefly.

The explicit evaluation and choice mechanisms represented a formalization and explication of the "conventional wisdom" among divisional managers. Later on in the fiscal project, the modeling effort was to serve a similar function of allowing managers to articulate their intuitions in a structured setting. The process of explicating managers' intuitive and implicit mental models is an important function of rational decision-making processes. This articulation of management's images of problems was accomplished through a series of straightforward steps orchestrated by the external consultants.

1) Brainstorming. Several key managers were assembled in several day-long or half-day-long sessions to brainstorm lists of what were divisional

problems, priorities, and next steps. Between brainstorming meetings, lists of the alternatives generated were typed and returned to the participating managers for review and were then used as the basis for the next meeting.

2) Rough Ranking. Once it was agreed that the list of issues was complete enough (this judgment was arrived at through subjective judgment and group discussion), a rough scheme was used to rank issues into three groups ranging from most immediate to least pressing. This assessment was based upon the spot judgment of the managers present in the room.

3) Grouping of Issues. Once all of the issues had been laid out and roughly grouped, it was noted that they could be grouped into larger categories. The five areas eventually emerged from an effort to group issues and alternative courses of action.

4) Further Processing of Issues. The list of issues and areas of concern were further developed in later sessions involving either the whole group or one or two individuals. These were more or less informal sessions designed to "flesh out the issues." Key managers came armed with their intuitive sense of what mattered and what was important. No formal analyses or explicit discussion of detailed consequences occurred. The process was merely a formalization of what the managers already knew.

5) Assignment of Responsibility. The original group of managers used a simple "responsibility charting" technique for assigning primary responsibility for each area to one manager. A single person then became the "area owner" and was responsible for further development within that area.

6) Formalization of Goals, Projects, Steps, and Timelines. Each area owner then proceeded to gain the involvement of other divisional professionals

in the task of detailing the projects, steps, and timelines that would be necessary to follow through on the area. To improve communication around the project development phase, a series of standard formats for describing project content and for evaluating project progress against stated goals was adopted.

The end product of this overall process certainly looked explicit and rational. There were detailed documents outlining alternatives, steps, goals, and evaluation procedures. However, the key steps underlying this veneer of rationality, namely the brainstorming and ranking and grouping of issues, were highly implicit. The individual managers were explicating their implicit "mental models" of what was important. This same process of having managers project their intuitions and beliefs onto a structured framework would occur again while working with the formal system dynamics model.

There were apparently no profound rifts between the various managers in what they considered to be important. That is, they all shared a common notion of the reality that described what the division was about as well as its major problems. By putting all the managers together in one room, multiple views on that single reality emerged, and hence a more thorough and complete explication of the division's implicit agenda of issues could be assembled. The primary evidence suggesting this agreement along major dimensions was the fact that the articulation of major areas of activity could be accomplished in three to four meetings over a period of several weeks.

Many implicit choice mechanisms were also at work determining which of the open alternatives received the time and attention of divisional managers.

Alternatives were eliminated from active consideration, not because they were perceived to be unimportant but rather because no one had the time to deal with the issue--it was not within anyone's job description to deal with that issue--or because the issue and its implications were not fully understood.

For example, throughout the course of the initial management improvement project, no significant action was taken on the fiscal management area. And this lack of activity occurred even though all the key managers within the division recognized fiscal management as a "vital" and "top priority" concern. The facts of the matter were that only two mid-level managers understood any of the substantive issues and they were already overcommitted to other tasks. Top managers (at the level of the Associate Commissioner and Bureau Directors) would become concerned about the lack of activity in the fiscal policy area when forced to think about it, but very few fiscal policy matters routinely crossed their desks forcing them to think about such matters. A self-reinforcing process was at work. Since divisional managers had historically not been concerned with fiscal matters (the whole department displayed a sharp demarcation between the program people and the fiscal people), such matters were not routinely routed across their desks. Since fiscal concerns had not become a part of their routine concerns, they had little chance to learn about the substantive issues nor to establish an organizational subunit responsible for monitoring fiscal policy matters.

A rational view of policy making might argue that the division's priority-setting mechanisms were defective, thereby preventing management from concentrating on those areas that in more reflective moments they would

classify as top priority. However, nearly all of the activities that occupied management time were priority activities. In this case, organizational history and routines as well as how well issues were understood seemed to dominate a purely rational and normative view of what "should" happen.

Genesis of the Modeling Effort and Phase I

During the summer of 1975, one of the consultants, who had been working extensively with accounting procedures and the flows of information surrounding the division's administration of federal monies, became more broadly interested in how the division was managing both its state and federal monies. Based upon bits and pieces of information that he collected in discussions with divisional personnel, he began to try to piece together an image of what some of the critical fiscal policies facing the division might be. Since the analyst himself did not clearly understand all of the options and alternatives nor their implications, and since managers within the division saw the overall fiscal puzzle from differing points of view, early attempts to focus on fiscal policy development led to multiple, diffuse statements of problems. Diffuse and rapidly shifting statements of the problem would appear to be characteristic of the early stages of problem formulation.

Guided by a seat-of-the-pants belief that some significant portion of the fiscal policy questions facing the division could be more precisely framed within a system dynamics model, in late September the consultant-analyst completed some preliminary sketches outlining the major structures underlying the statewide reimbursement system. In these early sketches, the

analyst was explicitly using the system dynamics theory of structure as a filtering lens, helping him to better understand the important features of the division's fiscal policy system. At that time, he concluded,

"Although there are many interesting policy questions associated with how the state chooses to reimburse localities, this study shall focus on the impact of state policies upon the equality of distribution of educational dollars within the state...The central dynamic hypothesis of this study is that fiscal policies associated with Chapter 766 tend to increase fiscal inequality (as measured by dollar expenditures per child) between the affluent and less affluent towns. Furthermore, this decrease in fiscal equality will have an impact both upon children identified as having special needs as well as those children not identified as having special needs."²²

Continuing with his belief that a system dynamics framework could help to frame some of the important questions surrounding fiscal policy, by late October the consultant-analyst was able to expand upon the sets of fiscal policy issues that should be of interest to the division:

"For the sake of argument, assume that the sum of special education and all other reimbursements were to be held constant at around four hundred and fifty million dollars per year. Given current growth rates of 766 expenditures, it is not inconceivable that claims will rise to above two hundred million dollars per year within one or two years. (In fact, there appears to be a vicious cycle or "band-wagon" effect that works to assure the rapid growth of special education. As more special education claims receive priority reimbursements, it becomes more attractive to file special education claims, which induces even more special education claims.) Unless other corrective action is taken, such a large statewide special education budget will produce substantial inroads into the percentage of claims reimbursed under Chapter 70 (regular day reimbursements). Again, unless additional educational dollars can be raised through state taxes, pressures will mount within the legislature to modify the fiscal and programmatic components of the Chapter 766 legislation...Such a policy would jeopardize the position of local educators who have fought for the expansion of special education on the grounds of state assurances of reimbursement. The credibility of local special educators would be eroded and their ability to begin additional special education programs or to continue the current program level might be seriously hampered."²³

Preliminary thinking also indicated to the analyst that there might be significant interactions between federal money management and all types of state money management:

"A second key fiscal issue not directly related to reimbursement is the procedures that the department of education used to fund the tuition of students currently "grandfathered" in as state wards under the 766 legislation. As long as those monies remain within state administrative and direct payment accounts and federal accounts under state administration, the state can expect to retain fiscal and de facto programmatic control of those students." 24

Up to this point in time, the analyst's attempts to define fiscal policy questions more clearly had been an effort that involved little explicit articulation of the issues outlined above with divisional managers. It was difficult to find a spot for such a discussion on any of the organization's existing agendas. That is, by using a system dynamics perspective, the analyst was able to create an abstracted image of the fiscal policy system, and he was able to gain some insight into some of the important problems within that system. However, since there was no common awareness among key managers of the importance of these problems, nor any organizational audience for these problems, abstract insights were of little value. By mid November, it became clear that the division would not be able to take aggressive action on the fiscal management issues that had been identified as formal projects in the management improvement effort. The analyst began to focus less on the technical definition of fiscal policy questions and more on how the organizational machinery could be put in place to address fiscal policy questions. The problem formulation phase required more than just asking the right question. Attention also had to be paid to getting an

organizational audience who could answer the fiscal policy questions.

"At this point in time, I am fairly convinced that the problems associated with processing data and computing reimbursements (not the same thing as the problems inherent in the formulas-- just the mechanics of implementing the formulas) must involve the establishment of at least one knowledgeable person in each Regional Educational Center and some amount of coordination between planning documents, reporting documents, state program documents, and federal fiscal and program documents. Clearly, some degree of coordination between the Bureau of Management, Program Audit and Assistance (the division responsible for the division's regional operation), the Bureau of Research, Planning, and Evaluation (the subunit responsible for planning reimbursement procedures), and external audit is called for."²⁵

By December 11, the consultant-analyst had decided that to introduce a discussion of the model-based issues would be precocious and to some extent counterproductive. Instead, those macro-policy issues needed to be tabled for the moment in favor of a strategy designed to build personal and organizational awareness of fiscal issues. At that time, eight specific sub-projects such as "integrate private school tuition, transportation, and program data into end-of-year report" were proposed as means of "putting together an organization that will be able to deal with reimbursement more effectively no matter what the formula in use."²⁶

Phase I and the Rational Framework

Much of the activity surrounding the consultants' involvement during the management improvement project can be explained in terms of the rational framework. With respect to the model, Phase I was definitely part of the problem formulation stage. A large portion of that effort consisted of a finer and finer articulation of various courses of action open to divisional managers. Much of the activity was devoted to the construction of more

explicit functional relationships between various bureaus and the articulation of procedures and routines for conducting divisional business. Five areas of activity were first established. Then goals, objectives, and projects were assessed for each of these project areas. Finally, specific steps and timelines leading toward the attainment of the stated goals were laid out.

Although, on the surface, large portions of the original management improvement project look as if they should fit nicely within a rational framework, some major puzzling holes in the rational story certainly exist. Where did the alternatives come from? Precisely how were the outcomes of various alternatives assessed? Who did the assessing? How were the choices made?

In the most explicit cases examined, it would appear that the decision-making process was to a large degree a formalization of the managers' personal and shared perceptions of reality within the division. That is, key managers projected their intuitions and beliefs on to a well-structured rational-looking framework. The management improvement process, by focusing on an explicit, rational-looking process, allowed for the sharing and mutual strengthening of perceptions between key decision makers and provided an opportunity to flesh out the details and fill in the gaps within individual decision makers' implicit mental models of the world.

In the worst case (from a rational perspective), important choices were made implicitly with no clear framing of alternatives or explicit consideration of outcomes. In these cases the real forces that framed priorities

were the realities of time pressures, what issues are routinely brought to a given manager's attention, what substantive knowledge did a given manager possess at a fixed point in time, and with whom did key managers routinely converse.

The rational framework would normatively argue that in the best of all possible worlds, these implicit decision-making processes would not occur. (We shall return to this point later when we look at the case from an organizational or cognitive point of view.) In fact, much of the consulting effort could be viewed as an attempt to improve organizational performance by promoting a normatively rational approach to the division's problem-solving procedures. (Also, this is often what decision makers want and appreciate-- it is what they have learned that they "should" be doing in graduate school.)

Although a system dynamics model was not formally evoked during the initial management improvement phase, the roots of the ensuing model can definitely be traced back to this early phase. By thinking in model terms-- by wearing the filtering glasses of a system dynamics perspective--the analyst was led to frame a set of fiscal policy issues in a manner that was different from the treatment normally given these issues within the division. That is, the analyst gathered a host of fiscal policy facts and details from different corners of the organization. He then hung these various facts on the framework of a system dynamics perspective to arrive at a view of the fiscal policy area and its importance that was different from and in some sense not compatible with the existing methods within the division. However, the lack of an organizational audience for fiscal problems inhibited further development of the issues raised in this problem-formation phase.

The same "irrational" factors (time pressures, standard procedures for routing issues through the organization, limits on individuals' substantive knowledge) that blocked the "rational" consideration of alternatives, outcomes, and policy choices also blocked the "rational" treatment of the issues raised and framed by these early efforts. The analyst could not find a forum within the organization for the articulation of the issues to be raised within the model. In the end, he decided (on an implicit basis, one might add) to pursue an organizational strategy of building a forum within which the issues and trade-offs framed by a system dynamics perspective could be raised.

4.4 PHASE II: TRYING TO ASK THE RIGHT QUESTION

The second phase of the overall project was a continuation of the problem-forming process begun in phase I. There are three areas of concern in this second phase. First, we are interested in how a key set of managers came to be interested in fiscal policy. Second, we trace the genesis of the Fiscal Policy Group, the necessary audience for fiscal policy questions within the division. Finally, we examine multiple attempts to ask the right, insight-generating fiscal policy questions.

During the second phase, the system dynamics model did not play a central role. The model's ability to frame an abstract image of fiscal reality and to draw insights from that abstract image was of little help because the division still lacked a unit devoted to fiscal policy. Near the end of the second phase, as the fiscal policy group gained an identity, the model was of some use in helping several key managers to structure their own thinking about fiscal policy.

The second phase of the overall fiscal policy development began in January 1976 as the projects and activities, begun within the management improvement project were completed. Between January and September 1976, the second phase of activity could be characterized by five distinct projects or incidents within a rational frame of reference. These five projects and incidents are part of the problem-forming rather than problem-solving process. These five activities were: 1) the formation of the School Management Services Team to train regional and local personnel in how to report reimbursable expenditures; 2) the formation of a Fiscal Policy

Group within the Division of Special Education; 3) a decision on how to compute full-time equivalent special education pupils and how to charge teacher costs against these pupils; 4) the construction of a preliminary system dynamics model for policy analytic purposes; and 5) the framing of a new agenda of activities to occupy the Fiscal Policy Group through the fall of 1976. These five activities are discussed in more detail below.

Finishing Off the Management Improvement Project

In January 1976, Pugh, Roberts Associates ended their formal contractual agreement with the Division of Special Education. However, the junior member of the consulting team stayed on to complete further work within the division. The exact focus of his continuing work was unclear as to which of the alternatives that surfaced during the initial management improvement project should be most forcefully pursued.

In retrospect, the month of January could be rationally characterized as a period in which "loose ends" from the management improvement project were tied up and a concerted effort was begun to build groups both within the regional and central offices who could better with fiscal policy issues. However, a cursory review of the written documentation of that month does not support the retrospective assertion that there was a smooth flow from the completion of one set of priority items on to the next set of priority issues. The consultant spent considerable time focusing on the preliminary design of an information system that would give key divisional managers a better fiscal picture of how monies were being spent by region and by town.²⁷ Considerable effort was also spent helping to articulate the final lines of

responsibility and projected tasks over the next 6 months within the Bureau of Management.²⁸ In addition, the consultant conducted a series of "scouting" interviews with managers in other Bureaus within the division and further dabbled with his system dynamics conceptualization of the fiscal policy system. Although he seemed to know that he wanted to build upon the efforts started within the management improvement project and that he wanted to concentrate on fiscal policy, the exact balance of specific and concrete focus of issues did not come forth easily. January was a month of floating attempts at problem formation. Neither the right question nor the appropriate organizational audience were clearly in sight.

On January 29, the analyst drafted a proposal to the Division of Special Education outlining his projected areas of activity over the next six months. This proposal contained two major sections on a "focus on management information systems" and an "integrated regional special education fiscal posture."²⁹ This memo was an ill-focused shotgun attempt to devise a fiscal policy project over the next six months. It reflected a lack of complete understanding of the major alternatives and outcomes that were to be forthcoming within the next six months. Subsequent conversations based upon that document helped to further clarify the analyst's thinking. A more focused version of the proposed activity was completed several weeks later.³⁰ The next six months of activity were to concentrate on four tasks:

- "1) Scouting of documents and procedures already in place through individual interviewing.
- 2) Assembly of a task force able to implement a series of integrated changes in procedures during the current fiscal cycle as well as plan for additional changes to be accomplished next year.

- 3) Identification of a set of issues and procedures that might be realistically accomplished within this fiscal cycle.
- 4) Implementation of the changes isolated by the above task force."

In essence, the analyst had drafted a contract the purpose of which was to formulate a problem.

School Management Services Training Effort

While this effort to gain focus was going on within the Division of Special Education, another division within the department was already mounting an effort to address the broad questions of reimbursement to cities and towns. During the month of January, Fred Williams, Associate Commissioner of Personnel and Administration, had drawn together a task force under the Bureau of School Management Services to discuss how an effort could be launched through the regional offices to improve the reporting of data on the end-of-year report for reimbursement.³¹ The operational plan evolved into an effort to spread fiscal expertise through the regional offices through an in-service training process--a plan that closely matched the projected activities of the consultant within the Division of Special Education.

The School Management Services task force's operational plan called for the execution of seven specific activities between January 1 and July 1, 1976:

- "1) Preparation of Reports/Guidelines
- 2) Development of Training Programs for Regional Staff
- 3) Training of Regional Staff
- 4) Printing of Reports/Guidelines

- 5) Distribution of Reports/Guidelines
- 6) Delivery of Technical Assistance to LEAs
- 7) Reports filed--Department of Education."³²

The analyst, who was having a difficult time arriving at a clear sense of focus for fiscal policy development within the Division of Special Education, decided to concentrate his attention on the efforts of the School Management Services task force. Over the next five months, the analyst participated in a series of bi-weekly meetings held at various regional offices as well as a series of weekly meetings of a coordinating group at the central office. During this period of time, the School Management Services effort realized most of its major objectives surrounding the training of regional personnel and the delivery of technical assistance to Local School Systems in how to fill out the end-of-year report.

During this project, the analyst made some contributions toward the progress of the group, but more importantly, he gained concrete knowledge concerning the operation of the reimbursement process. Such detailed discussions of fiscal matters did not occur within the Division of Special Education (principally because fiscal matters were simply not understood on a detailed level there). This detailed base-line knowledge was an essential prerequisite to the success of future projects.

Establishing the Fiscal Policy Group

Based upon a month of concrete involvement with the School Management Services group, the analyst drafted a memo to Hal Gibber, a program coordinator within the division, outlining a proposed structure for the Fiscal Policy

Group. The group would be designed:

"-To take the first steps toward addressing the key fiscal issues important to 766 and special education in the state.

-To perform a linking function with the fiscal school management effort under Fred Williams and to provide a key programmatic component and organizational support.

-To serve as a department-wide model for fiscal-program policy integration." 33

The March 11 memorandum outlined six specific functions to be performed by the group as well as group membership and the next steps necessary for the group's formation. Although the notion of such a group had been explicitly articulated during the previous November and had been written into the analyst's proposed agenda of activities, the actual formation of the Fiscal Policy Group was catalyzed by the analyst's involvement in the School Management Services training group.

The first formal meeting of the Fiscal Policy Group occurred within three weeks. At the inaugural meeting, an agenda of fourteen items were discussed.³⁴ The following six items were considered "timely or priority issues:"

Full Time Equivalency. One of the principal points of reporting difficulty on the SPED 5 (the special education component of the end-of-year report) during this past year was how pupil data were accounted for. The division and department need a set of guidelines (and possible sample worksheets) outlining how to compute full-time-equivalent students for various program prototypes.

Reimbursement Recreational Expenses. How are summer recreational expenses for special needs children to be reimbursed?

Special Education within Occupational Education Schools. Special education expenses are reimbursed on an excess cost basis, with cost greater than 110% of the state average excess cost reverting to Chapter 70. Occupational Education is reimbursed at a flat 50% under Chapter 74. We need some clear guidelines for local

education associations concerning the treatment of special education expenses within an Occupational Education Program.

Training Central Office. The School Management Group will be concentrating on the training of selected regional personnel. If division central office staff (and Project Directors?) are to receive a greater fiscal training, it must be the responsibility of the Fiscal Policy Group.

Retroactive Adjustments of Bureau of Institutional Schools Assessments.

Analysis of Where Federal Dollars Spent (By Town): Where State Reimbursements Spent. This is a continuation of the work that Bill Donaldson has already started on analysis of expenditure patterns." 34A

Of the fourteen agenda items originally considered by the Fiscal Policy Group, seven of these had arisen in conversations within the School Management Services training effort, two surfaced as impromptu comments during the first meeting of the Fiscal Policy Group, and five had been culled from prior interactions within the Division of Special Education. The experiences within the Fiscal Policy Group suggest that this agency articulated alternatives by getting the right mix of persons together in a meeting or by having one or several persons who know how to be in the right place, ask the right questions, and to then sort through conversations.

As a new-formed group with a fresh agenda of issues, the Fiscal Policy Group was prepared to take on its first substantive policy decision.

How to Compute Full-Time Equivalents

During the course of the School Management Services training effort, it became clear that no one knew how to compute full-time equivalents for special education, or the number of students who are receiving special

education services on a full-time basis.** There were a host of loosely connected and only vaguely understood issues circulating within the training sessions. What was the basic definition of a "whole day" upon which to base the definition of a full-time equivalent? Should full-time equivalents be based only upon student distribution of time or should how the faculty splits its time also play a part in the definition of full-time equivalents? These and other questions were quite important because before any special education reimbursements could be computed, this full-time equivalency figure had to be computed. In fact, efforts in the computation of full-time equivalency apparently had been responsible for much of the messy reporting of data and computation of aid that had gone on during the previous year.

Since the definition of full-time equivalents was the first major decision of the Fiscal Policy Group, it is worth some time to explain in detail how this decision emerged. Although a formal model was never evoked during the course of the full-time equivalency decision, the decision-making process followed throughout this incident sheds light on how the Fiscal Policy Group made decisions.

The source of the initial question was a crisis of indecision within the training sessions of the School Management Services team. Alternative solutions to the puzzle were laid out in a series of working memos drafted by individual members of the Fiscal Policy Work Group. With one exception,

** For example, one student receiving special services all day every day would be considered one full-time equivalent. Two students receiving special services for half a day every day would also be considered one full-time equivalent.

the outcomes of various alternatives were assessed informally with no explicit calculations of consequences. The whole process was evidently one of explicitly articulating what one or several members of the group already knew and then testing that member's thoughts, as written down in memo form, against the intuition of the Fiscal Policy Work Group's collective membership. Over time, the group as a whole did exhibit considerable learning, and alternatives seriously considered at the outset could be eliminated with little discussion later on. The articulation of alternatives and outcomes could be best envisioned as a self-clarifying dialogue between the perceptions of individuals and the collective intelligence of the working group.

A fairly straightforward method for computing full-time equivalency was laid out in a memo written by Joe Flahive, one of the two persons in the division most knowledgeable about fiscal affairs, on April 8.³⁵ Five tumultuous, conflict-ridden meetings ensued. At each meeting various protagonists came armed with detailed memoranda outlining how they believed that full-time equivalency should be properly computed.

In a meeting held on April 26, the entire work group agreed that the straightforward method outlined three and one-half weeks earlier was in fact the correct way to compute full-time equivalents. However, it turned out that the disputes of the past five meetings had turned on a separate issue that had not been recognized. Although everyone agreed on how to compute full-time equivalents, not everyone agreed on how costs should be assigned against these full-time equivalents. The debate within the group moved up one notch--the definition of the question being asked had shifted and all of the issues came more clearly into focus.

Three days later, five alternative methods for dividing teachers' salaries between special education and regular day services were drawn up in a brainstorming session. The group immediately rejected three out of the five as unreasonable, leaving only two concrete alternatives. Each position was advocated by one of the two most knowledgeable fiscal members of the work group. The essential points of difference pivoted around what fraction of time (if any) of regular day teachers could be charged off to special education when these teachers had students with special needs in their classrooms.

The following day, a Friday, the entire work group reconvened to consider the issue. At that meeting, the sides were clearly drawn and the issues laid out explicitly. A meeting was called for three days later (the next working day) involving two Associate Commissioners and the Deputy Commissioner for Coordination. In that meeting, each position was defended by a well-thought-out position paper.³⁶ In addition, each of the two options was evaluated along nine separate criteria representing three major dimensions of choice: 1) possible political consequences due to increased or decreased flows of monies to localities; 2) program policy considerations, that is, do the proposed changes reinforce or work against the stated program goals of the division; and 3) technical elegance and ease of administration.

In the end, it was decided to allow no regular day teacher's costs to be charged to special education. For purposes here, the outcome of the decision is less important than the process that led up to the decision.

Three weeks of discussion made little apparent progress. However, after this time, the group was able to ask the right question--to more precisely define the problem that needed solution. Five days after the right question had been asked, a definite decision had been made. The specification of alternatives and outcomes was an iterative process involving an evolutionary tension between the opinions and knowledge of one or two members of the group and the emerging group understanding of the problem. Before the proper question had been asked, the behavior of the work group may have appeared drifting and not unguided. However, this initial muddling about eventually led to a level of understanding that allowed the "best" alternatives to be lucidly framed and a very rational appearing decision-making process to take place.

The System Dynamics Model and Phase II

During the second phase of the overall fiscal policy development project, the progress of the system dynamics modeling effort could be best described as still in the muddling stage. The analyst was motivated toward the exploration of a set of broadly defined issues, and he received considerable interest and support in these explorations from managers within the division. However, the focus of the model was too abstract. Division managers found it to be an interesting exercise to discuss the broad issues raised by the model-building process, but the whole process had not reached a level of specificity that allowed concrete action steps to be taken.

In early March 1976, a simplified model of the special education fiscal-program system was programmed and a rough memo outlining the issues raised

by this model and possible extensions of the model was drafted.³⁷ The purpose of this model was to interest division managers in an extended modeling project and to hint at the range of issues that could possibly be treated in such an effort. At that time, it was claimed that an increasingly expanded agenda of issues could be addressed by the model as it became more and more elaborated.

The range of issues that were to be addressed by the fully elaborated modeling project was impressive. For example, with slight extensions the current model could examine the following questions:

"Will the statewide 766 program "overshoot" acceptable limits to its size due to substantial delays in the reimbursement process?

What will be the effects of such overshoot on program levels and quality?

Should screening and start-up costs be treated differently from program maintenance costs?

What are the trade-offs between program scope (size) and quality? Which will the division choose?

How can the division prevent long-term erosion of 766 quality and size?"³⁸

By adding greater to the detail, it was claimed that the model could address additional questions such as:

"How will expansion of special education tend to impinge upon regular day programs and hence erode support for special education programs?

What has been the effect of Chapter 766 on fiscal equalization throughout the state?

What are the additional trade-offs inherent in an equilibrium program when differences in both size and quality of inter-town differences are considered?"³⁹

All of these questions seem to be clearly linked to a system dynamics perspective. For example, the notions of "overshoot," "equilibrium trade-offs," and "delays" are central to much system dynamics analysis. Each set of more comprehensive questions was explicitly tied to a more complex sketch of the underlying structure that would be needed to answer such questions. All of these sketches reflected interactions between three primary types of variables: program variables, variables associated with the local budget-setting process, and variables associated with the state reimbursement process. Interactions between these three types of variables explicitly formed the closed boundary of the system to be studied. The structure of the model to be built in the third phase was slowly coming into focus.

However, only the first set of questions dealing with an equilibrium and overshoot type of behavior due to fiscal constraints and substantial delays in the state's reimbursement process was specifically tied to the initial model that had been built. The other sets of questions represented clear conjectural extensions of that model. The analyst had captured a set of vaguely defined issues that he had heard floating around the division and School Management Services training effort and had loosely structured these issues in a more or less integrated fashion within a system dynamics framework.

Division managers found this preliminary framing of issues "stimulating (in that) no one in the department is thinking that way" as well as "depressing (in that) it is evidence that we are doing all the wrong things."⁴⁰ The problem with the whole analysis was that neither the division nor the analyst could make the issues abstractly framed within the system dynamics

model connect with real world action steps that could be taken to answer the questions raised abstractly by the model. Furthermore, divisional managers were overcommitted in the daily management of the division and the analyst had become heavily committed to the formation of a fiscal policy group and to providing technical assistance to the School Management Services training sessions. Over the next two months, aggressive development of the model did not occur.

In May after the Fiscal Policy Group had been formed and had made its first major decision surrounding the computation of full-time equivalents and the regional training sessions were well under way, the analyst returned his attention to the promotion of the system dynamics model as a way for framing some longer-range issues. The same model programmed in March was more formally written up in a memorandum to Associate Commissioner Audette.⁴¹ This memo traced the causes of several possible types of behavior within the statewide fiscal program system in completely non-technical terms. The essential system dynamics arguments were made with no resort to equations or computer situations, with the actual model and its output being made available within the Appendix. A second appendix gave a rather sweeping introduction to the system dynamics methodology.

The principal lessons from the memo were that 1) fiscal concerns were central to the program well-being of the law; 2) program-fiscal concerns must be viewed as interactions between program variables, local budget-setting variables, and state reimbursement variables; 3) the Division of Special Education must immediately become proactive in fiscal matters or it stood to relinquish control over the destiny of its own programs; and

4) the fiscal program system should properly be understood in terms of system dynamics concepts such as a closed system, relationships between system causal structure and system behavior, and such specific notions as "equilibrium trade-offs," "overshoot," and "delays."

Associate Commissioner Audette was sufficiently impressed by the system-wide "big think" approach implied by the system dynamics approach that he scheduled a two-day workshop to more fully work the issues raised by the model. The notion behind this workshop was to take several of the broad issues framed by the model and to then work them through into concrete operational steps. This was viewed as a "kick-off" meeting to put the division on the road toward a more proactive fiscal posture. As Hal Gibber summarized the meeting:

"The methodology involved is system dynamics, a research tool relying heavily on computer simulations which initially allows policy makers to step back from operational issues and conceptually understand how the whole of the fiscal program system is structured and behaves over time (broad brush fashion).

Once that overall conceptual understanding is in place, we will have to look at the details of accounting systems, reimbursement formulas, management information systems, program budgeting, et al. In summary we attempted to both hypothesize the major forces at work in determining the inter-relationship between fiscal and program activities and to establish a process for further examination of this set of complementary issues." 42

In the end, the high hopes for the model and for a comprehensive planning effort based upon a deep understanding of basic causes did not work. The planning session became fixated on one major question: "What is the appropriate programmatic size and scope for 766 and how can these limits be operationalized so that the trade-offs most advantageous to the division are made?"

Nineteen "operational outputs" were identified as ways of dealing with this basic question. None of the nineteen outputs were ever operationalized.

The "big think" aspects of a system dynamics approach had captured the imagination of several key decision makers. The model had posed a series of interesting and interrelated questions based upon the system dynamics theory of structure as well as the issues that the analyst had heard raised in separate corners of the organization. However, the right insight was yet to be gleaned--the right question yet to be asked. Two days of effort had failed to connect the issues raised within the model with concrete operational output.

Although key managers were more fiscally aware and an organizational audience in the form of the Fiscal Policy Group was coming together, the search for the right question continued.

The Agenda Continues to Roll

Through the month of June a series of scouting interviews were held with key managers in Divisions other than Special Education involved with fiscal affairs. These interviews indicated that other fiscal divisions within the Department of Education were undertaking considerable efforts to improve the special education reimbursement process. At that time, it was considered important that the division coordinate its efforts with those of other divisions,⁴³ but these activities were considered mostly as "add ons" to the direct interests of the Division of Special Education (even though the division was not completely sure of what its own "direct interests" were).

By the end of June, the Fiscal Policy Group took another pass at defining an agenda. Nine items were identified for consideration. Two of these had been raised in the June interviews with other departmental personnel. Seven were restatements or rephrasings of earlier, as of yet unacted-upon, concerns. Interestingly enough, responsibility for the project that was ultimately to occupy most of the work group's time throughout the fall and lead to the most concrete results, "Establish a '766 fiscal policy guidelines' notebook in each of the regional centers" was delegated to an accountant with little managerial experience.⁴⁴

Over the course of the past year, significant steps toward the development of fiscal policy had been made. A group that considered itself responsible for fiscal policy matters had assembled and had addressed at least one major question. The group was continually growing in its expertise and ability to deal with fiscal matters. A system dynamics model had been built that framed a set of larger questions for the group's consideration. However, from a rational framework, no cogent articulation of the major operational alternatives open to the division had emerged. The group's best activity to date had been in a crisis response mode. The group still lacked a clear sense of what its goals should be. It did not have a workable agenda of tasks.

The principal impact of this year's worth of muddling through had been to win a niche within the organization's operating space that was concerned with "fiscal policy." The exact structure and content of that space was not fully clear. Considerable learning had actually occurred as division managers

wandered in, sometimes seemingly aimless patterns through the strange new world of fiscal policy. The stage had been set for the impressive and rational-looking frontal attack on fiscal policy issues that was to occur during the fall.

4.5 NORMATIVE ASPECTS OF THE RATIONAL PERSPECTIVE

Clear Normative Content of the Rational Theory

A rational perspective leaves little doubt about what one should do to make "best" rational decisions. One should examine a complete range of alternatives, assess the outcomes of all of the alternatives, agree upon a method for valuing the various possible end-states, and then make a choice based upon the criteria of value maximization.

Similarly, on the surface in any case, models should support rational analyses in fairly straight forward ways. Models should help in the process of problem definition, aid in the articulation of an exhaustive set of alternatives, provide a means for evaluating consequences of alternatives, and help to explicate the value basis upon which the final choice rests.

However, the rational gets quite thin when one stops talking about how one should decide and begins to talk about what actually transpires in real decision-making situations. The rational perspective provides a convenient yardstick for measuring actual decision processes against what should happen in an idealized case. However, a host of organizational, political, and cognitive factors can prevent real decision processes from attaining the rational ideal. When this occurs, the rational perspective lacks the detailed description of these real decision processes to yield concrete recommendations on how to correct for these "non-rational" factors. The rational perspective needs to be complemented by other views of the decision-making process. The analyst uses the rational ideal to gauge the performance of decision processes against an ideal. Following this "measuring up" process, the analyst must be able to take another, organizational, cognitive or political, view to understand what went wrong (what produced the devia-

tion from rational) and what to do about it.

Recommendations for Better Policy Modeling: A Rational Look

Specifically, the modified theory developed in this case study highlights two areas to which the rational analyst should pay close attention when diagnosing the performance of decision processes. First, the stage of problem formulation is a critical phase in the process of rational analysis and is often neglected in the literature on rational decision making. Within the problem formulating phase, analysts should remain aware of how key managers are thinking about the problem under study (cognitive factors) and they must be sure that an organizational audience exists to address the problems in question (organizational factors).

Second, analysts who are using formal mathematical models must remain keenly aware of the sharp distinctions that exist between the artificial world of a model reality and the real decision-making reality the managers inhabit. Specifically, the rationalized connections between alternative, outcomes, and choice within the model reality have been abstracted, idealized, and "cleaned up." Models are useful decision aids precisely because they can provide this sense of problem simplification. However, decision-making realities are riddled by a host of decidedly non-rational factors. Political intrigue and log rolling are not rational processes (according to the definition that we have been using here). Organizational processes, that is the way alternatives are "dished up" to key managers, outcomes evaluated, and goals established, do not conform to an ideal of synoptic rationality. Finally, managers in their own thinking process are continually taking "short cuts," simplifying or denying difficult trade-offs,

screening out relevant information, and often refusing to look at more than one side to a problem. All of these factors, known to operate in the complex world of real decisions, inhibit rational analyses.

The case study suggests that "projection" may be one important function that models play in bridging the gap between the sharply defined model reality and the messy world of decision reality. That is by projecting their beliefs, intuitions, and prior assumptions on to the model's structure and conclusions, managers have an opportunity to explicate, synthesize, and legitimate the many non-rational processes that actually occur--they have an opportunity to make the intuitive decision-making processes normally occurring within the agency more closely approximate the rational ideal.

The process of "projection" so briefly sketched in this chapter is an immensely complicated process having important cognitive and organizational dimensions. A rational theory lacks a discussion of the detailed cognitive and organizational factors that facilitate or inhibit projection processes. To understand projection in enough detail to be able to effectively manage it, analysts and managers alike must change their way of thinking about decision making. They must begin to think of decision as an organizational or cognitive process; for these perspectives contain the concepts and metaphors necessary to explain, understand, and better manage and control how managers project their intuitions on to the model, how they come to ask the right questions for the model to answer, and how they come to assemble organizational audiences capable of solving the problems addressed by the model.

In summary, the experiences gained within the rational case study

suggest that one should use the rational framework as a normative measuring stick to judge the performance of bureaucratic decision making and formal models in promoting rational-looking decision processes. Do not expect a rational framework to say how to correct defects found in decision processes. Instead, change the frame of analysis and self-consciously reexamine the same situation from another (that is, organizational, cognitive, or political) point of view. That is, the rational decision-making reality is a normative one. To be most effective, this normatively-defined reality must be complemented by other more descriptive decision-making realities.

4.6 NOTES FOR CHAPTER FOUR

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3. Minutes from Meeting October 15, 1976.
4. D.F. Andersen, "Fiscal Policy Options and the Management of Chapter 766," System Dynamics Group Memorandum D-2381, May 1976.
5. Minutes from Meeting of October 15 with R.H. Audette and B. Levine.
6. Figure 4.8 reproduced from minutes of Meeting with R.H. Audette and B. Levine, October 15, 1976.
7. See D.F. Andersen, "Agenda for Meeting with Bob Audette," containing simulations of a preliminary model, November 2, 1976.
8. D.F. Andersen, "Policy Recommendations from System Dynamics Simulation of the Special Educational Fiscal Policy System," memorandum to R.H. Audette and the Fiscal Policy Group, November 16, 1976.
9. R.H. Audette, Division of Special Education, Department of Education, "A Proposal to Eliminate Fiscal Instability within the Educational Reimbursement System," internal working memorandum, January 1977.
10. D.F. Andersen, "Policy Recommendations."
11. R.H. Audette, Division of Special Education, Department of Education, "A Proposal to Eliminate Fiscal Instability within the Educational Reimbursement System," January 1977.
12. Ibid., p. 19.
13. Ibid., pp. 19-22.
14. Author's notes on Meeting of Fiscal Policy Work Group, October 28, 1976.
15. Gene Thayer, "A Preliminary Look at Some Personnel Issues for End of Year Report in Special Education," internal working memorandum, November 4, 1976.
16. Interview with Hal Gibber, January 7, 1976.

17. Author's notes on presentation to Executive Committee, December 2, 1976.
18. This is Audette's own assessment of why the proposed changes met with difficulty in the Executive Committee presentation. Interview with Audette, December 22, 1976.
19. The effect of a clearly focused agenda on attaining Work Group goals was more extensively discussed by Hal Gibber in an interview, January 7, 1976.
20. The summaries of the five areas of activity are taken from, R.H. Audette, "Management Improvement Planning Area," Internal working memorandum, September 1975; H. Gibber, "Management Improvement Area: Organizational Development," Internal working memorandum, September 9, 1975; T. Bradford, "Private School Registry and Placement," Internal working memorandum, September, 1975; R.H. Audette, "Management Improvement Area: External Constituencies," Internal working memorandum, September, 1975; and D. Keeler, "Management Improvement Area: Fiscal Management Systems," Internal working memorandum, October, 1975.
21. D. Keeler, "Management Improvement Area: Fiscal Management Systems," p. 5.
22. October 6 memorandum, "Special Education Model--Preliminary Thoughts," David F. Andersen.
23. D.F. Andersen, "Fiscal Issues Associated with Chapter 766," memorandum to selected divisional managers, October 22, 1975.
24. Ibid., p. 5.
25. D.F. Andersen, "Benchmarks and Possible Future Actions 766 Projects," Internal working memorandum from Andersen to A. Frohmen, November 17, 1975.
26. D.F. Andersen, "Some Reimbursement Issues," Internal working memorandum, December 11, 1975.
27. See: "Project Description, Identification and Evaluation of Current Data Collection," Internal memorandum, January 1, 1976, Bill Donaldson.
28. See T. Bradford and D. Bregold, "Six Month Goals and Activities for Management Bureau," memorandum to Management Bureau Staff, February 2, 1976.
29. D.F. Andersen, "Development of Management Information Systems and an Integrated Fiscal Posture:-A Proposal to the Division of Special Education," Internal memorandum, January 29, 1976.

30. See: D.F. Andersen, "Development of an Integrated Regional Fiscal Posture: A Proposal to the Division of Special Education," February 11, 1976.
31. T.C. Bradford and F.E. Williams, "Operations Plan for State Entitlement Application Process, Second Draft," Internal memorandum to James Bradley, Dave Keeler, Thomas Passios, and Leo Turo, January 8, 1975.
32. F. Williams, T. Bradford, "End-of-Year Report Operations Plan," memorandum to Dave Andersen, Jim Andersen, Dave Backlin, Jim Bradley, Dave Keeler, Leo Turo, Tom While, Joe Yannacci, February 2, 1976.
33. D. Andersen, "Overview: Fiscal Policy Group," Internal memorandum to Hal Gibber, March 11, 1976.
34. H. Gibber, "Fiscal Policy Group Meeting," memorandum announcing the first meeting of the Fiscal Policy Group, April 1, 1976.
- 34A. Ibid.
35. See: J.G. Flahive, "Full Time Equivalency," memorandum to the Fiscal Policy Work Group, April 8, 1976.
36. See: "Agenda: Fiscal Policy Meeting," Internal memorandum, May 3, 1976.
37. See: D. Andersen, "Causal Influences in Simple Aggregate Model of Program Fiscal Interactions," March 10, 1976.
38. Ibid., pp. 2 and 3.
39. Ibid., pp. 4-6.
40. Author's notes on meeting with Terry Bradford, Director of the Bureau of Management, March 11, 1976.
41. See: D. Andersen, "Fiscal Policy Options and the Management of Chapter 766," System Dynamics Group Working Paper D-2381, May 14, 1976.
42. Hal Gibber, "Planning Sessions with Bob Audette, Dave Andersen, and External Coordinators," memorandum to Fiscal Policy Group and Management Team, June 1, 1976.
43. H. Gibber, "Next Steps," memorandum to Fiscal Policy Work Group, June 14, 1976.
44. Author's notes on Fiscal Policy Group's meeting, June 30, 1976.

CHAPTER FIVE

THE ORGANIZATIONAL STORY

The rational actor story was a story about systems analysis, model building, and a reasoned diagnosis of the forces at play within the fiscal policy system. This, the organizational story, is concerned with organizational diagnosis, the design of organizational subunits and the implementation of change. The cognitive story that follows treats the origins and limitations of the mental images that managers use to guide their actions in a world characterized by complexity.

The role of the analyst changes in each of these stories. In the first, he is a model builder and diagnostician of system performance, policies, and pressure points. In this, the second story, he is an agent of organizational change. In the final story, he is a teacher.

The rational actor story begins with the question, "Given a group that was interested in fiscal policy, how could the best policy alternatives be isolated and implemented?". The organizational story asks where did that group come from? How did it come to function as it did? What were its goals, routines, and operating procedures. The actual content of the puzzle-solving exercise that formed the primary focus of the rational actor story is really a secondary concern. Problem solutions flow naturally once the proper organizational machinery has been put into place.

5.1 THEORETICAL BASIS FOR THE ORGANIZATIONAL STORY

Chapter 2 presented a summary of the organizational theory of decision making as it appeared in the literature. Here that initial synopsis of theory is deepened to reflect experiences and insights gained through the case study.

Summary of Basic Theory and Naive Propositions

Figure 5.1 summarizes nine basic propositions forming the core of the organizational theory of decision making that motivates this, the second look at the case study. These nine summary propositions have been extracted from Chapter 2 where they were developed in more detail with reference to the literature on decision making.

Taken as a whole, these propositions, along with the more fully elaborated body of theory that lies behind them provide a basic vocabulary for describing organizational decision making. They provide the observer or practitioner with a set of colored lenses with which to interpret and assign meaning to the often undifferentiated flurry of activity that characterizes real bureaucratic decision making. These propositions act like a series of signposts that orient the observer of bureaucratic phenomena and help him to decide what is an important event and what may be ignored.

The frame delineated by these propositions draws attention to phenomena quite different from the rational frame. We are now (almost painfully) aware of the diversity of interests represented within a bureaucratic environment. The cool unity of single rationality has evaporated. Goals are no longer represented through the objective articulation of a joint utility function. Instead they are an ever-shifting mix of constraint that

attract the attention of the organization only sporadically.

These goals are not really of equal weight. Instead, organizations avoid the questions of commensurability altogether by attending to goals one at a time. When faced with problems, organizations do not coolly delineate all of the possible courses of action, weigh their consequences, and choose some optimal expected outcome. Instead they grope in a half-blind fashion, articulating only those alternatives that are close to how things are currently being done and choosing not the best, but the first, acceptable solution.

In this our second pass at the case study, we are interested in how the viewpoint generated by the organizational frame can lead to deepened insights into how models in general and system dynamics models in particular can be helpful aids to bureaucratic policy design. Later on, we will contrast the insights generated from the organizational perspective with those generated by the rational and cognitive perspectives. However, before we could start this search for across-perspective comparisons, we needed some clues as to what the organizational viewpoint specifically implied for the special case of model-based policy design efforts.

As a "first cut" at adapting the organizational view of policy design to our special case, we articulated a series of seven propositions that showed how system dynamics models in particular might be expected to assist in model-based policy design exercises. These are shown in Table 5.2. These seven propositions were not based upon any empirical observations. They were merely deductive predictions based upon careful thinking about the nature of organizational decision making and system dynamics modeling.

TABLE 5.1: Propositions Summarizing Basic Organizational Theory of
Decision Making (Propositions summarized from Chapter 2)

- 1) Multiple Actors and Parochial Interests. Policy is set by a coalition of organizational actors all of whom are pursuing a parochial set of interests and priorities.
- 2) Goals as Constraints. Mostly, organizations do what they have to. Organizational goals are a series of "don't go below or above" constraints.
- 3) Sequential Attention to Goals. Organizations pay attention to goals one at a time.
- 4) Standard Operating Procedures. The range of possible policy options is usually defined by the narrow range of standard operations within the organization's repertoire.
- 5) Decomposable Environments. Organizations function by assigning one subunit to monitor some single aspect of its environment.
- 6) Problem-Directed Search. When an organization deviates from a goal, it will initiate a search for solutions that is characteristically simple-minded, searching those alternatives nearest to current policies.
- 7) Information Screening. Nearly all aspects of the policy-setting process are in part determined by how information flows through the organization.
- 8) Negotiated Environments. Organizations do not attempt to predict the consequences of their actions far into the future. After each incremental policy shift, they wait to see how the environment responds.
- 9) Limited Flexibility. Because organizations adapt to their environments incrementally, they will only be capable of slow adjustments with limited flexibility.

TABLE 5.2: Original (Naive) Propositions Summarizing How System Dynamics Models Aid in Organizational Decision Making (Propositions summarized from Chapter 2)

- 1) Focus Attention on Inactive Goals. By focusing on a cluster of well-defined problems, a system dynamics model can keep an organization aware of some longer-range goals.
- 2) Sequence of Goal Attention Ignored. Because a system dynamics model focuses on a cluster of well-defined problems, it gives managers little explicit help in dividing their attention between competing constraints.
- 3) Provides Guidelines for Problem-Directed Search. System dynamics models provide explicit causal explanations of problem behavior. Hence, they can help organizations search for problem solutions.
- 4) Aids Organizational Processing of Information. Because system simulations contain explicit information flows, they can isolate which streams of information are critical to the policy-setting function.
- 5) Ignores Short-Run Feedbacks. A strategic model that can capture the underlying long-term causal feedbacks producing system behavior will characteristically ignore short-run effects.
- 6) Aids Development of Interagency Policies. System models will often draw their boundaries large enough to cover the activities of several agencies. Hence, policy conclusions will often require interagency coordination.
- 7) Tends to Develop Infeasible Policies. Recommendations from system dynamics models, because they often require interagency coordination, will tend to be infeasible.

Again, they were to serve as initial landmarks guiding our preliminary search through the richly complex empirical field of the case study.

These initial, naive propositions were highly suggestive. They suggested that there might be a "good-news" as well as "bad-news" aspect to using models to design policies within bureaucracies. On the one hand, they suggested that system dynamics models might be especially useful because they could generate a systems view of relevant problems and recommend sweeping interagency solutions to these problems. On the other hand, organizational theory tells us that such interagency solutions would in great likelihood be infeasible solutions. Strategic systems models might be good for focusing organizational attention on longer-run (and often ignored) strategic goals, but on the other hand such models would often completely ignore the short-run phenomena so important to the setting of organizational policy. Managers and analysts would somehow have to capitalize on the characteristic strengths of system dynamics modeling efforts while cleverly attempting to compensate for the companion weaknesses of the modeling approach.

A direct inference from these seven propositions was that applying system-modeling techniques to organizational decision-making processes is not an easy and straightforward matter. This view stood in sharp contrast to the rational view of decision making where system modeling was seen to directly and logically support all aspects of the decision-making process. In fact, from the rational point of view, the process of building a quantitative model was nearly one and the same with the process of making a good decision. This clean one-to-one correspondence between modeling processes

and decision-making processes was lost when decisions were viewed from an organizational perspective.

Now that the case studies have been completed, both the basic theory guiding this portion of our case study as well as the initial propositions concerning how models assist organizational decision making need to be reexamined in light of the evidence gathered. Does the basic theory seem capable of explaining a significant portion of the interesting points actually observed in the data? If not, how can that theory be modified so as to more robustly mirror the actual activities observed in the case? Likewise, do our initial hunches about the role of model-based analysis (generated only from careful deductive thinking) still seem to make good sense? Can we enrich this body of proposed theory based upon the observations within our case study? Finally, can we arrive at any prescriptions or helpful suggestions to assist future practitioners in more skillfully employing models in organizations?

Of course, even if we can generate a series of theoretically enriched propositions that seem to explain how models fit into organizational decision processes and appear to give helpful hints to future modelers, we cannot claim to have proved these propositions based upon the evidence of only a single case study. But we can require that the new updated propositions be somehow demonstrable and empirically grounded within the evidence of our case study. The purpose of the extensive case study that follows is to motivate more fully the modified propositions presented in summary form below.

New Distinctions and Concepts Necessary to Adapt Naive Theory to the Case.

The evidence collected in the case study suggests that the naive theory articulated above is "flat" and lacking in detail. An important aspect of the functioning of any organization is how the organization changes its goal structure, membership, or standard operating procedures in response either to changes in its operating environment or to forces internal to itself. The naive theory tells us very little about this change process, the process of organizations learning and adapting. And organizational adaptation is important to our story because the goal of model-based policy efforts is often to change policies, and changes in policy cannot always be separated from changes in the goals, membership, and routines--the organizational capabilities--of an agency.

In order to enrich our discussion and to include concepts of organizational learning and adaptation, we shall need several new concepts. In general, we shall need to differentiate more finely between the various types of operating units that constitute the greater organizational unit and to discuss the various types of linkages that allow these various types of units to function smoothly as a whole. We shall propose several propositions suggested by the evidence within the case study that will give us the vocabulary necessary to discuss the role of mathematical models in promoting policy changes. These propositions will be more fully derived in the case study that follows. We begin with a premise central to the organizational view of policy making:

* Proposition 5.1 *

* Policy Changes are Organizational Changes. Policy results *

* from the routine execution of organizational capabilities. Policy *

* changes must entail changes in organizational capabilities. *

Changes in organizational capabilities, that is, changes in the goals, membership, and standard operating procedures of an organization, may result from several different types of forces. Changes in an agency's operating environment such as the passage of new legislation may cause sudden shifts in organizational capabilities. On the other hand, some changes in capabilities may be initiated by forces internal to a given organization as the organization finds better ways to adapt to a fairly constant operating environment. These are the types of changes that are of interest here-- endogenous changes in organizational capability due to forces internal to agency. However, even endogenously induced changes may be of two types. First, an operating unit may change in response to its own initiative. Second, an operating unit may change in response to an initiative external to the unit but still internal to the overall agency. That is, a particular unit may respond to changes in its "bureaucratic environment". We summarize this discussion as follows:

* Proposition 5.1.A *

* Differentiated Environment. An organization's operating en- *

* vironment is differentiated into several qualitatively distinct *

* sections. For purposes of our analysis, we distinguish between *

* operating environments external to the entire agency and those *

* internal to the organization. This latter is the bureaucratic *

* environment. *

Furthermore, even within the bureaucratic environment different types of operating units exhibit markedly different organizational capabilities. The differences between types of units are critical for the initiation, diffusion, and sustenance of policy innovations. Although several taxonomies based upon an analysis of differential organizational capabilities are possible, we shall split operating units into three types: policy study groups, implementing operating units, and nonimplementing operating units.

Policy study groups are groups of managers, usually assembled on an ad hoc basis and having some representation from top management. The purpose of such groups is to study and recommend solutions to pressing policy problems. Often such groups become the host groups for model-based policy design efforts. It is a common tactic among analysts external to an organization to assemble such a team or task force to sponsor their work.

Implementing operating units are those units within an organization targeted to implement policy changes. These units are implementers only because they have responsibility for the operating areas affected by the

proposed policy changes. In other ways they are not distinguishable in their organizational capabilities from other operating units. For a single set of policy innovations there may be more than one implementing unit, or a new operating unit may be created to act as the implementing unit.

Nonimplementing operating units do not have primary responsibility for the policy changes under consideration. However, it is necessary and important to include such groups in our analysis of policy innovations because initiated policies within one operating unit often ripple out and impact upon these allegedly nonimplementing units. Interactions between implementing and nonimplementing units can often determine the success or failure of a policy innovation. To recapitulate:

* Proposition 5.1.B *

* Organizational Units Have Differing Capabilities. Organiza- *

* tional changes are initiated, diffused, and sustained by subunits *

* with widely differing organizational capabilities. For our pur- *

* poses, we distinguish between policy study groups, implementing *

* operating units, and nonimplementing operating units. *

A significant portion of changes in organizational capabilities and hence in organizational policies are effected by interactions between units with widely varying goals and routines. Such units are often located within the same agency. A study of how capabilities change, or how organizations learn, must deal with the patterns of interaction between various units. Such a study must include a discussion of the mechanisms whereby

these units interact.

Numerous examples of both formal and informal mechanisms that link units exist. For example, one common way to insure communication across units is to create patterns of overlapping membership between groups. These overlaps may be informal where a member just "sits in" on the meetings of another, or they may be rather formal such as the meeting of an executive committee that draws together the heads of all of the units within a single agency. Units may be linked by the flow of formal paperwork. Information gathered in the regional offices may be processed by the computer units at the central office. Contract awards or invoices may require the "sign-off" of members from several separate operating units. Units may also be linked in less formal manners. A policy paper from a study group may be purposely and prematurely "leaked" to another operating unit to gain its early impressions. Critical impressions may be shared over an informal lunch or in a car pool on the way to work. A study of changes in organizational capabilities must explicitly consider these mechanisms that link operating units, for the management of these linkages will prove crucial to assuring the coordinated implementation of a policy on an agency-wide basis.

* Proposition 5.1.C *

* Diffusion Linkages. The mechanisms by which organizational *

* units of differing capabilities interact to promote changes in *

* organizational policy must be dealt with explicitly when exploring *

* the process of policy innovation. *

An important puzzle facing the analyst of policy innovation is, exactly how do diverse units all "get into step"? It is challenging to consider how scores of organizational units pursuing many scores of separate goals can produce policy activity that is even somewhat coordinated. Conversely, this same puzzle is interesting because it gives some clues as to how diverse units "get out of step," producing the apparent lack of bureaucratic coordination that has, to many become the hallmark of modern public service bureaucracies. These same linkages that explain the diffusion of policy innovations are critical to assuring continued contact and coordination between various operating units.

In fact, the concept of an operating constraint is very useful for describing some of the linkages that work to insure coordination. An implementing unit may take some action that forces another unit to respond. For example, the central office changes its method of collecting and manipulating data, so the regions must also change their method of collecting data. Or a change in a funding formula by the federal government may cause state agencies to change their operating procedures to conform to the new regulations. In both of these cases, one operating unit took some action that created a new operating constraint for another operating unit. Failure to respond to newly imposed constraints could have adverse effects on the nonimplementing unit (that is, the unit being impacted indirectly by the change). At any point in time, the operating freedom of any unit is severely constrained by many such demands that have accumulated over the years. However, that same unit by its past initiatives has created the context that presently constrains the actions of yet other operating units. This

are organizationally "smarter" than operating units who face many more real operating constraints and have little time for abstract policy reflection. On the other hand, the operating units do have the operating "muscle" in the form of established routines and procedures for assuring that policies are put in place and become operational. Metaphorically, study groups are the organization's brains and operating units are the brawn.

The linkages between organizational units are critical because they are the conduits through which intentions become action. Information and action signals must flow in both directions through these conduits. Not only are policy innovations diffused outward to the operating units, but the policy study groups need to understand the intrinsic limitations of both the operating units themselves and the mechanisms that link operating units. Deficiencies in the capabilities of the operating units or of the linking mechanisms must be recognized early on and appropriate compensating actions taken. The process whereby operating constraints are mutually defined by operating units would be critically important within such an expanded theory of policy innovation. For over time mutually defined networks of organizational constraints mold the shape of routines and standard operating procedures--the stuff of which policy is made.

Such an updated theory of policy innovation would yield prescriptive suggestions concerning how to better manage policy innovations. For example, managers would be directed to target the operating units necessary to implement policy changes early on or to explicitly manage several types of diffusion mechanisms linking study groups to the implementing operating units.

But we leave the exercise of creating such a completed framework to

another research project. Our aim here is more modest. We examine the special case where the policy study group is a model-based study group (a not uncommon phenomenon for modeling projects). Using the vocabulary that we have extracted from an expanded theory base, we shall summarily derive a set of modified propositions, arising from the case study, that replace the initial naive propositions describing the role of mathematical models in organizational policy design.

However, one final distinction is necessary. The naive propositions were deduced by thinking hard about the organizational theory and the system dynamics methodological priors--the intrinsic characteristics of the model itself. A moment's reflection reveals that model-based policy design efforts contain much more than just models. For our purposes we shall divide model-based policy analysis into three levels: the model per se, the model-building process (narrowly defined), and the broader modeling process within the organization.

The model per se consists of the computer code necessary to simulate the model and policy analysis papers based directly upon the model equations or upon simulations of the equations. Next, the model-building process consists of the gathering of the information necessary to build the model--the assembly of a study group, the articulation of a causal structure, and the iterative specification of that structure first as a preliminary model and then in more advanced stages finally culminating in one or more policy positions. We shall not need to sharply distinguish between the model per se and the model-building process.

However, the third level, the broader process of modeling within an

organization, involves many activities that are only tangentially related (if at all) to the process of actually building a model. For example, a model could be built with little attention being paid to how the results of that model would diffuse throughout the organization. It is conceivable that an external analyst could enter an organization and define a problem without extensive interactive consultation with management and then set out to solve that problem. These activities (such as managing the diffusion of policy innovations and initially scouting the organization) could be associated with nonmodeling policy change exercises and hence will be considered parts of the broader organizational modeling process rather than as parts of the modeling building per se. The distinctions between these two classes of activities will sometimes be fuzzy, but we shall use the broad defining criteria of answering the question, could a model (not necessarily a good model) have been built without the activity? If the answer to this question is yes, then that activity is considered part of the broader organizational modeling effort as opposed to part of the more narrowly defined model building per se.

Our interest shall be focused on the more broadly defined process of organizational modeling. With respect to the more narrowly defined model-building process, one would have to give the broad advice, "build good models." Beyond that one would quickly become involved in questions such as aggregation, sensitivity analysis, or parameter selection. Although interesting questions in and of themselves, they shall not be the focus of our study here. Furthermore, it would appear that even good models often do not make good practical policy analysis exercises. For purposes of

designing better policy (as opposed to building better models), the focus on the broader issues of organizational-modeling processes seems more important than a focus on model building per se. Hence, we shall distinguish between modeling as a technical and creative art and modeling within an organization context--an imprecise melding of both technological and sociological factors.

* Proposition 5.2 *

* Different Levels of Modeling Effort. It is useful to think *

* of model-based policy design efforts as existing on at least *

* three levels: models per se, (artifactual level), the model- *

* building process (technical and creative art), and the broader *

* organizational modeling process (both technological and socio- *

* logical factors). *

Math Models and Organizational Policy Design--Modified Propositions

The original naive propositions outlining the role of mathematical models in the organizational policy design process can be considerably extended and deepened in light of the evidence gathered within the case study. The first four propositions outlined below sketch a broad picture of some of the relations that will exist between a modeling effort aimed at policy innovations and the broader arena of organizational activity. Subsequent propositions will become more specific, identifying points of influence that must be skillfully controlled if the modeling effort is to result in

for many other purposes. Such models will not have to lead to improved organizational capabilities in order to be useful. However, if the intent of a model is to promote concrete policy innovations, then an organizational view of policy making implies that the model must entail some improvements in organizational capabilities. This proposition implies that more than good models will be needed if a policy design effort is to be effective. The assertion that modeling efforts must be focused on implementing results right from the outset of the project is a step in the right direction.¹ However, this assertion goes beyond an emphasis on implementation. It suggests that changes in organizational capabilities of one form or another are a necessary prerequisite to an effective modeling project. This initial proposition permeates the entire organizational view of model-based policy analysis.

Since modeling efforts must change organizational capabilities, teams of analysts must pay explicit attention to the initial distribution of capabilities within an organization. A modeling effort that becomes housed within an obscure low-level study group with few linkages to operating units and receives little attention from top management will have little chance of effecting any organizational change. Any insights that may have been gained from the model-building exercise will be "washed out" by the poor initial positioning and visibility of the modeling effort.

* Proposition 5.4 *

* Positioning of Modeling Effort. Model-based policy re- *

* commendations only partially result from the model and the *

* attached model analysis. To a large degree, the final recom- *

* mendations will be colored by the organizational capabilities *

* of the host group as well as the quality of the linkages *

* established with other units. *

It seems likely that certain types of organizational units (such as policy study groups) would be more readily predisposed to host modeling efforts than others (such as operating units). The processes of abstraction and analysis, so characteristic of modeling efforts, are not as compatible with the tight timelines and "chin down" attitude that characterize operating units as they are with the more reflective policy orientation of policy study groups. The day-to-day routines of managing agendas, getting people together for meetings, meeting unexpected timelines, and general crisis management are not treated in the longer-run perspectives of strategic systems models. Since these same day-to-day concerns are the primary pre-occupation of operating units, the strategic recommendations emanating from a modeling effort often seem rather luxurious and sometimes extraneous to the hard-pressed line manager. The analysis team, working in close conjunction with its host unit, must work hard to bridge this apparent gap between the view taken by the model and the contingencies of daily crisis management. In their non-model building roles, the team of analysts must

must be able to train others in the concepts and issues being raised within the model; and, finally, they must be able to effectively manage the many details of keeping a policy study group on task.²

* Proposition 5.6 *

* Multiple Roles of Analysis Team. Model-based policy analysis *

* teams (in conjunction with their host units) must perform at least *

* two broad types of roles. First, such teams must be technically *

* and conceptually competent to practice the craft of model *

* building. Second, the team must be able to effectively manage *

* a wide range of organizational processes. *

A common strategy (or a common misconception) is that an analysis team can provide the conceptual and technical skill and that the management of organizational processes can be handled by the host unit. Such a simplistic view is prone to several fallacies. First, it assumes that the various roles can be split neatly apart and assigned to distinct individuals. It is unlikely that such a neat assignment of roles will ever be possible. Operating managers must be involved in the conceptual if not technical aspects of the model building if they are to "buy into" the final recommendations. Similarly, the analysis team must assume responsibility for the management of organizational processes or they will be abdicating responsibility to seriously confront concrete policy problems.

Thus far, we have sketched the process of model-based policy design within organizations as an imprecise amalgamation of technological and

sociological factors. Model building is no longer a completely detached rational-looking process that can be applied as an overlay to diagnose and cure the organization. To some degree, the roles of the modeler and the operating manager must become temporarily blurred and indistinct. The manager must share in the reflective activities of model building and the analysis team must experience the messy and imprecise world of daily crisis management. A more precise and differentiated description of the many linkages between analysis teams, policy study groups, and operating units will yield propositions concerning pressure points within the organization that managers and analysts alike can control to yield more effective policy design projects. Specifically, we shall begin by examining why some organizational units are hospitable hosts for modeling-building exercises and why others are not.

Operating units, constantly under pressure to meet constraints imposed on them by other units within the organization, tend to be the least hospitable hosts for model-based policy study efforts. Their very detailed, day-to-day, crisis management orientation is not compatible with the longer-run, more detached view taken by model study efforts.

* Proposition 5.7 *

* Operating Units Inhospitable Hosts. Operating units function *
 * under pressure to meet constraints. Of necessity, their operations *
 * are characterized by expediency. Models create a long-run somewhat *
 * abstracted view of policy questions that is not compatible with the *
 * perspective of operating units. *

When faced with a particular problem, operating units will typically employ rather narrow, problem-directed search routines in arriving at a solution. Such nonsynoptic problem-solving behaviors are highly functional, leading to solutions that are close to those currently in use and requiring only minimal modifications in routines and standard operating procedures. The more thorough analysis of alternatives often implied by a model-based policy design effort is considered at best extraneous because it requires the consideration of so much more information and the weighing of a broader range of alternatives. At worst, operating units might assume a broader analysis of alternatives to be non-functional and impractical because it may lead to policy solutions that require significant modifications in standard operating procedures and routines. That is, model-based policy design has the potential of "rocking the boat" and creating extra work for a unit already under pressure to meet its other goals.

Furthermore, strategic models such as those most often constructed by system dynamicists cannot help operating groups with some of the most severe problems that face them. For example, such groups usually pursue a multitude of only imprecisely defined goals as they respond to questions raised in all corners of the organization. The commissioner needs a written review of three pieces of proposed legislation by tomorrow; the regional office needs clarification on a new guideline as soon as possible; forms have to be revised for the next fiscal year; and the agency's legal office needs some summary statistics (in a form not readily available) to respond to a suit against the agency. On the other hand, well-constructed models treat only a small number of crisply defined problems. Although these models are

make assumptions about the long-run outcomes of such processes or can represent some of these processes in abstracted form, such models give little explicit help to managers who must manage these short-run tactical matters. Again, the intrinsic character of strategic policy models makes them extraneous to many of the concrete concerns of managers of operating units.

* Proposition 5.7.B *

* Short-run Phenomena Ignored. Organizations reduce uncertainty *

* through day-to-day negotiations with their operating environment. *

* Policy models are characteristically unconcerned with day-to-day *

* operations in any detailed and explicit way. *

Since operating units themselves are not good hosts for modeling efforts, the results of model-based policy designs must somehow be transformed so as to be more available to operating units. Abstract policy recommendations must be translated into concrete agenda items. Managers of operating units must actively participate in policy study groups examining issues using a model. In a word, bridges must be built between operating units and policy study groups because in companionship, these two types of units form a team capable of implementing policy changes. Whereas operating units provide the organizational capability for implementing policies, policy study groups provided a detached perspective for examining possible changes in organizational policies. Policy study groups typically have few operating constraints imposed upon them and hence are not forced to look for expedient solutions to problems. Such groups do not usually respond to tight timelines

the formation of an effective policy study group. Since model-building activities tend to be so heavily concentrated within policy study groups, it follows that the diffusion of policy innovations to operating units must be one of the more broadly defined nonmodeling activities accomplished by the team of analysts and host members of the policy study group.

Unfortunately policy study groups have certain characteristic defects in their organizational structure. Organization theory distinguishes between goals-as-intentions (what one wants to do) and goals-as-constraints (what an organization has to do). The constraint component of an organization's goal structure tends to dominate in determining operating procedures and routines. That is, when under pressure, an organization will tend to do only what it is constrained to do. Unless there is an abundance of unmobilized organizational slack, the intentional component of goals will have little effect on organizational behavior. Models housed within policy study groups serve well the function of defining intentions, but they are not so good for setting goals-as-constraints. Hence in an organizational sense of the work, policy study groups are unmotivated. They lack a complete and effective goal structure. This is not to say that individuals on policy study groups are unmotivated. Quite the contrary, individually they may know exactly what they want to do. Policy study groups as an organizational unit lack a complete motivating goal structure.

Since they are not constrained to accomplish any concrete organizational output (through the execution of standard operating procedures), policy study groups typically pursue a set of surrogate goals. The construction of a model, or the drafting of a policy report, are examples of such

surrogate goals. Although these activities can be extremely helpful in clarifying how individual managers conceive of their operating environment and the options open to them, they do not create pressures that will cause the study group to pursue a fixed set of constraints through a set of established routines.

Instability is a third characteristic defect of policy study groups. Since such groups do not have any fixed demands that they must meet and since individual members of such groups do have many pressing demands on their time from their other roles within the organization, there are few organizational reasons for such policy study groups to remain together. As pressures mount in other areas of the organization, such groups will have a strong tendency to dissolve as managers allocate attention to matters that have to get done. The fact that policy study groups do stay together cannot be well explained for organizational reasons. The "glue" that holds such groups together is the cognitive rewards that individual managers accrue from taking a more detached view of their day-to-day operations.

* Proposition 5.8.A *

* Study Groups are Organizationally Defective. Due to their *

* unique organizational structure, study groups will have several *

* characteristic defects. They are organizationally unmotivated, *

* lacking strong goals-as-constraints defining what they must ac- *

* complish. They will tend to pursue surrogate goals, activities *

* that managers want to do rather than have to do. Finally, they *

* will be unstable, exhibiting a tendency to dissolve as pressures *
 * mount elsewhere within the organization. *

The warm receptivity of study groups to modeling efforts coupled with their organizational defects generates the "good news-bad news" pattern of strengths and weaknesses of model-based policy study efforts within organizations that we originally saw in the naive propositions. At that time, we had argued that the relative strengths and weaknesses of organizational modeling efforts could be traced to some of the intrinsic properties of the models themselves. Now we must modify that view by noting that modeling efforts (narrowly defined) tend to seek out host units that are compatible with the view of the world that they imply. That is, models tend to be housed within policy study groups that are under less pressure than operating units. Hence they tend to be organizationally "smarter," usually employing more synoptic search procedures and being less constrained to search out expedient solutions. But these same study groups are more out of touch with operating realities as they pursue surrogate goals. Hence the original naive propositions must be modified to reflect the fact that modeling efforts are attached to host units with their own mix of strengths and weaknesses.

* Proposition 5.8.B *

* Focuses Attention on Inactive Goals. Because study groups are *

* not limited by the normal operating constraints imposed on other *

* units, they will have the latitude to consider important but *

* currently inactive (passive) goals that may have importance only *
 * in the long run. System dynamics models, by their focus on long- *
 * run strategic issues, can help a study group to understand the *
 * immediate implications of some longer-run issues. *

Similarly, study groups often find themselves examining problems whose implications for operating procedures and routines are not limited by "how things are done now." Hence standard problem search procedures, motivated by expediency, are not appropriate for the activities of policy study groups.

* Proposition 5.8.C *

* Provides Guidelines for Problem-Directed Search. When the *

* realm of inquiry of policy study groups exceeds consideration of *

* how things are currently done, such groups will need heuristic *

* devices for more fully exploring novel sets of policy options. *

* The explicit structure of formal modeling techniques provides *

* a frame for guiding problem-directed search when the problems *

* and solutions under consideration require the contemplation of *

* states of the world significantly different from how things are *

* currently done. *

Since policy study groups do not represent narrow organizational interests (the membership of such groups being drawn from across the organization) and since such groups self-consciously attempt to conceive of

* considers a broader range of alternatives, often encompassing *
 * states of the world significantly different from how things are *
 * currently being done, it will be more apt than operating units *
 * to recommend actions that exceed the implementation ability of *
 * the organization. Policies requiring interagency coordination *
 * are a common example of such policies. Formal models with a *
 * focus on strategic problems and with abstract representations of *
 * organizational capabilities will reinforce this tendency toward *
 * infeasibility. *

The above propositions, detailing how modeling efforts housed within policy study groups exhibit characteristic behaviors, lead us to consider a compensatory strategy for better managing organizational modeling efforts. On the one hand, the manager of a modeling effort should recognize the organizational strengths of study groups and formal models and capitalize on them. On the other hand, recognizing that such efforts have characteristic organizational deficiencies, every attempt should be made to systematically compensate for these defects through the management of the non-model-building aspects of the broader modeling project. One such broad compensatory strategy involves coupling study groups with operating units so that the complementary strengths and weaknesses of these two types of groups can be mutually reinforcing. In order to flesh out such a strategy, we will need added detail in our description of the linkages that exist between organizational subunits. We will begin by considering some of the ways that study groups become linked to operating units and then we will

consider the organizational processes that link operating units one to another.

Overlapping memberships between operating units and policy study units are the most important mechanism that links these two types of groups. By having operating managers participate in study group activities, the policy results that emerge from the study groups will already be understood by the relevant group of managers necessary to implement the recommendations. Sometimes it will be possible for analysts to sit in as members of the operating groups for some of their deliberations. Overlap of this sort enables the analysts to more fully understand real operating constraints in the policy area under study.

"Scouting" meetings are another valuable mechanism for linking study groups to operating units. During the early phases of a project, members of the study group interview managers not included in the study group to assess their impressions of the policy area under study. A modification of the scouting interviews occurs later on in the project when preliminary policy recommendations are ready. In either formal or informal interviews the preliminary recommendations can be checked with managers outside the study group to gauge their reaction. By "leaking" preliminary policy results, study group managers can get valuable feedback concerning the feasibility of their work to date.

Both the overlapping membership and scouting mechanisms require that the analysts or the host members of the study group assume the role of information broker, making sure that relevant policy information available at one point within the organization becomes available within the study

group and conversely that recommendations emerging within the study group are checked out early and often with operating managers.

A final mechanism for linking study groups to operating units is the formal transmission of documents, such as position papers and formal recommendations, from one group to another. Although such devices may be useful as an excuse for encouraging further discussion and exchange of information, the formal transmission of documents will not be a particularly effective linking mechanism because operating units are not constrained to take the output of study groups seriously.

* Proposition 5.9 *

* Linkages to Operating Units Critical. If the policy recommenda- *
 * tions of policy study groups are to be transformed into concrete *
 * organizational capabilities, it is critical that the study groups *
 * retain good working relations with the operating units that can *
 * effect policy recommendations. Examples of mechanisms that serve *
 * to link study groups and operating units are overlapping member- *
 * ship, scouting interviews and preliminary "leaking" of results, *
 * and the transmission of formal documents. *

One of the important side effects of strong working relations between study groups and operating units is that both types of units can greatly benefit from the complementary strengths of the other. In general, policy study groups employ more comprehensive search procedures, act under less time pressure, and are free to consider long-range goals. All of these

of the implementing unit will meet with unanticipated resistance from non-operating units and can be partially if not completely dissipated.

A complete policy innovation involves the process of knitting a web of commitments between the implementing unit and other operating units. For example, the data-processing unit desiring to improve the availability of statistical data for federal reporting purposes decides to change the organization of its computer software and file structure. In order to complete this change, the regional offices must change the forms that they use to collect the data. The initial action of the data-processing unit imposes a new constraint on the regional office. However, the regional office has been wanting some better data output for some time. Since they are changing the data collection forms anyway, they decide to incorporate some new data elements into the revised form. Now the data-processing people are obliged to marginally redesign their software and data files to account for the new demands being placed upon them by the regional offices. In this manner, one unit takes an action that imposes a new constraint on another unit, requiring a reaction. The reaction of the second unit causes yet additional constraints to be imposed on other units. At any point in time, a single unit will be reacting to constraints imposed upon it by its bureaucratic environment and at the same time taking actions that will impose operating constraints on other external units. There is a continual circulation of operating constraints. An action by an implementing unit imposes a constraint on a nonimplementing unit. In turn new action by the nonimplementing unit imposes new constraints upon the original operating unit. Because different operating units within the same agency honor the

constraints placed upon them by other operating units, some degree of policy coordination across these diverse units can result. However, unless the process whereby constraints become mutually defined and accepted is carefully managed, a new policy will not be coordinated across units and will be less effective. Hence policy study groups must carefully manage not only the linkages between themselves and implementing operating units; they must give careful thought to the linkages that connect implementing units to nonimplementing units.

* Proposition 5.9.B *

* Constraint Circulation and Policy Coordination. The linkages *
* between study groups and operating units are not the only ones that *
* must be carefully managed. Policy coordination across several *
* operating units occurs because different units both honor con- *
* straints imposed on them by their bureaucratic environment and *
* impose constraints on other external units. Unless this circula- *
* tion of constraints between implementing and nonimplementing units *
* is carefully managed, ineffective and uncoordinated policy changes *
* will result. *

Proposition 5.9.B as elaborated above completes a description of the propositions derived from the case study. These nine propositions describe how model-based policy design efforts support organizational decision making. The case study provides the base of evidence from which these nine propositions were derived. However, before delving into the case study,

we pause briefly to note the significant points of difference between these, the modified propositions, and the original naive propositions with which we entered the study.

A Note on Differences Between Naive and Modified Propositions.

The naive propositions were generated by careful reflection on the organizational theory of decision making and the intrinsic characteristics of system dynamics models as summarized by their methodological priors. The modified propositions result from the interaction between the original propositions and the evidence gathered in the case. It is useful to self-consciously reflect on the transformation that occurred between the naive and modified propositions, because this transformation represents in summary form what was learned from the case study about the organizational use of models.

One way to talk about this transformation would be to list the two sets of propositions and examine how they are different. Table 5.3 presents the original list of naive propositions with the list of modified propositions. Each of the original propositions maps quite nicely into one of the modified propositions, with the exception of the last one, "Aids Organizational Processing of Information". In the end, the case study spent little time explicitly treating the flow of information within the organization, so there was little evidence calling for the final naive proposition to be either modified or incorporated into a more comprehensive framework. It was left hanging.

However, Table 5.3 shows that the original set of naive propositions have been considerably expanded and enriched through interaction with the

TABLE 5.3: Comparison of Original Naive Propositions and Modified Propositions

<u>Original Propositions</u>	<u>Modified Propositions</u>
	5.1 Policy Changes are Organizational Changes
	5.1.A Differentiated Environment
	5.1.B Organizational Units have Differing Capabilities
	5.1.C Diffusion Linkages
	5.1.D Units Mutually Constraining
	5.2 Different Levels of Modeling Effort
	5.3 Models and Organizational Change
	5.4 Positioning of Modeling Effort
	5.5 Parochial Focus of Modeling Effort
	5.6 Multiple Roles of Analysis Team
	5.7 Operating Units Inhospitable
Sequence of Goal Attention Ignored	5.7.A Sequential Goal Attention Ignored
Ignores Short-Run Feedbacks	5.7.B Short-Run Phenomena Ignored
	5.8 Policy Study Groups Receptive Hosts
	5.8.A Study Groups are Organizationally Defective
Focuses Attention on Inactive Goals	5.8.B Focus Attention on Inactive Goals
Provides Guidelines for Problem Directed Search	5.8.C Provides Guidelines for Problem Directed Search
Aids Development of Interagency Policies	5.8.D Aids Development of Interagency Policies
Tends to Develop Infeasible Policies	5.8.E Tends to Develop Infeasible Policies
	5.9 Linkages to Operating Units Critical
	5.9.A Capability Matching

TABLE 5.3: Comparison of Original Naive Propositions and Modified Propositions

Original Propositions

Modified Propositions

5.9.B Constraint Circulation and Policy Coordination

Aids Organizational Processing of Information

case evidence. Modified propositions 5.1 and 5.2 introduce several new distinctions that were warranted by the case study. Three levels of modeling effort were recognized and it was found necessary to describe some of the characteristic differences between organizational units in order to describe the dynamics of organizational change. Propositions 5.3 through 5.6 were general ones that described in broad form some of the relations that must exist between modeling efforts and a broader view of organizational processes. Models are to be seen as agents of change; their positioning within an organization is critical; and analysts must compensate for the rather parochial focus of modeling efforts by emphasizing roles other than their roles as good model builders. Propositions 5.7 and 5.8 incorporated most of the points made in the original naive propositions. Here the relative strengths and weaknesses of model-based policy study efforts were enumerated. However, in the modified propositions these strengths and weaknesses were seen to be as much a function of the types of organizational units that host modeling efforts as it was a function of models themselves. Proposition 5.9 emphasized the importance of linkages between various organizational units as critical points to be managed if model-based policy studies are to be successful. By successfully managing the bridges between study groups and operating units, managers can insure that the complementary capabilities of both types of groups can be used to best advantage. Proposition 5.9 contains new concepts not originally contained within the naive propositions.

A comparative list of the naive and modified propositions such as that shown in Table 5.3 hints at the different flavor of the "before" and "after"

stories, but a deeper examination of differences arising from the case evidence would enumerate how the more fundamental themes underlying the naive and modified propositions have changed. Both sets of propositions tell a story that is characterized by certain major themes. Here we will broadly discuss how these underlying themes have been transformed as the original propositions interacted with the evidence in the case study.³

The original story was characterized by four broad themes:

1) Policy is the exercise of organizational capabilities. An organization's capabilities are defined by its formal division of responsibility, the membership in subunits, the goal structure of subunits, and the repertoire of standard operating procedures existent within the organization. Policy results from the routine exercise of these capabilities.

2) Models are characterized by methodological priors. The original story contained a rather narrow view of policy modeling. It focused almost exclusively on the model itself. It failed to adequately consider the broader arena of activity within which model building takes place. In an unclear way, the broader modeling process was assumed to be colored by methodological priors in the same fashion that the final model itself was.

3) Models as instruments of organizational capacity have some good (useful) and some bad aspects. Models and model-building efforts and model-based policy design efforts (they were all lumped together) were seen as instruments to be used in making decisions. Because such models were characterized by methodological priors, they would have some useful properties as well as some not-so-useful properties. For example, they would be good because they could help the organization to focus on inactive long-

term goals but they would be bad because they would tend to develop infeasible recommendations.

4) A normative component. The fourth theme was an implicit normative statement about what made good and bad organizational decision making. Good decisions happened when as much relevant information as possible was available before the decision was made. Models were good if they could help to bring the right information to bear at the right time. Decisions that led to conflicts in goals between organizational subunits causing the original decision to be changed or nullified were bad decisions. If models reinforced this tendency toward infeasibility, they were also bad.

The original story was rather simplistic and flat. It lacked any sense of how and why capabilities change over time. The categories and distinctions employed lacked the richness necessary to capture a sense of an organization changing and learning over time because of a modeling effort (or any other similar policy study effort). In the modified story, all of the initial themes were modified and elaborated by additional subthemes. The added depth and richness of the new themes gave the story the richness of vocabulary necessary to discuss changes in organizational capacity.

The first theme was broadened to include the notion of changes in policy:

Policy Change is Change of Organizational Capabilities. As deductions of this central theme came the first theme of the original story--namely that policy is the execution of organizational capacities. Furthermore, as a subpart of this broader theme, it became necessary to differentiate between several levels of organizational capabilities. It was necessary to

distinguish between policy study groups, operating units, and linkages between these if the mechanisms causing organizational changes were to be explained.

The second theme was broadened in recognition of the fact that modeling efforts include much more than just the models themselves:

Modeling Efforts are Differentiated. At the core of modeling efforts we have the models themselves that are characterized by methodological priors. This was the extent of the original theme. However beyond that, the modified theme recognizes that a wide range of modeling-related activities can and do occur and that these are important to understanding how modeling efforts impact on organizational policy changes. Great emphasis was given to the role of the analyst in performing tasks other than crafting good models.

The third theme was modified so that models were no longer seen as policy-making instruments in and of themselves. Modeling efforts were seen as one of several lines of activity that can be used to supplement routine organizational capabilities.

Models can Supplement and Change Organizational Capabilities in Some Helpful Ways. In some other ways they are not particularly helpful supplements to routine organizational capabilities. The good news--bad news aspect of the original theme was retained, but the modified theme recognized the fact that the usefulness of modeling efforts results from their interactions with other organizational capabilities. Specific suggestions were made concerning how models should be positioned within study groups and the linkages between study groups and operating units best managed so

that the strengths of modeling efforts can be maximized and their intrinsic limitations can be compensated for. The final theme was still an implicit normative statement about what makes good or bad organizational decisions.

Normative Theme. However, the modified story was more complex so the normative component implicitly underlying it was murky at best. As a story or theory becomes more complex, simple statements of what is good or what is bad become problematic and contradictory. A more complete discussion of the normative theme contained in the final story is contained in section 5.5.

In summary, the initial themes were modified to reflect a greater emphasis on organizational learning and change. Several new distinctions had to be introduced in order to provide the theoretical vocabulary for describing the mechanisms of change. Our conception of what constituted a modeling effort had to be enriched and enlarged to include many nonmodel-building roles on the part of the team of analysts. Finally, the ultimate utility of modeling efforts had to be judged not in terms of the models, but in terms of how the model supplemented and changed organizational capabilities through interactions with identifiable subunits and across similarly identifiable mechanisms linking various organizational units.

5.2 BACKGROUND AND OVERVIEW TO THE ORGANIZATIONAL STORY

The organizational story is the most complex of the three views of the case. This story involves interactions between many individuals and operating units, creating an intricate cast of characters at any point in time. Furthermore, this cast of characters shifts over time. Thus, as background to the organizational story, the organization of both the department and division with respect to fiscal policy will be reviewed. This discussion deepens the review of organizational structure presented in Chapter 2 to more fully treat fiscal matters.

Also as background, some attention will be given to the positioning of the system dynamics model within the larger organization. The relative importance and impact of the whole modeling effort is clarified by this discussion of the relationships of modeling activities to other fiscal policy efforts within the department.

Finally, a brief overview of the three phases of the organizational story will be presented. These three phases correspond to the same time periods used to organize the story in Chapter 4. For each phase, a summary of the overall fiscal policy activity is presented along with an overview of the role played by the model.

Departmental Organization with respect to Fiscal Policy Design

In the summer of 1975, the organization of the Department of Education with respect to fiscal policy was characterized by fragmentation of responsibility. There was limited cross talk between various units responsible for fiscal affairs. Although the subsequent two years show substantial efforts at organizational reform, there has been only marginal improvement

in the overall coordination of the various fiscally responsible units within the Department.

Fragmentation and the development of parochial interests is not a specific problem of the Department of Education. It is endemic to most all organizations that must deal with a complex environment. No single unit can handle the multitude of demands generated by such a complex environment. Hence the organization divides up responsibility for dealing with certain pieces of that environment. The result is a necessarily divided organization with parochial responsibilities. The Department of Education is organized to meet four broad fiscal functions imposed upon it by its environment. These four fiscal functions, budgeting, expenditure control, processing of local aid reimbursements, and auditing of local school districts, are discussed in some more detail below.

Budgeting. In fiscal year 1975, the Department of Education directly administered approximately 9.2 million dollars to finance its own internal operations.⁴ In addition, the Department retained more or less discretionary control over eight million dollars in federal funds.⁵ Budgeting for the expenditure of these funds was coordinated by the Bureau of the Budget, Division of Administration and Personnel.

State operating budgets originate within each bureau and are integrated into a single document before being passed on to the Secretary of Education for recommendation to the legislature. Both the Secretary of Education and the legislature exercise detailed control over these state funds.

Federal funds, on the other hand, are awarded to the Department of Education on a formula basis directly from Washington. The size of the

federal discretionary pool of dollars is essentially out of the control of the various operating divisions. The budgeting process consists merely of deciding how to best "invest" these available funds. Since many of the federal programs are allocated to specific types of educational programs (e.g. grants to vocational education, special education, etc.) the effective control of these monies rests with the appropriate program division. The centralized budgeting function, as embodied in the program emphasis document for federal funds, is an after-the-fact attempt to bring coordination to the overall flow of federal dollars.

Therefore, state operating funds are closely budgeted and controlled by a centralized system originating within the various program divisions and extending through a departmental budget and on to final legislative control based upon the recommendations of the Secretary of Education and the Governor. Federal funds, on the other hand, are exogenously given by acts of Congress and other administrative gymnastics originating in Washington. For all intents and purposes, the majority of these funds rest under the direct decentralized control of program divisions with only weak attempts at central control by the overall department.

Expenditure Control. Technically, the control of both state and federal monies was housed within the Department's central business office. A system of warrants and invoices was used to keep track of the flow of dollars. Warrants were eventually cleared and paid by the Department of Administration and Finance, the locus of overall financial control for the state government.

However, each of the program divisions had its own team of accountants

who performed the effective control of expenditures within the purview of that division (the division's portion of the state operating funds and its pool of federal program dollars). The Department's centralized business office and the individual program divisions retained duplicate sets of books. The business office accountants reported to the Department-wide management and Department of Administration and Finance concerning the status of all of the Department's accounts. The Division's accountants reported to the Division's management concerning the status of the Division's accounts. There was a steady traffic between the business office and the various independent accounting bureaus within the program divisions as the accountants constantly attempted to keep their books in line.⁶

Local Aid to Cities and Towns. In 1975, the state distributed over 682 million dollars in local aid to cities and towns for educational purposes. By fiscal year 1977, this figure had risen significantly. This local aid was in the form of direct appropriations for programs such as Vocational Education, School Transportation, Regional School Aid, Teacher's Retirement, A Racial Imbalance Program (METCO) and School Construction and Rehabilitation. In addition to these specifically targeted monies, the state also returned general distributions to cities and towns in reimbursement for expenditures that they may have made for bilingual, special, and regular day education. These reimbursements, totalling 452 million dollars in fiscal year 1977 are of central interest to us here because they are the principal means that the state used to finance the Chapter 766 legislation.

In order to compute reimbursements to cities and towns, there are three

primary functions that the Department of Education must perform--first the design of an end-of-year report that can be used to collect the needed reimbursement; second, the actual dissemination of the report and collection of the data; and finally, the cleaning, processing, and management of the collected data (making use of the Department's computing facilities) eventually leading to the final computation of reimbursement. In 1975, all three of these functions were housed within a single bureau, the Bureau of Research, Planning, and Evaluation under the directorship of Leo Turo. By 1977, and after a reorganization, several new units had sprung up to assume the responsibilities originally housed within that single bureau. This Department-wide reorganization is critical to understanding how the Department changed its fiscal decision-making processes from an organizational point of view. We shall examine the forces underlying this reorganization in more detail later on.

Auditing. The Bureau of External Audit within the Division of School Facilities and Related Services was responsible for auditing local education associations. In 1975, this bureau to a large degree was occupied with the auditing of federal grants awarded to local school districts. However, in the past the auditors had been actively engaged in both auditing local school districts and instructing local school officials in how to handle state reporting requirements. At that time, the Bureau of External Audit had worked closely with auditors from the Department of Administration and Finance.⁷

For the first time in 1976, the Bureau of External Audit undertook the auditing of special education expenditures within a selected set of cities

and towns. In 1977, after overall responsibility for the bureau had fallen to Fred Williams (former Associate Commissioner of School Facilities and Related Services), the Bureau of External Audit began an expanded and more aggressive audit of local special education expenditures.⁸

The Department had incrementally developed an organizational structure to accommodate the four fiscal functions outlined above. The Business Office, under the direction of Gerry Lambert in 1975, oversaw most of the "in house" control of expenditures. Each program division maintained a separate accounting office that essentially duplicated the books kept by the Business Office. The Department's operating budget was developed centrally under the supervision of Ramona Hilgenkamp. The coordination of federal funds and expenditures, to the extent that it existed at all, was also accomplished by Ramona Hilgenkamp.

Most all of the Department's external dealings with local education agencies was controlled by the Bureau of Research, Planning, and Evaluation. Leo Turo as director of that bureau was the person commonly recognized throughout the Department as being expert in most all affairs relating to state and to local schools. Through his years of involvement in the Department, Turo had developed an informal network of personal relationships including local school business agents, Departmental auditors, and key contacts within the Department of Administration and Finance. This network of contacts coupled with Turo's intimate knowledge of every detail of the Department's reimbursement laws, formulas, and forms was the stuff that made the Department's reimbursement system function.

In addition to performing the key steps in the reimbursement of local

aid, the Bureau of Research, Planning and Evaluation was also involved with a host of other primary responsibilities including the management of the Department's computer hardware, the collection and processing of pupil, staff and other statistical data, and the direct management of school transportation regulations and reimbursement. For our purposes, we shall be most interested in how Research, Planning, and Evaluation performed the specific function of computing reimbursements for local aid since it was this function that was so crucial in the crisis surrounding the financing of special education.

The reimbursement system that Turo worked with had been put together incrementally. Over the years, the system had performed well. The heart of the reimbursement system was and still is the end-of-year report. This document, filed by local school systems, reports their total expenditures during the past school year and becomes the basis for computing reimbursement. Originally, this report was a simple one or two page document that needed only to report total expenditures and revenues by several major classifications. As Federal Aid to Education increased and as the state legislature passed increasingly complex educational legislation, the end-of-year report became more and more complex. By 1975, the overall report had mushroomed to over 50 pages that were supported by reams of guidelines, appendices, amplifying statements, and booklets outlining standard accounting procedures.⁹

In the beginning, the reimbursement system could work well because of its relative simplicity. As the overall system increased in complexity, the Department came to rely increasingly upon Turo's personal expertise and

intimate familiarity with the overall system to insure its proper functioning. The program Divisions were relatively unaware of what reimbursement was or how it functioned.¹⁰ The implicit assumption was that fiscal matters were being taken care of somewhere by someone. Furthermore, fiscal matters were not really within the purview of a program division.

As he did everywhere else, Turo maintained an informal and personal network of relationships that could be used to communicate with the various program divisions. For example, in 1975 communication between the Bureau of Research, Planning and Evaluation and the Division of Special Education was embodied in a personal working relationship between Dave Keeler, an education specialist whose primary responsibility at that time was managing transportation for a population of children with special needs in private schools, and Leo Turo. Outside of this occasional personal contact, divisional managers were busy solving their own programmatic puzzles. They knew very little about fiscal matters and showed little interest in learning.

Growing Problems with the Organizational Structure

Beneath this gloss of complacency, there was a growing crisis. As educational finance was growing more and more complex, increasing strains were being placed upon Research, Planning, and Evaluation. Because of Turo's unique fiscal expertise and his role as bureau director, Research, Planning and Evaluation had become a repository of four to five fiscal functions each of which might have been able to occupy the attention of a single Bureau. For example, the data processing function was immense and surely needed a separate director. The functions of collecting, cleaning, and management of data (including the compilation of research reports) was

nearly a bureau's task in and of itself. Finally, the function of interacting with the local school districts, both in the collection of data and in the brokering of technical expertise was yet a third nearly independent fiscal function. Furthermore, Turo's management style was not one of delegation. To a large degree, he drew responsibility for this myriad of increasingly complex functions upon himself. This "one man show" began to strain, not due to a lack of diligence and long overtime hours, but rather due to the sheer volume and complexity of the task loads.

Program managers were slow to recognize this problem and sluggish in their response. For example, in the fall of 1975 when the massive work load of processing the end-of-year reports (with its newly added and complex section on Chapter 766) had hit the Department, Turo forwarded a request through Dave Keeler to the Division of Special Education for some additional clerical help. This message was delayed and confused and the clerical help did not materialize on time to substantially aid in the data processing tasks at hand. The fault lay not with individuals but rather with the system of relationships that had developed over the years.

The added complexity of the Chapter 766 special education reimbursement formula proved to be the straw that broke the camel's back. The conceptual and practical problems surrounding the computation of reimbursements to cities and towns under a complex "excess cost" formula mandated by the legislature were immense. These conceptual problems were only rivaled by the sheer volume of work that accompanied the processing of the end-of-year reports. To make matters worse, the new law also mandated that the Department must have the special education portions of the report

processed by the fall after the reports were due (the reports were normally due around the first of September following the close of the fiscal year). This timeline shortened by several months the amount of time usually available to Research, Planning and Evaluation to process the end-of-year report.

Before examining the causes of the special education fiscal crisis and the department's reaction to this crisis, it will be useful to briefly review the fiscal organization within the Division of Special Education.

Divisional Organization for Fiscal Policy Design

The pattern of fragmentation and divided responsibilities that was evident at the Departmental level was reflected in the organization of the division of special education around the questions of fiscal policy design. The Division was principally preoccupied with program issues. In early 1975, it had neither the resources nor the ability to become actively involved in fiscal affairs. The Division routinely concerned itself with budgeting and managing its own state operating funds and with managing the pool of discretionary federal dollars that came within its direct programmatic control. No significant efforts were made to deal with issues of reimbursement.

Organizationally, the Division had no constraints imposed upon it from its environment that forced it to be occupied with reimbursement questions. Such matters were routinely handled in Research, Planning and Evaluation. There was no need to develop a repertoire of routines and operating procedures to deal with reimbursement questions since questions of this nature were not routed across the desk of Divisional managers. Furthermore, since Divisional managers were never constrained to think about reimbursement

questions, they had not had a chance to develop any mental images of how such fiscal questions should fit into the complex of plans, goals, and standard operating procedures with which they were routinely familiar. In fact, from an organizational point of view, a key function that the system dynamics model was to perform was to create a sense of integration between fiscal and program affairs in the mind of key managers within the Division. By helping to create an active "fiscal policy space" within the thinking of key managers, the model was instrumental in the formulation of routines and procedures that integrated fiscal activity with program activity.

As at the Departmental level, the Division also performs three primary fiscal functions--budgeting and expenditure control for state funds, allocation of federal funds, and policy development for reimbursement of local aid to cities and towns. In fiscal year 1975, the Division allocated seven full-time accountants and from five to nine professionals (the figure is fuzzy since program managers also participate in budget preparation), plus a rather large consulting group to the management of the first two functions.¹¹ All tolled, these two functions (control of state and federal dollars) involved managing the expenditure of approximately forty million dollars.¹²

In fiscal year 1975, the Division allocated less than one half of a person on a full time basis to the control of reimbursement requests and allocations.¹³ However, reimbursements to cities and towns represented a flow of over eighty-six million state dollars for special education back to localities. These reimbursements represented initial expenditures of over one hundred and ninety million dollars on the part of cities and towns.¹⁴

As was noted earlier, the Division of Special Education was a unit that was concerned primarily with program considerations. Of the nearly 150 positions listed on the 1975 organization chart, including state employees as well as a number of federally funded employees and consultants, only twelve to sixteen of these, or about 10% were concerned with fiscal matters at all. However, even given the relatively small amount of effort that the Division allocated to fiscal affairs, a surprisingly small fraction of that fiscal effort (less than 5%) was devoted to controlling the largest flow of dollars--namely the reimbursement flow.

Many good organizational reasons exist to explain why the Division initially paid so little attention to reimbursement. First and most important, the Division had no direct operating responsibilities with respect to reimbursement. All of the routine procedures and computations were carried out elsewhere within the Department--most notably within the Bureau of Research, Planning and Evaluation. Since the Division was not constrained to take any action with respect to reimbursement, there was little incentive to internalize reimbursement issues into the Division's goal structure. As concrete evidence of the lack of organizational goals surrounding reimbursement policies, the Division's three year plan drafted in November 1975 contained not a single reference to reimbursement related goals, objectives, or benchmarks. The nearest comment was an objective outlining the need for collaborative service agencies to develop increased access to third-party entitlements (a form of reimbursements by private insurer, MEDICAID, etc. instead of State reimbursement).¹⁵ Neither had the Division established any standards, routines, or procedures for the review of

reimbursement-related issues.

Second, given this total lack of expertise in reimbursement issues, persons with questions concerning reimbursement would not routinely query the Division for answers or policy. As a consequence no information concerning reimbursement would be routed as a matter of routine across the desk of Divisional managers. This further reinforced the tendency of Divisional personnel to exclude reimbursement matters from their goal structure, routines, and procedures.

Finally, program personnel within the division were not trained in fiscal matters and to some extent would tend to hold "that other fiscal world" off at a distance and surrounded in mystery and awe.¹⁶ Hence there were few people within the division knowledgeable enough in fiscal affairs to even begin the bootstrap operation of training the rest of the Division in the rudiments of reimbursement.¹⁷ Furthermore, those persons who did have the necessary fiscal background were usually accountants or lower-level management who lacked access to the management at the top of the Division. For example, a discussion with Joe Yannacci, the Division's chief accountant in October of 1976 demonstrated that he personally understood the reimbursement system and most of its implications and adverse consequences. However, in discussions of fiscal policy, the accountants were usually asked to comment only on detailed matters. The more sweeping policy questions were reserved for higher level management--paradoxically those were the same persons who initially had the least expertise in fiscal affairs.

This brief discussion of fiscal organization at the departmental and

divisional level sets the stage for the fiscal crisis that was to hit the department in the fall of 1975 triggering several layers of responses within the department.

A New Direction for Fiscal Policy Activity

The tidal wave of fiscal concerns, contradictions, and confusions that hit the Department in the fall of 1975, the main brunt of which was felt in Research, Planning and Evaluation, was not without forewarning. The very inception of the bill was plagued with concerns over its financing. The Department of Education, based upon extrapolations of past expenditures estimated that the total price tag to the state for the Chapter 766 legislation would be approximately nine million dollars.¹⁸ By 1974 as the implementation of the law approached, the Department estimated "a 'ball park' figure of about \$40 million as the additional fiscal year 1975 costs of special education across the Commonwealth."¹⁹ William Cowen, Secretary of Administration and Finance charged that that figure was low by more than a factor of 2. He estimated that the costs of Chapter 766 would go as high as \$100 million. In an angry interview with the Boston Globe he asserted that "Coming up with this kind of program without financial backing is a fraud."²⁰ Officials from local cities and towns were no less vociferous in their opposition to the funding arrangements surrounding the law. Malden Mayor Walter Kelliher called Chapter 766 "the most ill-conceived piece of legislation I ever saw. It shows a lack of fiscal responsibility at the governor's level and at the legislative level."²¹

This initial tumult and confusion surrounding the funding of the bill had built up further during the first year of the law's implementation.

Most local school superintendents had planned their school budgets for fiscal year 1975 (the first year of Chapter 766's implementation) in December of 1973. These budgets had been approved by the city council or town meeting in March of 1974. However, the final program guidelines, explicitly delineating the program responsibilities of the local superintendents did not become available until August of 1974.²² The local press was alive with feature stories concerning the ill-received reimbursement scheme surrounding the Chapter 766 legislation.²³ The state was experiencing a budgetary crunch and local tax payers were becoming increasingly reluctant to pay higher and higher property taxes to support what some considered extravagant educational expenditures. The national economy was in a slump; unemployment was high throughout the state. How the state chose to fund such a potentially expensive mandate was on many people's minds.

Back at the Department of Education, the Bureau of Research, Planning and Evaluation was dealing with these mounting pressures as best it could. As we have seen earlier, the resources of that Bureau were stretched to the limit. However, since the end-of-year reports requesting reimbursement for the first year of the law's implementation could not come due until the books had been closed for fiscal year 1975, the growing crisis did not hit the department with full force until nearly a year after the confusion had come to a frenzied peak within the local school districts.

Research, Planning and Evaluation, although ultimately unable to unravel all of the incoming contradictions without added support, was braced for the difficult times ahead. Elsewhere, particularly within the Division of Special Education, the story was different. Bambi Levine, an administra-

tive assistant to the Associate Commissioner recalls, "It was worse than that, not only didn't we know what the issues were (surrounding reimbursement), we didn't even know what were the right questions to be asking."²⁴

The Department responded by unleashing three rather independent responses to the fiscal crisis that had hit the Bureau of Research, Planning and Evaluation. Each portion of this three-pronged response could be reasonably identified with one key manager within the Department. These three were Steve Kaagan Deputy Commissioner for Coordination, Fred Williams then Associate Commissioner for Administration and Personnel, and Bob Audette Associate Commissioner for Special Education. The coordination (or lack of it) between these three efforts would form an interesting organizational story in and of itself. However, since the development of the fiscal policy simulation model was housed within the Division of Special Education, we shall concentrate on the activities within special education while using the following brief summary as a backdrop of overall Departmental activity against which to view the Division's activities.²⁵

Local Aid Task Force and Redesign of the End-of-Year Report. From Deputy Commissioner Kaagan's point of view (he was a planner by background) the central problems of the Department's reimbursement crises were that the reports and procedures being used were overly complex and cumbersome, and that the processing of the end-of-year report was not efficient. In a word, the Department needed to overhaul and tighten its ability to process statistical and financial data. To this end, several coordinated steps were taken.

Tom Barrons was brought into the Department to supervise the Data

Processing functions. The Department needed a special unit capable of handling the many technical problems associated with hardware and software management. A priority consideration would be moving the Department off its own hardware onto the more sophisticated computing capabilities of the State College Computing System.²⁶

Ramona Hilgenkamp who had been in charge of budgetary control for the state's operating funds, was appointed as head of the Local Aid Task Force. This ad hoc group was to assume the responsibility for processing the reports and computing reimbursements for fiscal year 1976. Later when Ramona was appointed Acting Commissioner of Administration and Personnel, the Office of Local Aid, a newly spawned mushroom on the Department's organization chart, assumed the responsibilities formerly undertaken by the ad hoc task force. Tom Collins was to head up the Office of Local Aid.

Completing his attempt to rationalize the processing of information, the Deputy Commissioner wrote two separate consulting contracts for fiscal years 1976 and 1977-78 respectively for the redesigning of the end-of-year report. These two contracts were awarded to Touche-Rosse and Peat, Marwick and Mitchell, both prestigious CPA firms. These contracts turned out to be important within the Division of Special Education's efforts, because these external consultants provided deadlines and constraints within which the Fiscal Policy Group had to respond. The imposition of such external constraints was an important factor in assuring the vitality of the Division's Fiscal Policy Group.

Increasing Regional Capabilities--Emphasize Fiscal Audits. To Fred Williams, the problem was not that the information management systems

themselves were defective. Instead, the problem was that there were not enough skilled personnel, located in the right places throughout the State, to support a centrally located information management system.

His response was to institute a series of training sessions for regional School Management Services personnel. This training which ran from January through May of 1976 built a team of fiscal "experts" in each of the regional offices. In turn, these regional personnel became an important resource in training local officials and performing pre-audits on local returns before they were forwarded to the central office. On an on-going basis, the Bureau of School Management Services was charged with maintaining a pool of fiscal expertise within the regional offices to deliver technical assistance to the local school districts. Leo Turo, with his extensive knowledge of fiscal affairs and network of contacts in both the regions and local schools directed the Bureau of School Management Services.

The school management services effort was critical to the Fiscal Policy group within the Division of Special Education because it provided the initial training in fiscal matters for Divisional personnel as well as for the analyst who later worked on the system dynamics model. The school management services effort framed the first problems addressed and solved by the Fiscal Policy Group thereby helping that group to function fully effectively.²⁷ Finally when Fred Williams moved over to become the Acting Associate Commissioner of School Facilities and Related Services, he assumed responsibility for the Bureau of External Audit. He took it upon himself to assure that the Department's fiscal auditors became heavily involved in the auditing of special education reimbursement claims.²⁸ The

Division of Special Education's fiscal policy group came to rely upon the cooperation of the fiscal auditors as a key element in its plan to stabilize the growing reimbursement costs associated with special education reimbursements.

Effect a "Fiscal-Program Marriage". Bob Audette, Associate Commissioner of Special Education, saw the fiscal crisis of late 1975 as evidence that the "tail was wagging the dog". That is, to a large degree, the program policies and priorities within local school districts were being dominated by the details of fiscal policies that were being formulated elsewhere in the Department and beyond the control of the Division of Special Education. The Division needed to form its own core of fiscal experts to assure that its own program interests were not being violated by decisions made in other fiscal units. Fiscal concerns and program concerns needed to be united in a fiscal-program marriage.

The purpose of this story is to trace how the Division of Special Education set out to achieve this fiscal-program marriage. Specifically, we are interested in the role that the system dynamics model played in the division's efforts at fiscal policy development.

The Model's Position in the Greater Policy Arena

Telling a story that focuses on the role of a model in the policy-making process creates a Ptolemaic bias. The reader can be left with the impression that the model is the center of the policy-making universe with a host of other organizational activities circling in its orbit. Of course, this model-centric view of the policy-making process is an artifact created by the prior decision to focus primarily on the role of the model.

Figure 5.4 schematically presents a more realistic picture of how the model actually fit into the fiscal policy universe. The total universe of fiscal policy activity, shown as a rectangle in Figure 5.4, is only a small slice of the total organizational activity. Many other important programs were continually vying for the attention of departmental managers including desegregation in urban (especially Boston) school districts, the development of service delivery systems for unserved special needs populations, the creation of a stronger internal management structure within the department, and numerous other projects of importance equal to the overall

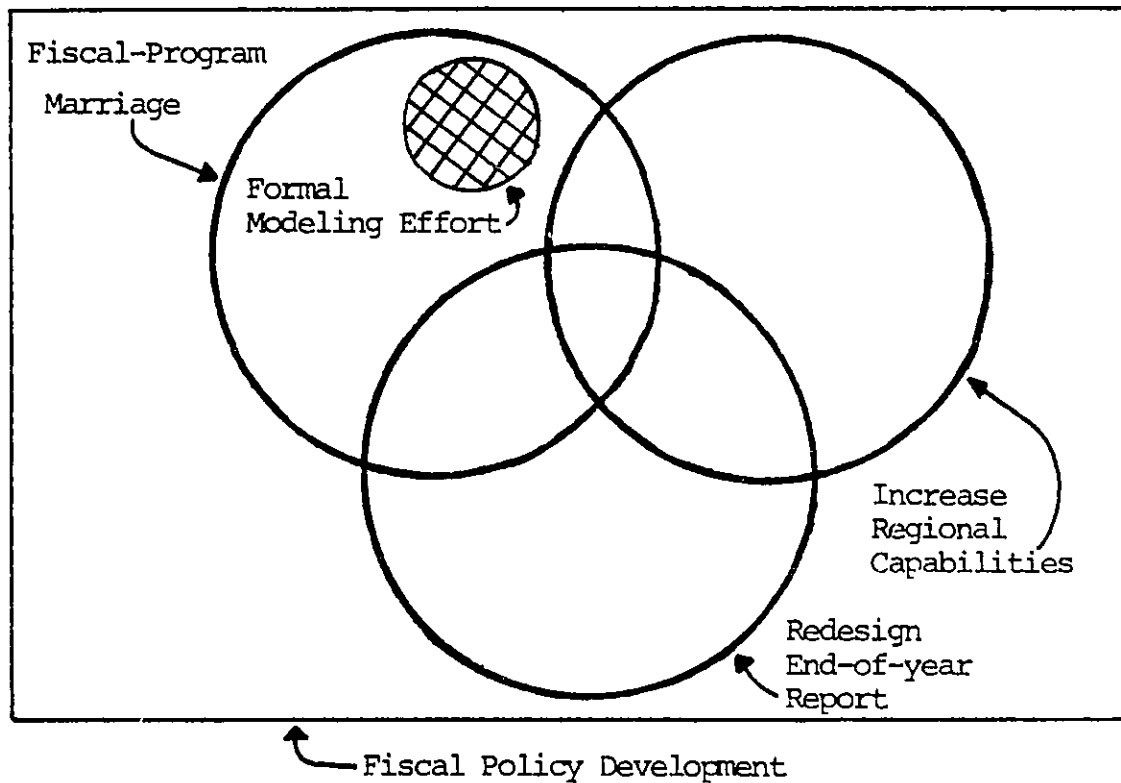


Figure 5.4: Positioning of Formal Modeling Effort in Fiscal Policy Arena

fiscal policy project. Even within the arena of fiscal policy development, three different efforts of sizable proportions had been launched--efforts to redesign the end-of-year report, to increase regional capabilities, and to effect a fiscal-program marriage.

The formal modeling effort was one of several layers of activity within the Division of Special Education's attempt to create a greater fiscal awareness. The story that follows focuses on the model building effort and infrequently transcends the ring of activity associated with the Division of Special Education. The focus of the story seldom wanders outside the arena of fiscal policy development to actively consider the host of other interesting projects that were occupying the attention of divisional and departmental managers.

The bias created by a preoccupation with model-centric activities can be significant. To overcome this bias, attempts have been made to draw the reader's attention to significant aspects of non-modeling and non-fiscal policy activities as they appeared. In fact, how the modeling effort interfaces with other organizational activities will occupy much attention in the organizational story.

Preview of the Story's Three Phases

Besides the positioning of the modeling effort, it is important that the reader remain oriented to the temporal dimension of the case study. This is a two year case study that witnessed some degree of organizational change and learning within the Division of Special Education. At the beginning of the case study (the summer and fall of 1975), fiscal policy was not an active concern within the division. By the end of the case study (April

of 1977), some organizational capacity was in place within the division to deal with fiscal policy.

To handle the time dimension within the case, the organizational story has been segmented into three phases. These phases are the same temporal divisions that were used to organize the rational story. Phase I spans June through December of 1975. Phase II covers January through September of 1976 and Phase III extends from September of 1976 through April of 1977.

Figure 5.5 schematically represents the intensity of organizational activity and modeling activity over the course of the entire project. The overall level of organizational activity was lowest during the first phase when the division was taking little to no action on fiscal policy matters. The second phase saw a relatively rapid build-up of fiscal capabilities as the Division was responding to the fiscal crisis of the fall of 1975. During the third phase, the rate of growth of fiscal capabilities slowed considerably, the majority of activity being concentrated in exercising the capacity put in place earlier. The overall level of modeling activity was at all times only a small fraction of the total organizational fiscal activities (the vertical scales on figure have not been precisely calibrated and are meant only to give a subjective impression of the timing of the rise and decline of fiscal and modeling activity within the division). However, the modeling project reached a peak around December of 1976 and tapered off during the winter and spring of 1977. By the end of the project, the modeling activity had tapered off nearly to zero and some amount of normal operating capacity was left in place (although this capacity was probably also experiencing a slight decay).

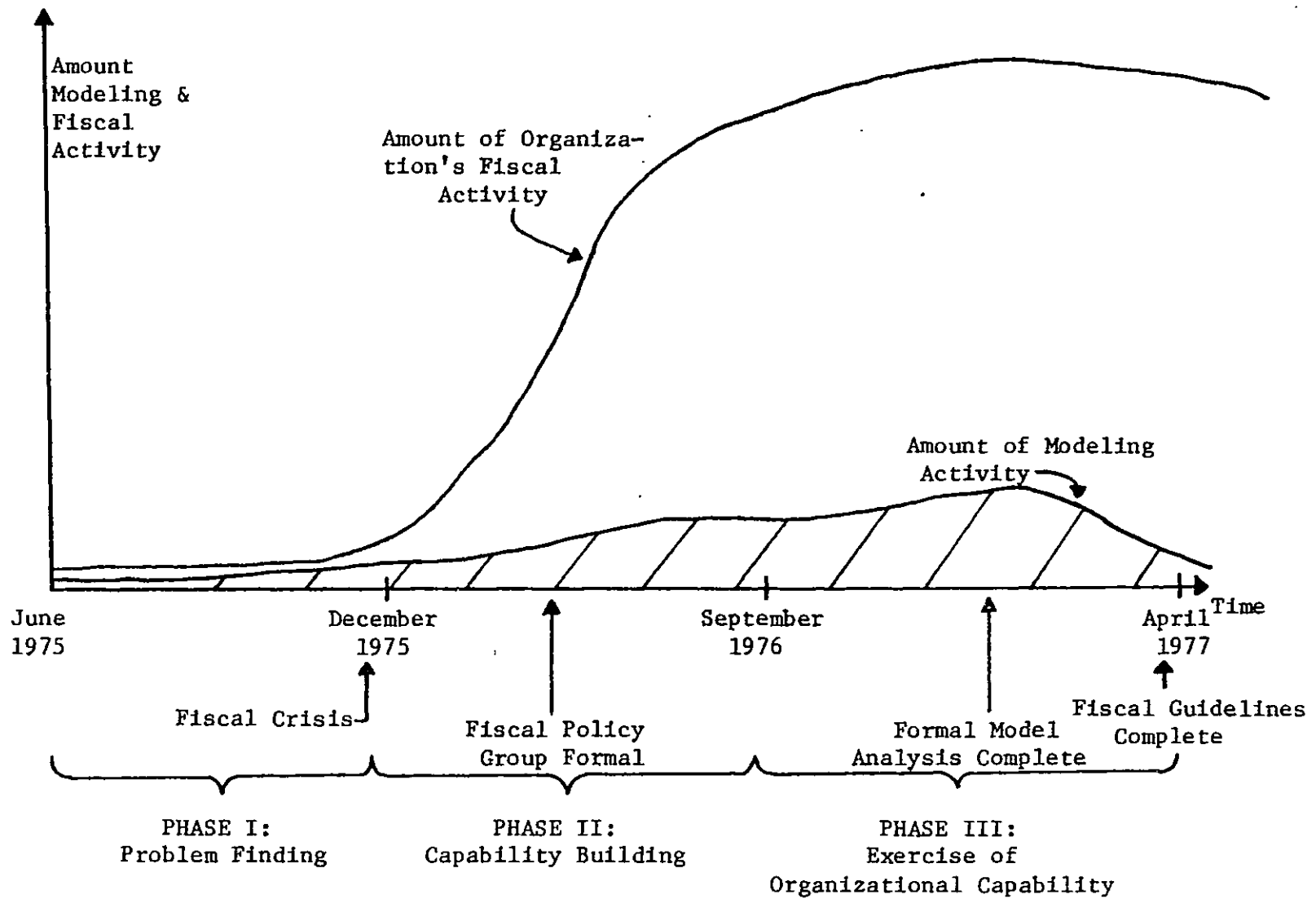


FIGURE 5.5: Relative Pace of Modeling and Fiscal Activity Over Three Phases of the Case Study

The first phase of the case study could be characterized as a time of problem-finding and organizational diagnosis. At this point there is no really detailed organizational story to tell. Although the analyst had prepared some preliminary sketches for a model, there was little perceived need nor audience for fiscal policy analysis within the division.

After the fiscal crisis in December of 1975, the interest in fiscal policy began to grow within the division. The second phase was characterized by capacity building. In April of 1976, the division's fiscal policy group first came into existence and settled its first fiscal policy issue. Formal modeling activity was officially initiated in May of 1976 when a team of divisional managers met briefly to discuss a position paper based on an initial system dynamics model. However, throughout the second phase the model continued to play a background role, lacking a mature organizational audience for fiscal policy analysis.

The fall of 1976 saw some maturation of the newly developed fiscal capabilities within the division as the fiscal policy group set out to define specific fiscal guidelines delimiting what expenses could and could not be reimbursed as special education. The modeling activity reached a peak in December of 1976 when several position papers based upon a management team's analysis of a system dynamics model came into existence. The third phase, consisting of the exercise of organizational capacity, continued through the winter and spring of 1977 as the fiscal policy group finalized its fiscal policy guidelines and promulgated them to local school districts throughout the state. This third phase of activity will be of most interest in the organizational story for at this phase of the project

an active modeling effort was interacting with several other streams of organizational activity.

Each of these three phases of organizational activity are now examined in more detail.

5.3 PHASES I AND II: BUILDING ORGANIZATIONAL AWARENESS

At the conclusion of the first two phases of the case study, the division was aware of the importance of fiscal policy issues and was taking some action to solve fiscal policy questions. The organizational story of the first phase is a short one. It is a story of organizational diagnosis and problem finding.

Phase I and the Organizational View

In retrospect, the first phase of the fiscal policy effort provides a clear example of how shifting self-consciously from a rational perspective (the perspective initially preferred by the analyst in this study) to an organizational one can lead to a better managed and more useful policy design exercise.

As we have seen earlier, when the analyst began to think about the financing of Chapter 766 from a system dynamics point of view, he was led to consider the dynamics of reimbursement policies and procedures as they impacted the overall program. In a rather straightforward fashion, he was led to conclude tentatively that the reimbursement system as then structured would in all likelihood lead to increasing inequality in the distribution of state funds to localities,^{28 a} that a self-reinforcing "band-wagon" effect would promote ever-increasing special education costs, that an erosion of state support for regular day education would follow upon ever-growing special education costs, that special education could risk the loss of political support due to its unmanaged costliness, and, finally, that adverse legislative action might be taken against the Chapter 766 law itself.²⁹

The analyst went on to recommend that,

"a systematic analysis of the forces and pressures underlying and causing these problems must be completed. Such an analysis should isolate sensitive points at which policy intervention will be most effective. Furthermore, an attempt should be made to assess what negative impacts, if any, might result from the proposed changes in departmental policy."³⁰

In retrospect, this very preliminary diagnosis of the importance and causes of fiscal problems appears to have been essentially correct. However, at the time that this analysis was completed, the analyst was faced with a puzzling problem. It is a well known fact in the management science literature that rationally conceived analyses, such as the one begun in September of 1975 suffer from chronic implementation problems.³¹ That is, how can rational analysts persuade an organization to take their modeled image of reality seriously enough to actually take policy action based upon that model? The literature in management science implementation is at best scattered and diverse³² and in general is not particularly helpful in either diagnosing the causes of potential implementation failures nor in providing prescriptions concerning how to avoid them.

However, in this case, by shifting from a rational and analytic view of the policy problem to an organizational view of the policy problem clear-cut diagnoses and prescriptions could be made. First, special education had no subunit whose goal was to guard the Division's interest in how over one hundred and ninety-two million dollars of local funds were being spent and reimbursed. Second, no fiscal information that required action of some sort routinely flowed through the Division. Third, there were no standard procedures or routines in place for dealing with fiscal affairs. Finally,

fiscal goals had not been internalized into the thinking of the Division's top management.

As a broad prescription, the Division needed to establish a group primarily interested in fiscal matters. Divisional managers needed to settle upon fiscal goals for the Division. These goals needed to be translated into routine operating procedures, and finally, the Division needed experience in finding satisfactory solutions to fiscally-related problems.

At the time, the analyst did not complete such a clean-cut diagnosis and prescription (hindsight is a wonderful thing). By December of 1975, he realized that some (albeit vaguely articulated) projects would have to be mounted as a means of "putting together an organization that will be able to deal with reimbursement more effectively, no matter what the formula used."³³ However, through much of the winter of 1976, he continued to be guided by a sort of "rational hang-over." He was unwilling to abandon the pursuit of causes, alternatives, and outcomes long enough to concentrate fully on the building of organizational capacity--the cornerstone of an organizational view of policy development. Shifting from a rational to an organizational view of the policy-making process would have allowed the analyst to diagnose and take prescriptive action on the implementation "blind spot" in the rational view of the policy process. However, the rational and organizational views appear to have complementary blind spots. A prior organizational disposition to study routines, goals, subunits, and problem searching behaviors cannot lead to a diagnosis and prescription of how to improve the organization in and of itself. A prior disposition to study organizational phenomena must be coupled with a wider (in this case

"rational") look at the organization's operating environment in order to determine how goals and procedures should be modified.

The two frames crystallize distinct views of the policy process. These separate views are complementary. As suggested by a retrospective look at the first phase of this case, the analyst who can move easily back and forth between rational and organizational views of policy analysis will be better able to manage formal modeling efforts and produce a more useful result.

Phase II--The Organizational Groundwork is Laid

From the rational perspective, the second phase of the project was puzzling, choppy, and characterized by halting starts and dead ends. This phase was seen to consist mostly of the assembly of background information to help specify and clarify issues. At one point, after the Division's fiscal policy group had come together, there was one fleeting moment of rational-looking activity. The fiscal policy group completed an analysis of the full-time-equivalency issue and set forth some policy guidelines. However, that particular incident did not directly involve the formal system dynamics model. Later on, a preliminary formal model was completed and some policy options were explicitly explored. But that tentative effort arrived at no concrete actions being taken. The whole second phase seemed preliminary and preparatory to the real work of specifying alternatives and outcomes and implementing real policy options.

However, from the organizational perspective, the second phase was the time when the bulk of the real policy design was accomplished. A fiscal policy unit specifically charged with overseeing the Division's fiscal policy

interests was called into being and proved itself capable of tackling a major issue. Explicit attention was paid to the relations between the fiscal policy group and other fiscal units within the Department. Divisional managers became aware of the importance of fiscal goals and explicitly articulated these goals for the fiscal policy group. The outlines of the Division's arena of routine fiscal activity was sketched. Finally, the system dynamics model was used as a vehicle for focusing the attention of Divisional management on several key issues. In this modeling exercise, the model performed the function of crystallizing an image of important fiscal concepts and interconnections so that managers could begin to judge the scope of the relevant fiscal issues and begin to articulate Divisional goals.

The model, nonetheless, played a decidedly background role during the second phase of the organizational story. The lack of visibility of the model during the second phase reflects the fact that for the most part the formal model was not germane to the bootstrap construction of organizational capacity that occurred in the second phase of activity. The model was not directly germane because the formal, highly analytic activities of model development (in this case focusing on a simulation of the Division's policy environment) only treat a narrow wedge of organizational reality. Specifically, the model was not concerned with a detailed enumeration of the tasks and goals of the organization, the configuration of units within the Division, the standard operating routines, and the Division's procedures for searching out satisfactory solutions to newly arising problems. Put another way, model based analysis pre-assumes an organizationally defined audience and

problem. When building the audience and awareness of a problem is a major task, many of the relevant activities fall outside of the aegis of the formal modeling effort.

In the remaining pages on the second phase of activity, the detailed stories of several incidents, critical to the development of organizational capacity, are presented. The significance of each of these incidents is interpreted from the frame of reference set by an organizational process view of policy development.

School Management Services Training. Although the creation and training of the school management services experts in the regional centers was an effort originating outside of the Division of Special Education, it was critical to the organizational innovations that were to follow within the Division. Early in January of 1976, the analyst who had been working within the Division became involved in the school management services training efforts. Later, the newly spawned fiscal policy group within the Division was "piggy-backed" on the momentum created in school management services group, thereby assuring that the fiscal policy group was successfully launched.

In early January of 1976, Fred Williams, Associate Commissioner of Administration and Personnel, had initiated the School Management Services (SMS) effort in order to attain seven operational goals, all linked to the processing of the end-of-year report:

- "(1) Preparation of Reports/guidelines.
- (2) Development of training programs for regional staff.
- (3) Training of Regional Staff.

- (4) Printing of Reports/guidelines.
- (5) Distribution of Reports/guidelines.
- (6) Delivery of technical assistance to LEAs.
- (7) Reports filed--Department of Education."³⁴

We have seen this same list before in the process of telling the rational story. At that time, this listing looked like an enumeration of alternative courses of action. However, a second organizational process view of this listing reveals a whole new logic beneath the formation of the fiscal policy group.

In this list Williams had pin-pointed several critical routines and procedures that could not be ignored by the Department. The end-of-year reports had to be distributed; local education agencies had to be informed of the report's contents, and some unit within the Department had to collect and process the reports. These functions were very real operating constraints for the Department. Other managers less skilled in the organizational aspects of policy development could easily draw up a plan of action that lacks the sound grounding in organizational routines and hence effectiveness of William's initial operational plan.

Associate Commissioner Williams was also sensitive to the operating goals of various units within the Department. The Central Office needed to have a wider base of fiscal expertise if it was to cope with the increasingly complex demands generated by reimbursement financing. The regional offices, recognizing the increasing importance of reimbursement wanted an "increasing piece of the fiscal action". In the winter of 1976, Williams projected that his strategy could be a "winner all around". He had built a

policy package around several necessary functions. The goals of his package corresponded with those of important units within the Department. The Associate Commissioner himself attended nearly all of the working sessions to provide leadership. He had found an organizational pressure point.

The open agenda of the SMS effort was to construct better organizational routines. The hidden agenda was to build a new organizational unit and fiscal capacity that cut across regional lines. Williams was especially sensitive to the difficult issues surrounding the creation of a new organizational interest. He personally took responsibility for the development of training programs for regional staff--a key component assuring that the regional personnel would eventually come together into a coherent SMS unit.³⁵

On the advice and direction of Alan Frohman, the senior consultant in the Phase I Management Improvement Project, Andersen, the junior analyst who kept on thinking in terms of system dynamics models and other rational approaches, became involved in William's SMS training and team building.

Formation of Special Education Fiscal Policy Group. As the attempts to develop a SMS training package progressed, it became clear that the missing link in the training package was a clear understanding of how special education reimbursements worked. The regional personnel were confused over the details of both the program and financing of Chapter 766. The same confusion that had swamped the Department's already strained reimbursement system was still there.

Here at last there seemed to be a well-defined organizational rationale for building a group interested exclusively in fiscal policy within the Division. This fiscal policy group could respond to the demands and con-

straints imposed upon it by the SMS effort. On March 11, about a month and a half into the SMS effort, Andersen, in a memo to Hal Gibber the Division's Director of Program Coordination, proposed a structure for the fiscal policy group. The group would be designed,

"-To take the first steps toward addressing the key fiscal issues important to 766 and special education in the state.

-To perform a linking function with the fiscal school management effort under Fred Williams and to provide a key programmatic component and organizational support.

-To serve as a Department-wide model for fiscal-program policy integration. (Emphasis Added)." ³⁶

As we have seen under the rational story, the fiscal policy group set out an agenda of six "possible issues" that could occupy its time over the next several months. Among the most "timely and of priority interest" were how to compute full-time equivalency measures, how to reimburse recreational expenses, how to treat special education expenditures within occupational education schools, and how the central office staff could receive training in reimbursement. ³⁷

The organizational analyst would be assured to know that the founders of the fiscal policy group had planned an agenda of future activities for themselves. However, the organizational policy analyst would also want to know if enough attention had been paid to the establishment of routine procedures and information flows that would allow the group to function efficiently. Had anyone paid attention to the membership of the fiscal policy group to assure that proper coordination would occur with other units in the Division?

Fortunately, these issues had been attended to in some length. In the

April 1 memo outlining the formation of the group, Gibber laid out the complete cast of organizational units believed to be important in the development of Divisional fiscal policy. A "linking pin" membership concept was established, assuring that every major fiscal unit in the Department had some form of representation and review of the Division's activities. Finally a complex and lengthy section (in the form of flow charts) outlined how the fiscal policy group proposed to receive issues from its environment, process responses, and disseminate policy to all interested parties.³⁸

This initial memo was especially sensitive to the sometimes complex relationships that would exist between the Fiscal Policy Group and the SMS effort. Since both the Division of Special Education and the SMS effort had both regional and central offices components and since the membership in both groups was often overlapping and unclear, great attention was paid to who would be responsible for fielding comments and complaints from the regional offices and who would be responsible for assuring that the issues thus received became structured into the agenda of the Fiscal Policy Group and appropriate action taken.

On paper this newly formed group looked good. It had well articulated goals, and broad membership with a smaller "working group" designated to draft preliminary recommendations for the larger review group. The procedures for processing issues seemed well thought through. But the Fiscal Policy Group was just a paper tiger. The facts of the matter were that historically no one had ever routinely come to the Division of Special Education to have a fiscal question answered. Why now, just because several pages of interesting looking paper had been drafted, should this historic

pattern shift?

An organizational change such as the one being attempted by the Division cannot be unilateral. Other operating units within the Department had to recognize that the Division's commitment to an active fiscal policy stance was for real. The fiscal policy group was a paper tiger in search of a crisis.

The Full Time Equivalency Issue. Fortunately, a crisis was not long in coming, and the group's handling of this first issue was an important first step toward the solidification of a concrete ability to tackle fiscal issues within the Division. A set of organizationally conditioned events led to this first issue coming to the attention of the Fiscal Policy Group and to its eventual resolution. The organizational theorist would assert that the organizational conditions that allowed the initial question to surface routinely in the right place at the right time are the most important determinants of effective policy development. The actual solving of the problem thus posed--the focus of the rational story--is almost incidental to the organizational theorist.

Not by coincidence, the "inner planning group" of the SMS effort contained six members, four of whom were also on the inner "work group" of the fiscal policy group. These four were Dave Keeler, Joe Yannacci, Joe Flahive, and Dave Andersen. Dave Keeler had been designated the SMS "contact person for special education regional staff."³⁹ Joe Yannacci had been designated by the Fiscal Policy Group to become the "intake" person who would collect issues to be put on the work group's agenda.⁴⁰ In a routine meeting on April 8, the work group was reviewing the agenda of issues that Joe Yannacci

had collected in the week since he had been assigned that task. In that meeting, the question of how to compute full-time equivalents (FTES), an issue that had been plaguing the SMS group for over a month and had already been placed on the agenda of possible topics for the Fiscal Policy Group, came up for discussion. The ensuing discussion was heated and ill-focused. There was sharp disagreement between Joe Flahive and Dave Keeler concerning how the issue should be resolved. However the points of difference were not clearly delineated.⁴¹ The next day, Gibber drafted a memo announcing the next meeting of the Work Group and asked that members review two draft documents of the opposing positions.⁴² Over the next three and a half weeks, the FTE issue underwent a very rational-looking process of analysis. That story, resulting in the ultimate redefinition of the question being asked and a major policy stand being taken, is told within the tale of rational analysis.

The important point here is the difference in emphasis that results from taking an organizational as opposed to rational view of the policy design process. The rational analyst would argue that the key element resulting in resolution of this crisis was the precise posing of the right question, the explicit pursual of alternatives and their outcomes, and a reasoned and weighted choice between these policy alternatives. On the other hand, the organizational analyst sees the formation of the Fiscal Policy Group and its overlapping membership with the SMS effort as well as the routines mapped out for processing issues as a key determinant of successful problem resolution. The organizational analyst would point out that there are many other well-posed questions floating about within the

organization (remember there were twelve "possible agenda items" for the Fiscal Policy Group at its conception) but a policy innovation resulted in the case of the FTE issue because of a unique set of organizational capacities (in the form of group membership, routine procedures, etc.) that caused this particular issue to receive the right mix of timely organizational attention.

The organizational explanation becomes even more convincing if possible "hidden agendas" on the part of the Fiscal Policy Group are considered. The Fiscal Policy Group was in a situation where it needed to draw and resolve a crisis if it was to establish an organizational identity. Apparently the lack of clarity over the issue of full-time-equivalency was key to the bad reporting of special education expenditures that the Department had experienced the previous year. And bad reporting was believed to be the crux of the greater fiscal crisis. The fiscal policy group had hit upon this apparently critical issue by inserting an organizational sensor (in the form of overlapping members) into the operating routines of the SMS unit and extracting the kernel of a crisis from that group. The fiscal policy group declared its "ownership" of this crisis.

The FTE issue had many features that made it attractive to the Fiscal Policy Group from an organizational point of view. They could solve this issue without having to solve the whole problem of how reimbursement should work (clearly a task beyond their capacity at that time). Furthermore, if they could resolve this crisis, they would have removed a major "thorn" in the side of the SMS effort thereby gaining some Department-wide visibility. The paper tiger would begin to look more real.

Every attempt was made to handle this "first big assignment" in a thoroughly professional manner (a professional problem solution looks very reasoned--rational). Furthermore, since there was some real conflict over the two principal options for the resolution of the FTE issue, the process of arriving at resolution had to look objective and detached so that neither side of the argument would feel unfairly treated thereby tainting the Fiscal Policy Group's reputation because of its handling of its first issue.

So it could be argued that much of the rational-looking discourse surrounding the FTE issue, right down to the explicit definition of criteria for evaluating the two options, could be seen as the Fiscal Policy Group pursuing its own hidden agenda of winning itself a place in the larger Department-wide organization.

There is one final spin-off of the FTE incident worth mentioning. During February and March of 1976, the analyst had been working on the side with a simple system dynamics model of the Chapter 766 "fiscal-program system".⁴³ Following the FTE incident, the analyst was able to connect the two policy options under consideration in that decision with various testable parameter changes in the simple model that he had been constructing. Given his model, the analyst was able to argue (after-the-fact, unfortunately) that the FTE decision had sizeable consequences for both the size and quality of special education programs in the Commonwealth.⁴⁴ The ability to argue that fiscal decisions could have major, sometimes unanticipated, impacts on program considerations was important for getting the Division's management to take fiscal policy development seriously.

The "Big Think" Exercise. Solving its first problem did not automatically turn the Fiscal Policy Group into a major organizational force with which to be reckoned. Time pressures drew the group's participants back to other aspects of their jobs and other fiscal units continued to operate in established patterns.

The analyst, who had been percolating a system dynamics model more or less under wraps since September of 1975 (it was now mid-April 1976), decided that the group had come together enough so that it could begin to consider the image of fiscal policy contained in a system dynamics view of the problem. Until then, the Fiscal Policy Group had been treating carefully defined and well-orchestrated issues that had been framed elsewhere within the Department. The time had come to take a fresh look at the Division's fiscal environment as well as some of the forces that connected fiscal policy decisions to program consequences.

Based upon a simple system dynamics model that he had constructed, the analyst wrote a position paper that argued four principal lessons:

- (1) Fiscal concerns were central to the program well-being of the law.
- (2) Program-fiscal concerns must be viewed as structured interactions between program variables, local budget-setting variables, and state reimbursement variables.
- (3) The Division of Special Education must take immediate initiatives in fiscal matters or it stood to relinquish control over the destiny of its own programs.
- (4) The fiscal program system should properly be understood in terms of system dynamics concepts such as a closed system, relationships between causal structure and system behavior, and such specific notions as "equilibrium trade-offs", "overshoot", and "delays".⁴⁵

The purpose of the paper was to stimulate further discussion over the Division's own goals and what actions it could take in the near future to insure increased control over its own destiny.

Associate Commissioner Audette was attracted to the "big think" aspects of the system dynamics perspective. He found the idea of using simulation analysis to examine Divisional policy "intriguing" and "sexy".⁴⁶ He read the position paper and an article on the System Dynamics methodology with interest. He scheduled a two day planning retreat to be attended by Gibber, Andersen, and himself to further discuss the issues presented in the paper. The agenda for that meeting contained five (very rational looking) items:

- "(1) Conceptual briefing on model and concerns raised within the model.
- (2) Identifying major concerns within the model and refining these into issues.
- (3) Prioritization of the issues.
- (4) Generating options and identifying necessary information to operationalize the options.
- (5) Operationalizing the response."⁴⁷

The rational looking purposes of that meeting were not met. Much wide ranging discussion transpired and many lists of concerns, issues, and priorities were made.⁴⁸ However, none of the specific options articulated at that meeting were ever operationalized. A rational analyst would have found the final outcome of the planning session disappointing (as did this analyst).

However, an organizational analyst would have been encouraged by the planning session. The goals of the Division's management were opening up

to include fiscal matters. Based upon at least one solid fiscal accomplishment and a growing sense of involvement, Divisional managers were beginning to see themselves as fiscal as well as program managers.

The jargon and concepts of the fiscal world were beginning to filter into the managers' mental images of Divisional goals, routines, and procedures. The model, by articulating a set of important issues and providing a concrete focus for discussion was helping to crystallize a fiscal reality within the Division. The summer of 1976 represented a period of incubation of fiscal goals. Goals that were to later appear in more concrete Divisional operations.

Bad Starts, Dead-Ends, and Other Organizational Fumbles. The story told thus far is somewhat skewed. What we have been seeing is a steady and progressing build-up of organizational capacity. The SMS effort led to the formation of the Fiscal Policy Group. The Fiscal Policy Group tackled the FTE issue, and finally Divisional managers began to feel comfortable taking an initiative in setting fiscal goals for the Division. Such a continuous and seemingly progressing story line nearly always hides a multitude of false starts, dangling loose ends, and organizational fumbles. The following anecdotes illustrate some of the organizational problems that continued to plague the Division's fiscal efforts through the summer of 1976.

In July, the Office of Local Aid completed a routine review of how reimbursement was to be computed for the upcoming fiscal year. This review's purpose was to update the computer software necessary to process the end-of-year reports (for fiscal year 1976) that would soon be arriving within the Department. Several routine and marginal changes were made that would

have an impact upon the reimbursements for special education.⁴⁹ Most procedures were left unchanged. By not changing several computations, over twenty-million dollars in indirect costs continued to be charged to special education rather than regular day education. The memo noting these routine changes was not routed through the Division of Special Education's fiscal policy group.

As a second example, one of the priorities of the fiscal policy group was the thorough training of Divisional managers in the reimbursement process. This responsibility was delegated to Bonnie Bluestein, as administrative assistant to Hal Gibber. In April, Bluestein set up a procedure whereby interested managers could attend the SMS training sessions being held in the regional offices.⁵⁰ By late June, she had drafted a plan to assure that the needed fiscal training would be extended to other Division staff by the end of October.⁵¹ In the early fall, Bonnie was transferred from the Central Office to the Boston Regional Office. The training package as outlined above was abruptly allowed to drop. A fiscal training package, deemed a "top priority" by Divisional managers for more than a year, was let to drop once more because of the simple lack of a person to attend to the issue.

A third anecdote involves the sustenance of the routine issue-logging procedures established by the Fiscal Policy Group (with elaborate flow charting) and eventually delegated to Joe Yannacci. Less than several weeks after the procedure was established, the SMS team of Central Office and Regional fiscal "experts" went out into the field to train the local school systems in the end-of-year report. Understandably, local special

education directors or business agents who had questions concerning special education got in touch with the SMS personnel who had given the presentation. The Division's elaborate issue-logging routine soon atrophied from disuse. Instead Dave Keeler, one of the SMS trainers and formerly the fiscal "expert" within special education, began to feed Hal Gibber memos outlining issues to be taken up by the Fiscal Policy Group.⁵² Apparently organizational routines have a logic of their own that often defy the best laid plans.

Finally, Bruce Perlstein from the Commissioner's Office of Planning became concerned over the growing and seemingly unchecked costs of special education transportation reimbursements. He drafted a position paper that was presented in a meeting attended by Associate Commissioner Audette of Special Education. Audette arranged to have Ed Gotgart and Mickey McGonagle, the Division's most knowledgeable persons in transportation to sit in on future meetings. However, at that time Gotgart and McGonagle were principally skilled in contracting for transportation through private vendors and knew little at all about reimbursement questions. Once again, the Fiscal Policy Group did not become involved in these preliminary discussions at all. The organizational lines of delegation and responsibility even within the Division of Special Education were not yet clear over the role and function of the Fiscal Policy Group. Hence the group failed to participate in yet another major fiscal decision impacting on special education reimbursements.

The third phase of the analysis sees the Fiscal Policy Group becoming more firmly entrenched within the Division and the Department as a group with some expertise in the field of special education reimbursements.

5.4 PHASE III: THE EXERCISE OF ORGANIZATIONAL CAPACITY

The bulk of the system dynamics model building was concentrated in the third phase (from September of 1976 through April of 1977) of the overall project. To a large degree, the rational story makes it look as if the process of model building is nearly one and the same with the process of policy design. Both model building and rationalized policy design are concerned with the articulation of alternatives, the assessment of outcomes associated with these alternatives, and finally the valuation of the outcomes and choosing between policy alternatives.

But at each step, the rational view of policy design raises nearly as many questions as it answers. How does the organization generate alternatives? Are outcomes formally or only implicitly assessed? How are outcomes valued and choices made? By whom? An organizational look at the policy design process answers many of these questions in a manner that makes the enterprise of policy design look much less rational. The organizational story draws our attention to a whole different set of concepts and variables.

In a word, policy is the rather ordinary and every day exercise of established organizational capacity. Policy design is the building of organizational capacity. Insofar as a formal model supports capacity building it is supporting policy design.

Figure 5.6 summarizes the major activities that took place within three threads of activity. The "think tank" stream of activity encompassed the actual construction of the system dynamics model. It was the activities of the think tank between September 1 and mid-November that formed the bulk of the rational story. The activities of the other organizational groups

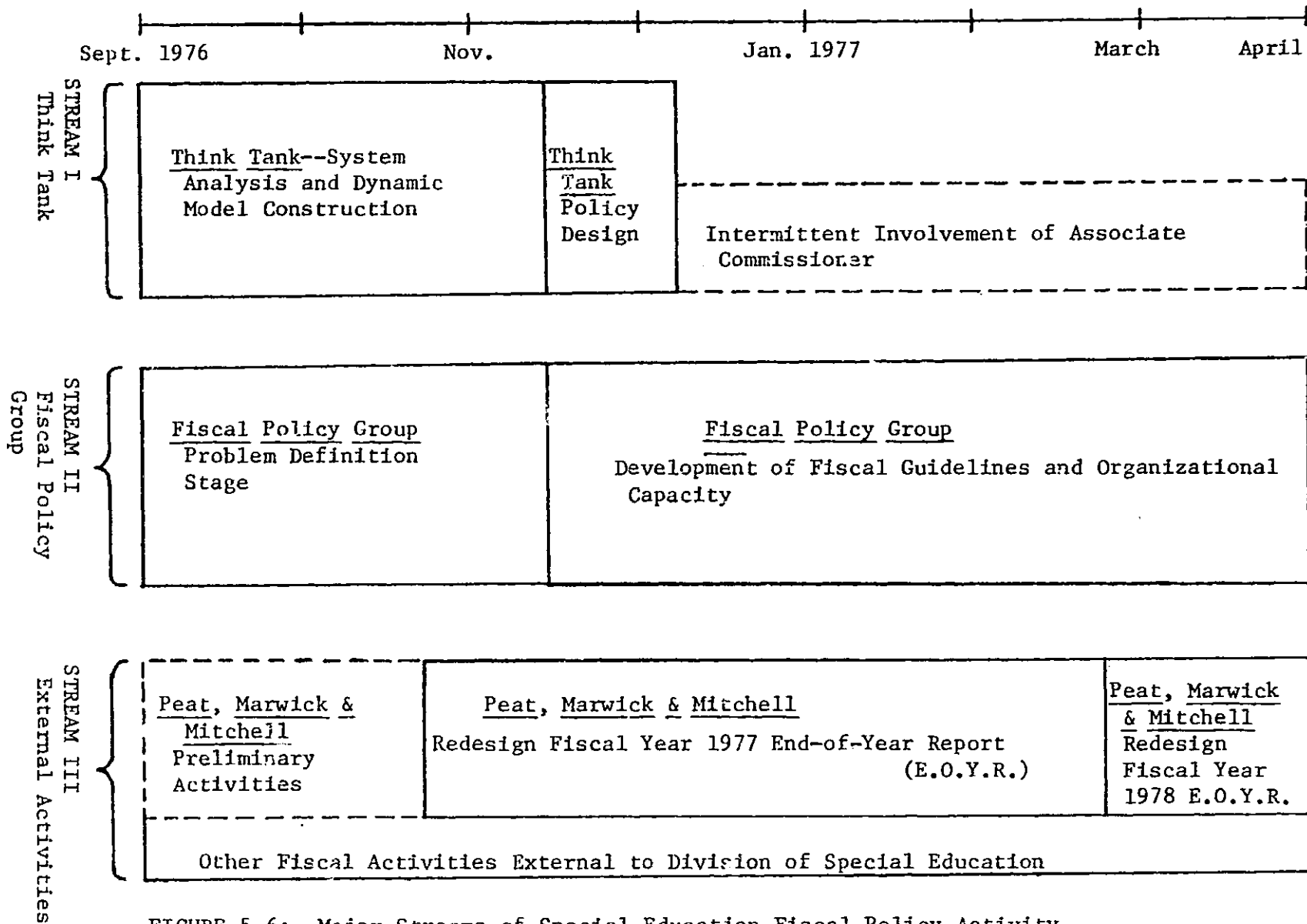


FIGURE 5.6: Major Streams of Special Education Fiscal Policy Activity
September 1, 1976 to April 1, 1977

were only vaguely important to the rational views' ill-understood implementation process. Figure 5.6 indicates that an organizational view of the policy-making process encompasses a much wider span of organizational actors and interests. Many actors who know little or nothing concerning the rational analyses taking place within the think tank are key actors in the development of fiscal policy. The routine functioning of the fiscal policy group and other organizational units external to the division is an important element contributing to the shape of divisional fiscal policy.

The think tank was an ad hoc group centered in the office of the associate commissioner that came together to ponder what the division's stance should be with respect to fiscal policy development. From the first of September through the middle of November, this group was explicitly involved with the conceptualization and design of a system dynamics model of program fiscal interactions. Based upon this formal analysis exercise, considerable time was spent in November and December drafting a series of specific policy positions designed for presentation to the legislature. The momentum that had been building up within this group throughout the fall was broken when several of the proposed policy recommendations were deemed "politically infeasible" by Commissioner Anrig at a meeting in late December. From January until April of 1977, the attention of the associate commissioner focused on fiscal policy only in sporadic bursts--usually in the form of presentations or conference appearances that the associate commissioner was required to attend. The sustaining thread of fiscal policy development shifted down to the fiscal policy group.

From early September through mid-November, the fiscal policy group -

representing the second thread of activity - was engaged in a process of problem search and definition. During that time, the group was "scouting" the activities of other fiscal units within the Department, responding to information needs from a group of external consultants hired to redesign the end-of-year report, and framing its own goals. By mid-November (not coincidentally at the same time that the think-tank group began to focus on policy design questions), the fiscal policy group began to focus on developing guidelines for the allocation of costs to special education as a task that would occupy its attention through April. In addition the fiscal policy group continued to interact with other fiscal units within the department as it grew in fiscal expertise.

As has been noted earlier, several other streams of activity centering around reimbursement policies were taking place within the department. These activities, as they impinged upon the fiscal policy group, formed the third stream of activity. Most specifically, a team of external consultants from Peat, Marwick, Mitchell and Company placed deadlines upon the division's fiscal policy group as the consultants redesigned the format of the reimbursement documents. These constraints imposed externally upon the Division were critical to keeping the fiscal policy effort on task (the time of otherwise pressed managers would have been diverted to other tasks).

The Think Tank--Developing a Systems View of Fiscal Policy

On September 1, 1977, after being away from the Department for nearly a month, Andersen met with Fred Williams to review activities that had

occurred during that time. This was the first in a series of "scouting" meetings designed to begin the third phase of analysis of fiscal policies within the Division. In that meeting, Williams noted that a most interesting development had occurred around the issue of reimbursing special education transportation costs. The department's planning office had suggested that special education transportation reimbursements be limited according to a complex formula. In a heated meeting, Associate Commissioner Audette had rejected this proposal. Williams suggested that this incident might be a good one to follow up on.⁵³

Andersen conducted a series of three preliminary meetings with the Division's transportation personnel in an attempt to understand the issue in more detail. A week later, the same transportation issue came up in another meeting with Associate Commissioner Audette. In a memo summarizing the discussion at that meeting, Andersen argued that this transportation issue was only a manifestation of several larger, and perhaps more fundamental problems,

"The current question being asked seems too narrow. It leads to opaque answers that could be more elegantly treated in a larger arena...Because this definition of the problem does not consider changing what data items are collected nor how we define an allowable expense, the solution (to a problem thus defined) becomes a complicated formula that may only be a band-aid; that may fail to get at the root of the growing program costs and that may cause political hassles."⁵⁴

The conversation at the September 8 meeting intimated that the broader perspective within which to address this and a host of related puzzles was a system dynamics view of special education reimbursement policies. Audette was intrigued enough by this proposition to schedule a series of weekly

meetings beginning in October to address the broader set of fiscal issues as they would be framed within a system dynamics framework.

And so the think tank cabal was born.

Membership. The membership of the think tank group was initially comprised of Associate Commissioner Audette, Bambi Levine, his administrative assistant, and Andersen, the system analyst. Later on, Hal Gibber, director of program coordination, Gene Thayer, a former superintendent of schools and then planner for the Division, and John Laird, a writer and analyst for the Division were to become involved in the project.

The membership of the think tank reflected a fairly common pattern of organization that can be found among ad hoc study groups set up to study policy questions with the aid of an external consultant. The external analyst secures the interest and support of "top management" and then a special study team reflecting the necessary informational inputs for the study is assembled. This team, in a self-consciously rational way, studies the area of policy concern and attempts to design policy solutions. Since this pattern of organization for executing a policy design study based upon some form of mathematical modeling is quite common, it is interesting and worthwhile to look at the goals, search procedures, routines, and other organizational capabilities associated with such groups and to ascertain how these study groups differ from other types of organizational subunits. Many of the problems with implementing policy solutions derived from mathematical modeling efforts can be traced to an organizational analysis of the capabilities and deficiencies of the subunits within the larger organization that are often hosts to such policy studies. A paradoxical fact is

that these groups which are most open and amenable to rational-looking policy design exercises also contain some major organizational deficiencies that tend to make them ill-adapted to actually execute concrete policy actions.

For example, in the case under study, the relatively small membership of the think tank group encouraged the rapid evolution of concepts and policy alternatives. However, such a limited membership could also prove to be an organizationally dangerous strategy. The results of the system dynamics analysis could rest within the confines of an ad hoc study group that was not charged with the execution of any routine functions. Before the results generated within the study group could become concrete policy actions, they first had to be diffused out to other operating units within the division. These operating units oversaw the execution of policy decisions through the execution of their routine procedures. Fortunately, the think tank group did include in its members key personnel who in their other roles within the division could see to it that the recommendations designed within that group were carried to fruition. In this case, an important role played by the analyst was managing the process whereby specific recommendations designed within the think tank were picked up on the agenda of the fiscal policy group and eventually implemented. In general, an analyst (or one of his organizational allies) must manage the construction of organizational bridges along which policy innovations may diffuse from study groups to more conventionally defined operating units with greater organizational capabilities. Otherwise, there will be a sharply decreased probability of success of the entire policy design exercise.

Goals and Goal Attention. Another organizational deficiency of the think tank group was that it had no well-defined goals. To an organizational theorist, goals are constraints imposed upon an operating unit--things that have to get done. For example, a budget has to be drawn up, a set of guidelines have to be revised, or requests from local agencies have to be answered. The think tank, as is the case with most study groups, did not have to do anything. The group wanted to accomplish many things but it was not constrained to meet any deadlines or to be responsive to any other agency or unit.

Herein lies an important distinguishing feature between the rational and organizational views of decision making and policy formation. The rational analyst would argue that knowing what one wants to do, as embodied in some form of utility function for example, is an adequate statement of goals. An agency that was continually responding to outside pressures could be seen as drifting and not pursuing a coherent set of goals. On the other hand, the organizational analyst would point out that a group with a well-defined notion of what it wanted to do but with no operating constraints imposed upon it is essentially goalless. Of course, a clever manipulator of organizational processes could set in motion a series of events so that an operating unit is in a position whereby it must do what he wants it to do. (Indeed, this is the basic strategy that lies behind management-by-objectives. First have managers describe in writing what they want to do and then establish a set of rewards and sanctions so that they then must do what they want to do.) The crux of organizational policy design is the establishment of a set of organizational rewards, and sanctions, such that

operating units are constrained to set up standard operating procedures and routines that accomplish management's desires.

Instead of real constraining goals, the think tank group responded to a form of surrogate goals. It was paying attention to a set of future hypothetical situations that might constrain the division to act if no action were to be taken in the interim. The system dynamics model helped to create a sense of urgency by framing issues in a manner that heightened their importance. By simulating the effects of current policies, the model created an expectation that such policies would with a great likelihood lead to consequences unacceptable to the Division. (For example, figures A.5.A and A.5.B of a report to the think tank, reproduced in Appendix A, indicate that unchecked costs due to current operating policies could lead to a growing probability of repeal of the entire 766 program). The model helped to create an artificial vision of the division's relevant policy environment that encouraged managers to allocate attention to goals that would not become pressing and problematic for several years to come (at which time it would probably be too late to implement the fiscal controls called for within the simulations).

But however compelling and important the issues and future constraints being treated within the context of the model, these are not the same sort of real and immediate constraints with which the organizational analyst is familiar. At any time, the think tank was free to abandon its consideration of these issues and no other group would have paid the least attention--there was no external constraint compelling the study group to continue its inquiry. Lacking organizationally defined constraining goals, the group

lacked organizational motivation (even though individual members of the group may have been personally motivated to continue the model-based inquiry).

The analyst attempted to partially compensate for the absence of organizational motivation by continually reminding the group of where it had been and where it was going⁵⁵ and by using the structure of the model-building process to continually structure and clarify the issues under question.⁵⁶ However, an organizational analysis alone can not reveal why the think tank group stayed together and ever accomplished anything. This group was without organizationally defined goals; it lacked organizational motivation. We shall have to wait until the telling of the cognitive story to understand all of the forces that held that group together and made the modeling exercise a useful one.

An analysis of the goal structure of the think tank, and more generally of study groups set up to design policies, yields two major organizational deficiencies inherent in such groups. First, such groups are characteristically free of organizational constraints and, unless bridges (usually in the form of overlapping memberships) can be built to other operating units within the bureaucracy, policy designed in such groups will have a strong tendency to die on the vine. Second, study groups are organizationally unstable. They tend to be striving toward surrogate goals that take on importance only in the minds of individual members of the group. Management's attention can be easily diverted from such surrogate goals by real organizational constraints--usually in the form of unexpected crises or "crunches" on management's time.⁵⁷ In order to effectively manage a model-based policy design project, an external analyst must either not rely

upon such study groups or find ways to compensate for their predictable organizational deficiencies.

Of course, policy task forces do have some unique advantages that make them well-adapted to serve as the organizational host for a model-based policy design effort. Because such groups are not bound by immediate and pressing goals, they tend to have more organizational elbow room for paying attention to future concerns not yet impinging directly upon the organization; they tend to employ much more flexible and comprehensive search procedures when confronted by a policy problem; and they are extremely useful as devices for changing management's mental images concerning what are the important issues and problems facing the organization.

Before exploring the organizational advantages to policy study groups, we shall dwell a while longer on the actual activities undertaken by the think tank in this case.

Principal Activities. The routine activities of the think tank group were not particularly routine. As we have noted above, the group was unique in that its function was not to respond to routine pressures, but instead to step back and attempt to be self-consciously rational and "policy oriented." Figure 5.7 summarizes the major activities--meetings, drafting of reports, presentations, etc.--that occupied the think tank from September 1, 1976 through January 15, 1977. Meetings, reports, or presentations that were important antecedents to another meeting or event are shown as "flowing into" the subsequent event. In this way the flow between important events is depicted in an after-the-fact PERT chart arrangement. All of the charts shown in this section depict portions of a more complete master chart that

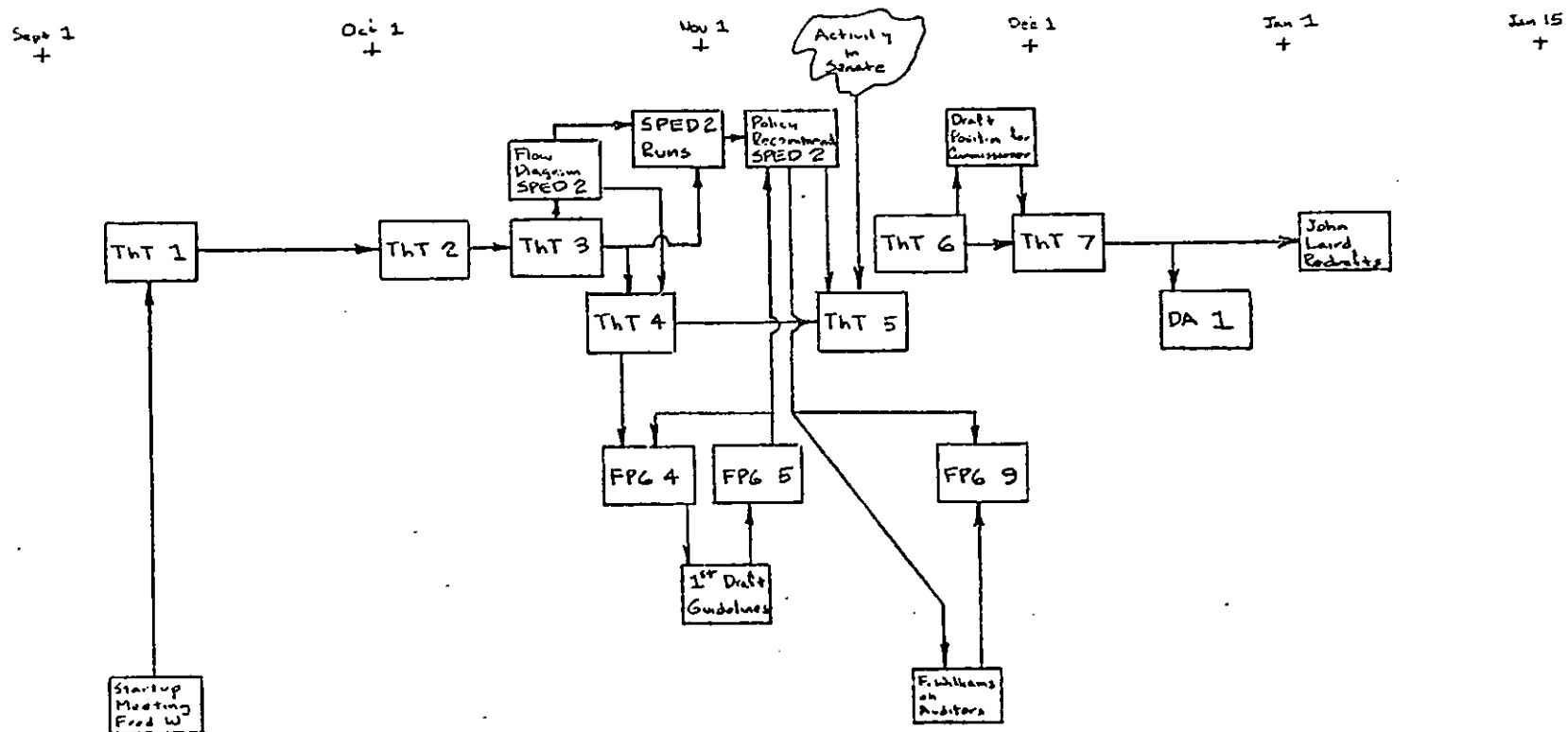


FIGURE 5.7: Major Activities Involving Associate Commissioner (Think Tank) September 1, 1976 to January 15, 1977

tracks the flow of all important fiscal policy events between September 1, 1976 and April 1, 1977. The complete flow chart is presented in Appendix B. Between September 1 and mid-December an important series of seven meetings (labeled ThT1 through ThT7 on Figure 5.7) were held. These meetings began with the design and construction of a system dynamics model and culminated with the presentation of a major position paper to the department's executive committee. Meetings labeled ThT1 through ThT4 were a series of half-day working sessions wherein much of the conceptual groundwork for the system dynamics model was laid out. Between these meetings, the analyst spent considerable time transcribing notes from the previous meeting and designing the agenda for the subsequent meeting. These meetings progressed extremely rapidly because much of the material being consolidated and systematically integrated in these meetings had been the subject of the less structured discussions that had transpired during the earlier phases of the fiscal policy analysis. The substance of these meetings entailed a rational-looking discussion of system goals, system structure, and modes of behavior over time. The substance of those meetings has been more fully discussed under the rational story in Chapter 4.

Between October 25 (ThT4) and November 18 (meeting ThT5), a series of critical meetings and events transpired. These activities illustrate the type of important interplay that must exist between the rather ethereal policy study groups such as the think tank and the more organizationally grounded operational units such as the fiscal policy group. In a series of key exchanges, the guiding system principles and abstract understandings of system performance originating within the think tank were blended with the

flurry of empirical details, and options surfaced within the fiscal policy group to form a coherent and operational policy package.

To summarize a complex process, by October 25, the think tank was able to articulate in broad terms where the policy energies of the division should be concentrated but could point to few concrete projects to operationalize those policies.^{57A} At the same time, the fiscal policy group, which had been doing its organizational homework, had conducted scouting interviews in every fiscal corner within the department and had compiled long lists of feasible-looking projects.⁵⁸ But the policy group was at a loss as to which of these activities was most important--what package of activities would produce the most impact?

On October 28 (meeting labeled FPG 4 on Figure 5.7), the analyst presented to the fiscal policy group the broad policy conclusions emerging from the think tank. Four projects, the details of which are not important to our discussion here, were identified as "action priorities" by the fiscal policy group. Between then and the next meeting of the group (meeting FPG 5, November 5, on Figure 5.7), Gene Thayer and Hal Gibber completed a first draft of a set of guidelines outlining what costs could be charged to special education.⁵⁹ One of the four action priorities had been launched.

Armed with the knowledge that the fiscal policy group would be able to actually develop such guidelines, the analyst made the creation of such guidelines a cornerstone of his allegedly model-based policy recommendations. In the telling of the rational story, we had noted that there was a broad gap between the articulation of policy alternatives in terms defined within the model and the specification of policy alternatives that had meaning

within the host organization. In this case, the analyst used organizational processes to help bridge that gap. He "leaked" the model-based results to an operating unit, observed their response, and then incorporated their responses into his final policy recommendations.

On November 16, a second chain of interesting events was triggered. These activities covered meetings ThT5 through ThT7 on Figure 5.7 and culminated in the presentation of a policy position paper to the department's executive committee. After a November 16 meeting of the Peat, Marwick and Mitchell advisory committee (a department-wide committee established to work with a team of external fiscal consultants), Bruce Perlstein, a fiscal planner and legislative liaison for commissioner Anrig, met briefly and informally with the special education delegation to the advisory committee. Perlstein reported that the State Senate's taxation committee was considering amending legislation to the funding formula for Chapter 766.⁶⁰ Such a move, if imprudently executed, surely could have undercut the progress made by the Division over the past two years.

This crisis came at a serendipitous moment for the think tank. The surrogate goals which the group had been attending were probably being actualized much sooner than anyone could have anticipated. A system dynamics model capable of assessing the impacts of different funding formulas upon the overall system was up and running at that time. The analyst rushed to complete a position paper outlining the policy implications resulting from that model. (Both the model and this position paper are reproduced in Appendix A.)

In a hurriedly-called meeting two days later (meeting ThT6 on Figure 5.7), the hypothetical constraints portrayed within the model seemed very real indeed. Audette had read the system dynamics position paper and was excited by both its approach and results. However, as he told Andersen, "You haven't carried your analysis far enough."⁶¹ He agreed that the major problem facing special education was its growing unchecked reimbursement curve. He agreed that fiscal incentives built into the law were to a large degree causing this growth. However, he disagreed that the preferred solution was to institute strong fiscal controls--to get into the business of becoming "fiscal policemen." Instead he argued that the division should advocate eliminating the enriched reimbursement formula entirely and concentrate on enforcing the program mandates of the law--on becoming "program policemen." Localities would all be given a certain lump sum of aid based only upon their gross enrollment to cover both special and regular day education. There would be no incentive to make expenditures look special rather than regular. By removing the strong incentives that made special education dollars more richly reimbursed than regular day, the fundamental forces driving the growth in claimed special education dollars would be eliminated. To test this hypothesis, Audette requested that computer simulations be performed to test the effects of "neutralizing" the reimbursement of Chapter 766.

As summarized in Chapter 3, the simulations returned a mixed view of whether or not the "neutralizing" scheme would work. In all cases, neutralizing the reimbursements did check the growth of special education claims. However, if program standards were not strictly enforced by the division

the effectiveness of Chapter 766 in identifying and serving children with special needs would be severely hampered. That is, the neutral funding scheme had the promise of releasing the division from the stance of fiscal policeman but also had the danger of severely harming the program if the role of program policeman was not strictly enforced.⁶²

The next day, November 19, Audette convened a meeting of himself, Levine, Laird, and Andersen to consider the steps necessary to prepare a position paper based upon the concepts of fiscal neutrality (meeting labeled ThT6 on Figure 5.7). This paper considered a sweeping set of changes in the funding of special education and in the organizational role of the division in monitoring the special education programs of local school systems. The position paper was designed for presentation to the Senate committee on taxation. However, before presentation to the legislature, the proposals would first be cleared internally by the department's executive committee. The executive committee presentation was scheduled for December 7. Long days and concentrated effort ensued for members of the think tank. The surrogate goals, the former motivation to action, had been replaced by real constraints--positions needed to be thought through, options weighed, and alternative courses of action presented.

Associate Commissioner Audette in several public appearances elaborated upon the points being developed in the position paper. For example, the Springfield Morning Union reported an address that he gave to a gathering of special education professors and educators in Westfield, Massachusetts:

"Special education in Massachusetts has grown too big and needs to be curtailed...Current state educational reimbursement formulas give more money to school systems for special-needs children, so

it pays to 'keep Johnny handicapped.' Systems get less money 'if a special needs kid goes back into a regular classroom...' IF this continues, I personally would favor removing all fiscal incentives for special education,' Audette said."⁶³

On December 7 (meeting ThT7 on Figure 5.7), when the position paper was presented to the executive committee, the think tank's sense of direction and purpose was burst like a soap bubble that had drifted into a brick wall. Commissioner Anrig judged that the proposals outlined by the think tank by far and away exceeded the organizational capabilities of the department.⁶⁴ Furthermore, in Anrig's opinion, the whole report was based upon several "politically untenable" propositions. In fact, the division was directed to destroy copies of the report that contained several of the more volatile propositions and to prepare a revised copy that could be read without problems by a much larger audience.⁶⁵ In effect, Anrig was arguing that the most undesirable consequences predicted by the model would probably occur--namely that by advocating such a set of proposals, the department would be giving up its "big stick" as fiscal policemen and would in all likelihood not attain the organizational capacity to become effective program policemen. Anrig noted that "you (Audette) have more faith in institutions than I do."⁶⁶ The whole special education program would suffer from the proposal in its present form. However, he encouraged the division to continue and deepen its current line of research into the area of fiscal policy.⁶⁷

Parenthetically, it is interesting to note that the system dynamics model was explicitly used to make several of the points presented in the December 7 meeting. This turned out to be a tactical mistake. Much of the

discussion in the December 7 meeting focused on the validity of the model. How well did it track historic data? How could it handle several minor disaggregate effects? Etc. This discussion took the focus away from a discussion of the substantive issues presented within the model. And these issues, once clearly framed through the model-based study, could have been presented logically and coherently on their own merits without any reference to a model whatsoever. Presenting the issues through the model tended to cloud over rather than to clarify the issues under discussion. The think tank had worked itself into a classic "groupthink" situation. Everyone had become so convinced that he was right, that the group was right, and that the model was right that inadequate preparation had been given to the thinking through of various ways of defending the positions presented in the paper.⁶⁸

This unexpected obstacle stopped the think tank dead in its tracks. The group stopped meeting regularly. The surrogate goals that the group had been pursuing all fall had become tarnished. The pursual of such desirable ends soon gave way to more real and pressing demands for the time and attention of think tank members. The associate commissioner turned more of his attention to the many demands that were always pressing upon him, returning to fiscal policy matters through the winter and spring with scattered bursts of enthusiasm. The analyst began to focus more exclusively on the concrete activities that were rapidly evolving in the fiscal policy group. Hal Gibber headed up a brief-lived attempt to gather some of the "hard data" available within the department that would tend to support many of the recommendations made within the report. This effort soon became

swamped by other pressures on his and the fiscal policy group's time.⁶⁹

John Laird prepared a redraft of the position paper that was to reappear several times later on in the spring.

In fact, position papers based upon the system dynamics model were apparently quite interesting as vehicles for promoting discussion over the financing of special education. In the spring of 1977, a revised version of the paper presented to Commissioner Anrig and the executive committee was reviewed with interest by the staff of the Secretary of Education.⁷⁰ On June 27, that same paper formed the basis for a four hour informal and wide-ranging discussion on the financing of special education by the Massachusetts Board of Education in conjunction with Commissioner Anrig and Associate Commissioner Audette.⁷¹

By serving as a focus for such relatively high-level policy discussions, a model may promote policy innovations in some highly indirect fashion. However, in these cases the model is serving more of an indirect theory-building or pedagogical purpose and less of a direct policy innovation function. We shall not attempt here to trace the many such possible indirect contributions of modeling efforts to policy innovation.

After December, the associate commissioner continued to be involved in fiscal policy design through intermittent but important forays into the stream of on-going activities. For now, we shall attempt to further highlight some of the organizationally interesting aspects of how the think tank actually functioned through the fall.

Problem Directed Search. As is evident from the above discussion, the think tank was an unusually "smart" group in the organizational sense

of the word. Organizations are usually not "smart" in the way that they attack problems. When confronted with a problem, they will tend to search out only a few sets of alternatives, all of which are only incrementally different from how things have been done in the past. Such relatively narrow search behavior is highly functional. Since groups are usually pursuing highly operational goals they cannot afford to arrive at unusual problem solutions. If they did, they would not be able to meet their operating constraints---highly complex and novel problem solutions make it difficult to attain operational goals.

The think tank's smartness was directly related to its lack of real organizational goals. Since it did not have to actually do anything, it could be as detached and globally comprehensive about its problem solving behavior as it wished. Because study groups characteristically lack organizational constraints and can be so nearly rational, they form attractive host groups for model-based policy design efforts. An analyst is naturally attracted to a group that can pursue an "objective" analysis (as opposed to a parochially self-interested one) and the participating organizational decision makers feel cognitively rewarded because such groups provide them with an opportunity to step back from the constraints of daily operations and to consider options in a leisurely fashion (as opposed to always responding to crises).

The analyst who enjoys working with such groups because they are organizationally smart and receptive to his synoptically rational point of view, must find ways to compensate for the companion organizational deficiencies of such groups--namely their isolation from the mainstream of

operational routines and their tendency to dissolve under pressure from real constraints. We have suggested the construction and maintenance of organizational bridges for the diffusion of policy innovations as a remedy of the first defect. The creation of surrogate goals, where possible tied to real organizational constraints, has been suggested as a strategy for dealing with the second problem.

Coordination and Feasibility. A principle finding of organizational theorists is that policies that require even moderate degrees of cooperation between several operating units will tend not to work. That is, coordination is organizationally infeasible.

It follows in a rather straightforward manner that because study groups are organizationally unconstrained and smart, they tend to see with ease the benefits of inter-unit cooperation and only with great difficulty the obstacles that might limit such cooperation. In the case under study, the think tank was led to a strategy that strained the organizational capacity of the department and was perhaps politically infeasible as well. By encouraging decision makers to step back from their routine operating view of the department and to take a broader "more rational" view, the model directly contributed to a tendency toward infeasibility on the part of the think tank.

The model led easily and in a rather straightforward fashion to the identification of the reimbursement mechanism as the "best" way to control an unstable chain of events. The complete line of reasoning began with greater special education expenditures leading to greater reimbursements which in turn made further special education expenditures more attractive because they would be more fully funded. Over time the increased attractive-

ness of special education expenditures led to even greater expenditures. Although the model did point out the clear dangers inherent in such a strategy, the inertia of organizational responses had not been designed explicitly into the model and decision makers were seduced into an improbable if not infeasible policy position.

The same strategies mentioned above--maintenance of policy diffusion bridges and surrogate goal construction--would probably go a long way toward reducing the tendency of study groups to generate infeasible policies. Not incidentally however, these same strategies also seriously complicate the job of the analyst who would have to remain aware of a plethora of organizational factors outside the environment of his host study group. An added burden is also placed on decision makers within such groups. They have to take responsibility for throwing the monkey wrench of rather routine operating puzzles into an otherwise elegant and psychologically rewarding policy design exercise.

Fiscal Policy Group--The Division's Operating Unit

As opposed to the think tank, the fiscal policy group was an operating unit that behaved nearly as predicted by an organizational view of policy making. It operated in response to real operating constraints, employed problem-directed search procedures, used short-run feedback cues to negotiate an uncertain bureaucratic environment, and achieved modest but feasible results through its routine operations.

As sketched above, the fiscal policy group was formed in March, 1976 because the division lacked an operating unit to address fiscal questions.

Although the fiscal policy group had promulgated some major policy guidelines⁷² and had assembled an agenda of possible problems and projects,⁷³ it was still a relatively inexperienced organizational unit. Since it had not been around long enough to establish its own style and routines and fit into the greater established patterns of department-wide fiscal planning, demands were not being imposed on the group in any predictable fashion. Furthermore, the group was not really clear about its own priorities. Its listing of possible problems to be solved and projects to be undertaken was more a listing of all visible possibilities than an actual list of projects to be undertaken seriously.

The fiscal policy group was an ideal companion to the think tank. It provided the sustaining organizational capacity necessary to bring the ethereal policies designed within the think tank to fruition. Furthermore, the fiscal policy group's scouting of concrete details and options throughout the department provided the grist to be ground in the policy mill of the think tank.

As we shall see, the story of the fiscal policy can be told as a textbook case of policy development as the execution of organizational capacity. After a brief discussion of the membership of the fiscal policy group, we shall characterize the first two and a half months of the fiscal policy group's operations in the fall of 1976 as a classic example of problem-directed search. During this searching period, the fiscal policy group began to evolve a set of organizationally defined goals, entering into a series of mutually constraining commitments with other units in the department. In pursuing its newly emerging goals, the fiscal policy group dis-

played an ability to negotiate an uncertain bureaucratic environment, constantly correcting its policy development efforts based upon feedback cues elicited from other units and managers in the department.

Finally, through the winter and spring of 1977, the fiscal policy group attained status as a mature operating unit. In the course of its routine operations, it found itself allocating its time and attention between the multiple demands placed upon it by other departmental operating units. The concept of sequential goal attention explains admirably the effort allocating behaviors employed by the fiscal policy group during this period.

Membership. The fiscal policy group was chaired by Hal Gibber, director of program coordination for the Division of Special Education. His ability to keep a group of people working well together prevented the splintering and dissolution of the group and helped to keep the whole effort on task. The remaining membership of the fiscal policy group was divided into two parts. The smaller core, the fiscal policy work group, was intended to do the bulk of the substantive work--to draft initial positions for final approval. The relatively broad membership of the work group assured that a host of interests could be represented in the initial drafting of positions. The members of the work group included Bambi Levine, administrative assistant to the associate commissioner; Gene Thayer, a state-wide planner for the division and formerly a superintendent of schools; Dave Keeler, a project director closely associated with the SMS effort and the Bureau of External Audit; Ed Gotgart, the Director of the division's Bureau of Management; Bill Donaldson, a data specialist working for the division; Joe Yannacci, chief accountant for the division; and David Andersen, an ex-

ternal consultant hired to work on fiscal policy. By November, two new and important members representing operating units outside of the division were added to the work group. Gerry Mercadante, an education specialist working for the Office of Local Aid attended most of the work group meetings regularly as did Bruce Perlstein, a fiscal planner and legislative liaison from the office of the Commissioner of Education.

The second part of the membership of the fiscal policy group attended only occasional meetings and was intended to provide review and approval of the drafts completed by the work group. This review group included: Bob Audette, Associate Commissioner of Special Education; Fred Williams, Acting Associate Commissioner of School Building Assistance and Related Facilities; Steve Kaagan, Deputy Commissioner of Coordination; and Ramona Hilgenkamp, Acting Associate Commissioner of Administration and Personnel. More often than not, the members of the wider review group would send a proxy member to meetings involving the approval of draft material.

In retrospect, the major problem with the membership of the group was its failure to include regional special education project directors and representation from the local special education administrators.⁷⁴

Problem-Directed Search. On September 1, the fiscal policy group set out to attack a broad and vaguely defined difficulty--how could the division best accomplish an integration of fiscal and program policy? By November 12, the group had specifically focused on two concrete projects--the development of special education reimbursement guidelines and the redesign of the special education portion of the end-of-year report to match those guidelines. A third less concrete project, "frame issues to be addressed in fiscal

year 1978," was also identified for attention.⁷⁵ The intervening clarification and focusing of questions is a classic example of problem directed search, the process whereby an organization searches its environment for feasible solutions to problems that it is facing.

On September 1, after the fiscal policy group had laid dormant for much of the summer, Andersen and Gibber met to lay plans for getting the group started up once again. At that time they decided that they needed to conduct a series of preliminary scouting interviews to "assess any technical issues and (to) review areas of activity department-wide" that had come up over the summer.⁷⁶ Later on that same day, Andersen met with Fred Williams. Over the summer, Williams had changed jobs from Associate Commissioner of Administration and Personnel to Acting Associate Commissioner of School Building Assistance and Related Facilities. Part of his new responsibilities included direct supervision of the Bureau of External Audit. Williams had made a substantial commitment to completing audits on the fiscal year 1975 special education returns.⁷⁷ It was in this meeting that the germ of the notion of developing special education expenditure guidelines that could also serve as post-expenditure audit standards was first planted.⁷⁸ As we shall see later, the notion of relating special education expenditures more closely to auditable standards was to appear repeatedly as a solution to the reimbursement difficulties facing the division of special education.

After these two initial meetings, the search effort of the fiscal policy group bogged down. Three weeks later, Gibber noted that the entire division (especially the Bureau of Management) seemed to be so tied up in

operational details that the total divisional effort to be devoted to the fiscal policy group "looks like what Bob (Audette) and I can give working with you (Andersen)." ⁷⁹ This was the first of several times when it appeared possible that the entire fiscal policy effort could have dissolved because it had failed to accumulate a "critical mass" of organizational capacity.

The Bureau of Management had been without a director for several months and the new director, who was to resign within a month, was busy trying to orient himself. Morale was low in the division. The special education federal accounts were being audited and allusions (later proven wrong) were being made about the improper management of these funds. Indeed, the new Director of the Bureau of Management resigned because of a dispute over the management of federal dollars.

In an attempt to get the fiscal policy effort moving, Andersen set down his best thoughts concerning what were the central fiscal problems facing the division and their solutions. These thoughts represented a subjective compilation of many of the scouting interviews conducted to date (including those conducted earlier in the summer of 1976)

"The most important question is how to allocate regular day versus special education costs and how to enforce that distinction--not questions about the formula or data items (directly).

Solution:

- 1) Define policy in terms of audit standards.
- 2) A rule of thumb: the end of the audit trail is educational plans of individual children (needs much unpacking).
- 3) Redesign the end-of-year report, the education plan format, and program audit, and school implementation, special education implementation plans for compatibility.
- 4) Implement training through SMS.
- 5) Put teeth in this via External Audit.
- 6) A Major Push for fiscal year 1978." ⁸⁰

Meanwhile, the fiscal policy group was coming under pressure from the Peat, Marwick and Mitchell consulting effort to clearly articulate what they wanted put in the fiscal year 1977 end-of-year report. Responding to that pressure, on September 30 Gibber arranged a set of problem searching interviews with Steve Kaagan and Ramona Hilgenkamp. In these meetings, a host of specific issues needing attention were brought up. Based upon notes taken in that meeting, Andersen drafted an expanded "wish list of issues" that were candidates for the attention of the fiscal policy group. In that memo, each of the following seven issues were discussed with several paragraphs of detail:

- 1) Design policies such that special education audit trails end with educational plans.
- 2) Provide more reported information on regular day "support services" staffing patterns.
- 3) Consolidate procedures for reporting special education staffing patterns.
- 4) Collect data that can be used to complete the federally mandated state plan and average daily attendance document.
- 5) More clearly report federal grants to localities to avoid "double charging" to special education reimbursement accounts.
- 6) Provide for uniform and clear reporting of "grandfathered" children and children in state institutions.
- 7) Increase the ability of Local Education Agencies to accurately anticipate their special education reimbursements.⁸¹

However, the fiscal policy group was still in a searching phase. This and all the previous such listings of issues were by no means either complete or exhaustive. They were merely recapitulations of points made in scouting interviews. Such lists served a memory function, helping the group to remember what had been said at previous meetings as it attempted to decide where to go next.

On October 22, the fiscal policy group met with the Peat, Marwick and

Mitchell consultants for the first time. This meeting offered the fiscal policy group an opportunity to search yet another corner of its operating environment in an attempt to more clearly define the problems, goals, and constraints that it should be considering. The October 22 meeting was wide-ranging. It elicited a long list of unresolved issues and concerns as possible candidates for action. An outline of the issues raised for consideration is presented below:

- "I. ARTICULATING THE PRINCIPLE THAT THE EDUCATIONAL PLANS SHOULD BE THE "END OF THE AUDIT TRAIL" FOR ALL SPECIAL EDUCATION REIMBURSEMENTS
 - A. Manual of Definitions and standards.
 - B. Making implementation plan compatible with the EOY report.
 - C. Development of auditing standards for special education.
 - D. Expanded/Changed Expenditure categories on SPED5.

- II. SPURIOUS INCENTIVES ACROSS VARIOUS PROTOTYPES
 - A. Collapse first four prototypes.
 - B. Current disincentive to mainstream day school students.

- III. INTEGRATION OF EOY REPORT WITH OTHER SPECIAL EDUCATION PROGRAMS AND PROJECTS
 - A. Consistent Reporting of tuitioned money and tuitioned students.
 - B. Uniform and consistent reporting of all institutionalized students.
 - C. Complete Disclosure of third party payments.
 - D. Reporting of Federal Grants.

- IV. COMPUTATION OF FORMULA, "HITTING THE CEILING", AND LARGE VARIABILITY WITHIN A PROTOTYPE
 - A. Use of head count as well as FTE in aid computation.
 - B. Transportation.
 - C. Problems with modified prototypes.

- V. OVERLAP BETWEEN SPECIAL EDUCATION AND OTHER PROGRAM AREAS
 - A. Career Skills Prototype.
 - B. Bilingual Education."

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At this point, it is not necessary to delve into the details of each of the proposals outlined above (although it is interesting to note that this list is nearly inclusive of all of the issues repeatedly articulated

through April of 1977). What we are interested in here is the source of these various projects. Each was based upon different implicit definitions of what were the most important fiscal problems facing the division. Some came from discussions previously reported with the auditors, some from scouting interviews with Steve Kaagan and Ramona Hilgenkamp, and some from discussions with the Peat, Marwick and Mitchell consultants. All were surfaced in the discussion on October 22 by one or more of the persons present. The broad membership of the fiscal policy work group had made this discussion possible.

Each one of the tasks listed above would have required a large expenditure of effort on the part of the fiscal policy group. All tolled, the activities listed in the October 26 meeting represented roughly five to six times as much organizational effort as the fiscal policy group actually expended throughout the course of the fall, winter and spring. At that time, some means to prioritize and initiate some form of action on this menu of possible projects was needed.

The last input into the fiscal policy group's problem directed search activity came from the think tank. On October 28, just two days after the memo summarizing the fifteen projects had been drafted, Andersen "leaked" the policy directions emerging in the think tank to the fiscal policy group. As noted in the previous discussion of the think tank's activities, the October 28 meeting resulted in the definition of four principal areas of activity:

- 1) Draft guidelines and standards outlining what costs should be allowed as special education.
- 2) Break-out the categorization of special education staff on the end-of-year report.

- 3) Simplify the reporting process by collapsing the first four prototypes (to neutralize the money across those prototypes).
- 4) Base reimbursement on a head count formula as well as FTE formula.⁸³

Within ten days, Gibber and Thayer had completed a draft of the guidelines, the first proposed activity. This idea, first raised in a scouting interview with Williams in early September had come to fruition. The fiscal policy group had suddenly shifted from a problem-search mode to a problem-solution mode. One week later, November 12, the fiscal policy group met and assigned operating responsibility for the major tasks that it was to tackle through the fall. Gene Thayer undertook primary responsibility for the development of a package of guidelines. Dave Keeler was to assure that the guidelines would be accurately reflected in the design of the 1977 end-of-year report. Ed Gotgart was to collect and formulate issues for consideration in the upcoming fiscal year 1978. Hal Gibber assumed a monitoring and coordination function, assuring the fiscal policy group's efforts were in concert with those of Peat, Marwick and Mitchell, the division's program policy group, and the work group's larger fiscal policy review group.⁸⁴

Back in September, the problem search phase had begun with a vague perception of fiscal difficulties. By searching all of the relevant operating units within its bureaucratic environment, the fiscal policy group had assembled a "wish list" of possible projects. Based upon the input of the think tank, this broad list had crystallized into two major operating projects--guideline development and format redesign for the 1977 end-of-year report. With the conclusion of the problem-directed search phase, the fiscal policy group was moving into a new era. It began to actively pursue the organizational goals arising from its problem search phase.

Emerging Goals. The fiscal policy group had a long list of things that it wanted to do. Yet, at mid-October there were very few things that the group actually had to do. In the light of other pressures and demands that would be made on members of the group, the effective goals of the group would become only those things that had to get done due to commitments to other operating units. In this section, we shall be concentrating on that small number of operating constraints that defined the fiscal policy group's goal structure.

In the beginning, the only constraint upon the group was that it had to respond to requests for clarification of an issue emanating from the SMS group or from the regional offices. Over the summer a backlog of such issues had piled up and needed attention by the fiscal policy group.⁸⁵ During the course of the fall, other issues continued to surface and the fiscal policy group took some action on them. For example, on November 23 a meeting was devoted to how localities should claim reimbursements for special education recreation programs run during the summer. On January 17, the policy group examined how indirect costs were allocated to special education and reimbursed by the state. Also in January, the fiscal policy group was asked to decide whether or not localities could install elevators during the renovation of buildings and have these costs reimbursed by special education. All of these questions followed a similar pattern. Somehow a question drifted into one of the department's operating units. This unit would forward the question to the fiscal policy group. The policy group would draft a response to the question as best it could

The second thing that the fiscal policy group really had to do was

respond to requests for information from the consultants at Peat, Marwick and Mitchell. Figure 5.8, a presentation of the major meetings, and presentations of the FPG, illustrates graphically the pattern of interaction that existed between the consultants and the fiscal policy group during the fall of 1976. To a large degree, the preliminary start-up meetings of the fiscal policy group (meetings FPG1, FPG2, and FPG3 on Figure 5.8) were motivated by a diffuse pressure to "have something ready" for the consultants." Also, as shown in Figure 5.8, the majority of the early fiscal policy group meetings (FPG3,4,5,6,7) were either convened specifically to draft a response to a question raised in the Peat, Marwick and Mitchell meetings or were receiving input and feedback from some other meeting involving the consultants. This pattern of interaction wherein the fiscal policy group responded to constraining goals set by the Peat, Marwick and Mitchell effort continued through the winter and spring of 1977.

The third broad goal of the fiscal policy group, to produce a set of guidelines outlining allowable special education costs, represented a true initiative on the part of the group as opposed to a reaction to initiatives from other operating units. However, even when creating a new initiative, the FPG needed to be tied in with and committed to other operating units. Without such commitments, the guideline initiative could have been pushed aside and left to wither as other more pressing needs occupied management's time.

The period between December of 1976 and the beginning of the following February was critical for the guideline initiative. In a painstakingly slow process, the FPG knit a web of commitments between itself and other

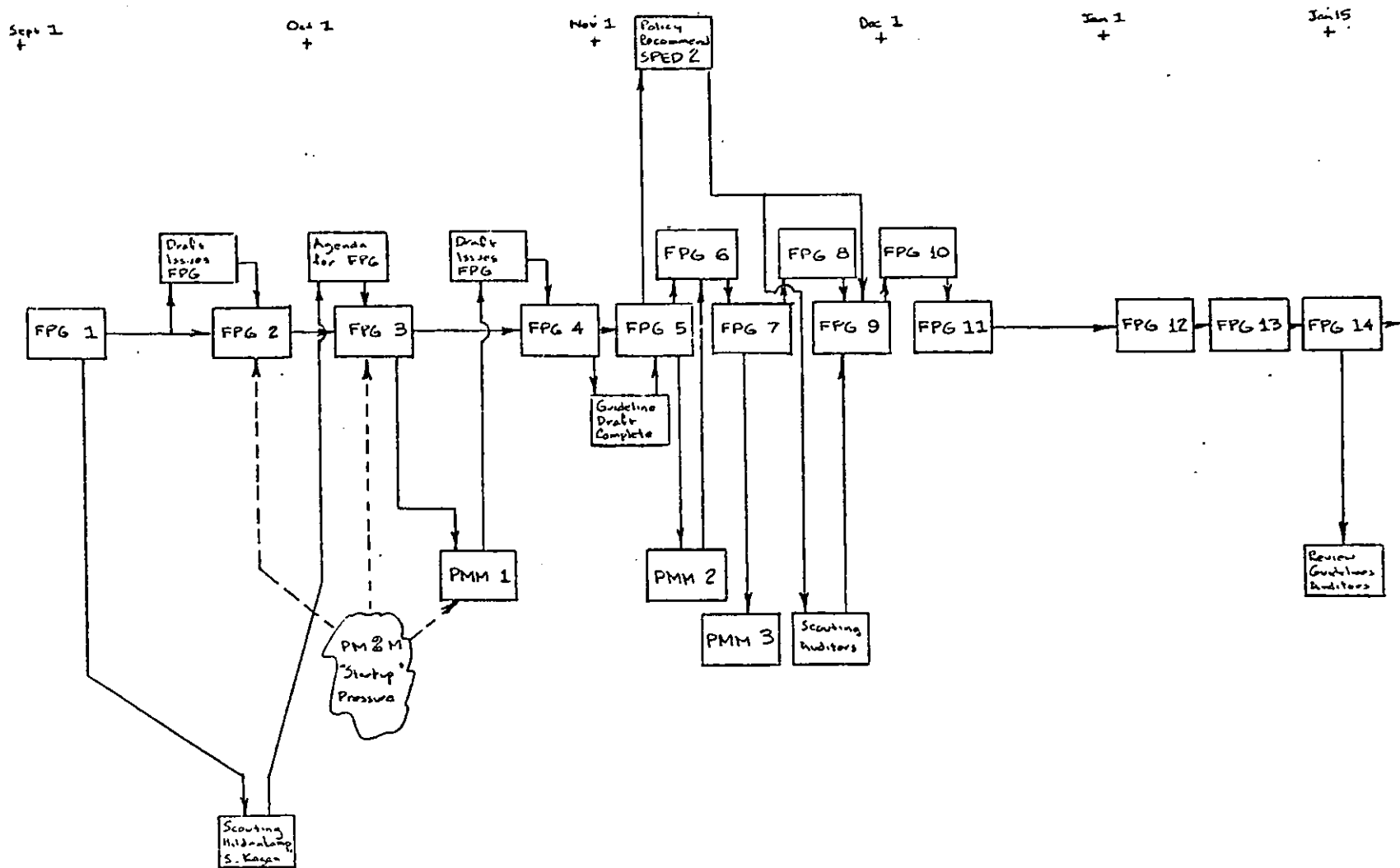


FIGURE 5.8: Major Activities of Fiscal Policy Group; September 1, 1976 to January 15, 1977

operating units thereby assuring the internalization of guideline development as a constraining goal for the FPG. For example, on November 29, the whole notion of producing a set of guidelines that could be used as audit standards was first checked with Fred Williams. On December 2 (meeting labeled FPG 9 on Figure 5.8), Williams forwarded a copy of the guidelines that the auditors were then using to audit a prior year's returns. At that meeting, the FPG gave its approval to the standards being used by the auditors. By December 16 (meeting FPG 11 on Figure 5.8), the auditors approved, in principle, an early draft of the FPG's guidelines. In a December 15 meeting, Williams assured members of the FPG that the SMS would promulgate the guidelines to the local school systems if they were ready on time for the spring training sessions.⁸⁶

The web of commitments continued to widen. On January 12 (meeting FPG14 on Figure 5.8), a preliminary draft of the guidelines was circulated to virtually every fiscal operating unit in the Department.⁸⁷ By now the FPG had signaled its intentions to so many different groups that it very much had to produce an acceptable guideline package.

On February 2 (meeting FPG18 on Figure 5.9), the FPG received final review and sign-off on the fiscal guidelines from Associate Commissioner Audette. On February 9 (meeting PMM8 on Figure 5.9), references to the forthcoming guidelines were written into the instructions to the 1977 end-of-year reports. When this report went to press, the final binding constraints were forged. From that point on, guideline development was a concrete operating goal of the FPG.

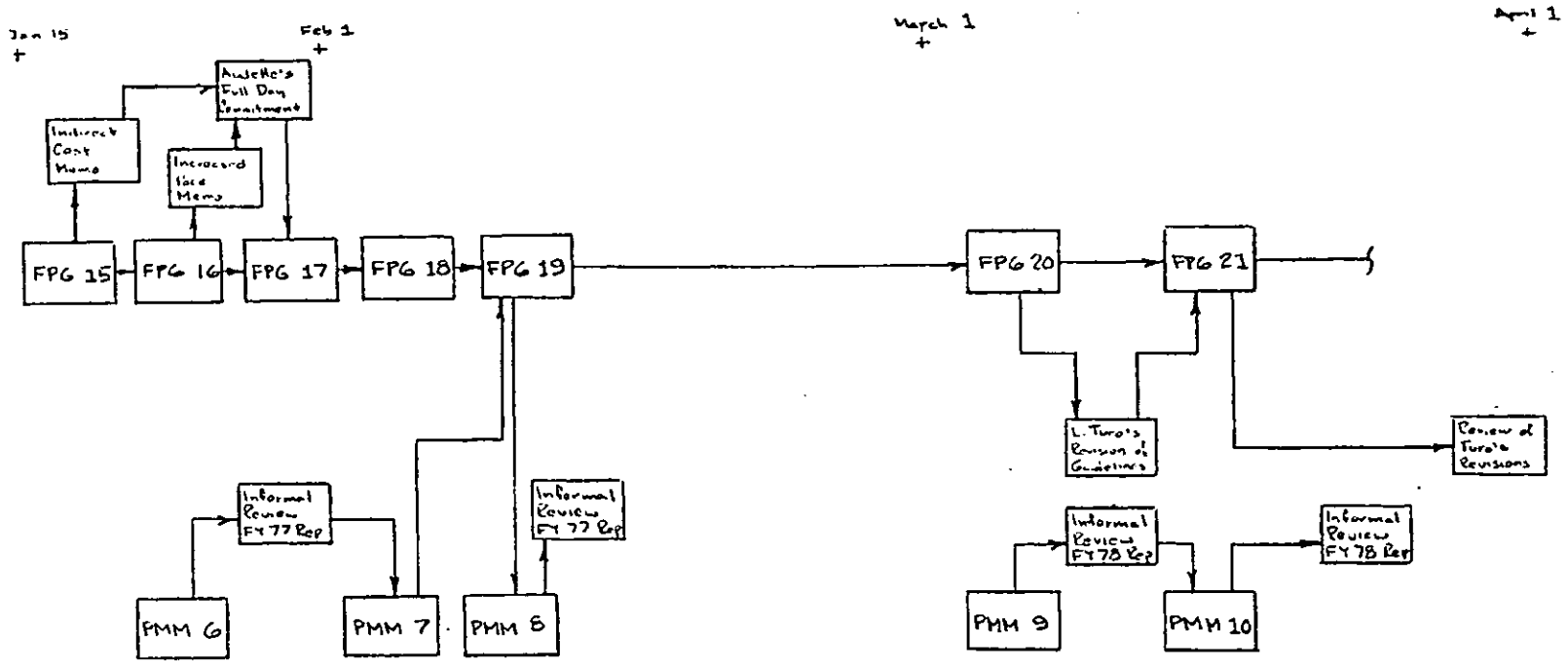


FIGURE 5.9: Major Activities of Fiscal Policy Group; January; January 15 to April 1, 1977

Negotiating an Uncertain Environment. An organizational view of policy development does not see managers and operating units as taking bold and decisive policy strides forward. Instead, managers and operating units are seen as a blind man, cane in hand, working his way through unsure streets. He never stops moving; he is always tap-tap-tapping. But he is also continually feeling for clues as to the lay of the land and will readily alter his course to avoid obstacles. He knows where he wants to go, but he avoids bold strides forward lest he stumble over an unexpected obstacle.

The operations of the FPG provide an excellent example of an organization carefully feeling its way through a complex bureaucratic environment in search of its goals. On October 10 (FPG3), January 12 (FPG14), and March 10 (FPG20) the FPG convened meetings of nearly every operating fiscal unit in the department to check its progress. As described above, in addition to these formal meetings, the FPG held individual scouting meetings with key managers outside of the division (such as Fred Williams, Steve Kaagan, and Ramona Hilgenkamp) to assure that its projects and activities were in concert with those of other operating units.

Most importantly, the membership of the fiscal policy work group included active involvement from many of the major operating fiscal units outside of the division. Gerry Mercadante was primarily a member of the office of local aid. Bruce Perlstein was in contact with the fiscal planning within the Office of the Commissioner of Education; and Dave Keeler was active in SMS and in close contact with the Bureau of External Audit.

Finally, through its nearly continual interactions with other operating efforts such as the Peat, Marwick and Mitchell effort, the FPG remained in

close contact with the issues and positions being raised at other points within the department.

However, there was one rather ironic gap in the FPG's attempt to stay in touch with important constituencies in its operating environment. In April once the fiscal guidelines were printed and distributed, a hue and cry went up from the special education regional project directors, the field representatives of the division who had most contact with local schools.⁸⁸ The project directors felt as if they had been left out in the development of the guidelines and felt uncomfortable in having to interpret and present the guidelines to local districts. Apparently in its attempt to bridge the fiscal-program "gap" and to keep fiscal units elsewhere in the department in touch with the division's needs, the FPG had neglected to keep in touch with its own program arm. Similarly, local special education directors felt as if they had not been consulted in the guideline development effort. These oversights were chalked up to experience and the relevant environment to be negotiated was expanded to include more special education program people for the next fiscal year.⁸⁹

Routine Operations--Sequential Goal Attention. By February 1, the FPG had graduated to status as a mature operating unit. Between February 1 and April 1, the group's attention was split principally between two goals, getting out the guidelines and responding to requests from the Peat, Marwick and Mitchell consulting effort. Figure 5.9 illustrates how during this period the group sequentially "solved" one issue as it came up and then moved on to another. For example, four of the five reviews of the consultant's efforts were completed by informal sub-groups of the larger FPG

called together for just that purpose. Meetings FPG17 through FPG21 were almost exclusively oriented toward guideline development.

Later in April and May as additional demands came up from other operating units, the FPG handled them one at a time as they came in. For example, when SMS requested technical assistance for the training of local special education administrators in the guidelines, the FPG responded by allocating personnel to that task.⁹⁰ Conversely, when Peat, Marwick and Mitchell stopped requesting periodic reviews of their work, the FPG paid literally no further attention to the issue of how to redesign the 1978 end-of-year report.

All told an organizational view of policy development explains well the activities of the FPG from September 1976 through April 1977. In particular, the guideline development effort, the major policy innovation of the FPG, can be seen as the result of routine execution of organizational capacity. Guideline development was isolated as the preferred task via nearly classic problem-directed searching behavior. As the goal of guideline development became internalized, the group pursued these objectives by negotiating uncertain obstacles in its organizational environment and by allocating time and attention to routine operating concerns one at a time as they were brought to management's attention.

Operations of Units External to the Division

In order to round out the organizational description of fiscal policy development during the third phase of the overall effort, it is necessary to discuss the activities of several operating units outside the Division

of Special Education. There are several important reasons why it is necessary to track the operations of these external units.

First, the overall operating environment is characterized by many perspectives. Thus far, we have only seen one slice of the action--that defined by the perspective internal to the division of special education. Overall policy results from the interaction of organizational capabilities internal to the implementing organization with corresponding capabilities of operating units external to the implementing unit. It is often easy to lose sight of the fact that external actors pursue goals, negotiate their environment, and respond to pressures in much the same fashion as actors internal to the implementing unit. External goals are different from (sometimes opposed to) internal goals and are less vividly perceived and appreciated.

Second, the interaction between internal and external units can be characterized as a circulation of actions and reactions between groups. That is, as shown in Figure 5.10, the context within which an internal group acts is to a large degree defined by the actions of external actors. In turn, these external actions can be viewed either as reactions on the part of the external group or true initiatives on the part of the external group. The reactive component of activity by external actors is to some extent determined by the actions of the internal group (plus the actions of other external groups). In other words, by its actions the internal group defines a context (sets constraints) that force external groups to react. In reacting, external groups define a new context (set new constraints) to which the internal group must react anew. In this manner, operating constraints

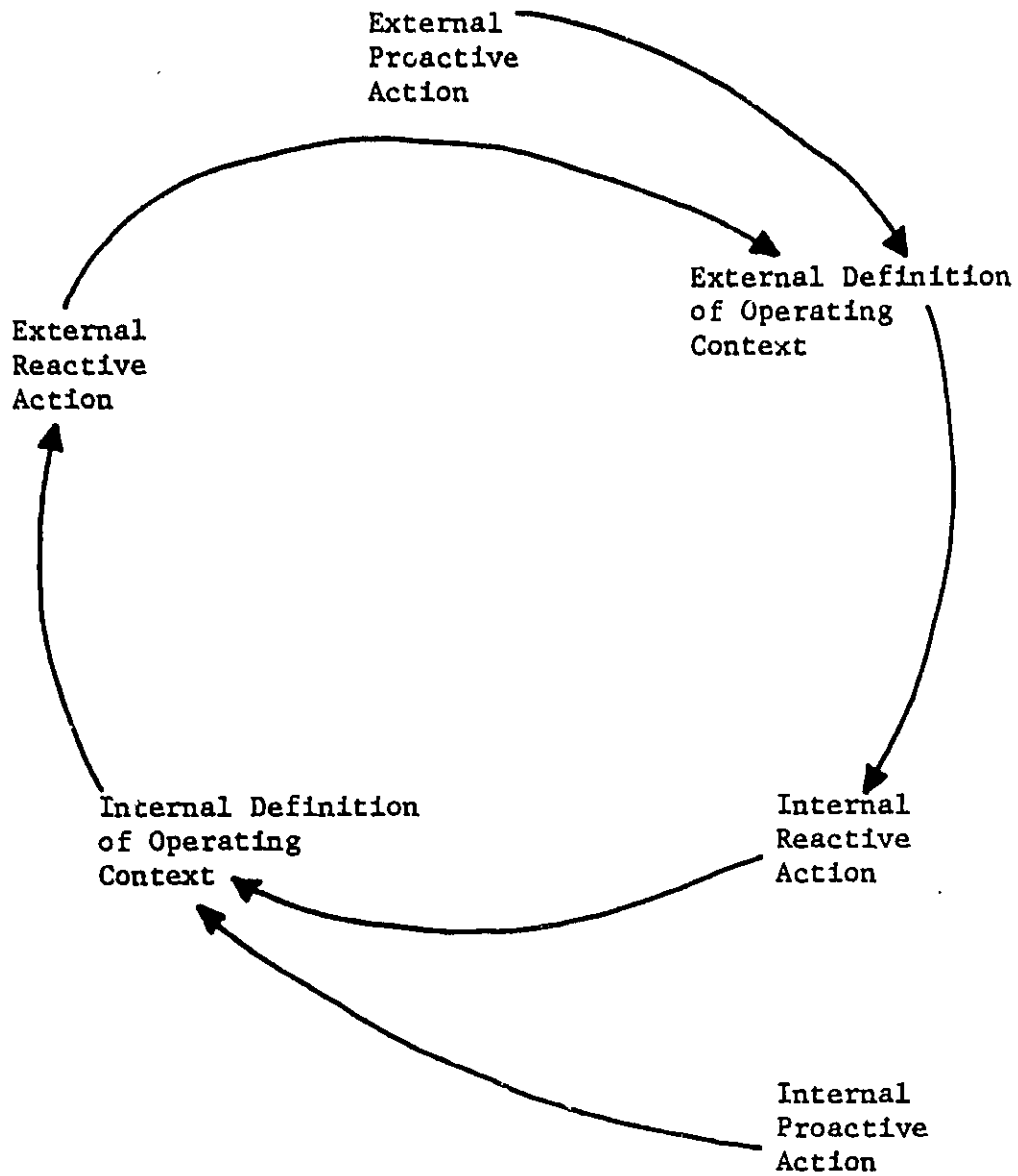


FIGURE 5.10: Circulation of Constraints Between Internal and External Groups

are constantly being "circulated" between different operating units all of whom are both attempting to initiate new projects in pursual of their own goals and reacting to constraints imposed upon them by other external operating units.

Third, it is important for a manager to understand exactly how constraints are circulating within his organization. Because by manipulating how constraints become defined for both internal and external operating units, management can have significant impacts on policy development. Management is like a plumber who must know how to "hook-up" the circulation of action outputs from his operating unit with those of other units to attain the "best" organizational performance.

A concrete example will be helpful here. Back in September, the FPG went out of its way to assure that it became heavily involved with the Peat, Marwick and Mitchell effort. In this way, it could use the energy and structure (in the form of deadlines) of the Peat, Marwick and Mitchell effort to help structure itself. Later on in February of 1977, the FPG began to pull back from such a close involvement with Peat, Marwick and Mitchell because by that time the FPG had a full and pressing agenda of its own and could not afford to get "swamped" by the multitude of issues being surfaced by the consultants. In a similar fashion, the FPG attempted to link its guidelines with the 1977 end-of-year report, with the SMS training effort, and with the creation of audit standards because by passing constraints to these other three operating units, the FPG could get added leverage in the implementation of its policies.

Finally, analysts who wish to launch model-based policy innovations

through study groups must understand how concrete policy action results from the circulation of real operating constraints between internal and external groups. If policy analysts do not fully appreciate the mechanisms whereby their model-based conclusions diffuse from study groups and become circulated through operating units and translated into action, then it is unlikely that analysts will be able to skillfully manage these mechanisms. Hence, model-based policy innovations will stand relatively smaller chances of being implemented. This point has been made previously and need not be further elaborated here.

Reaction of Special Education to External Constraints. Figures 5.11 and 5.12 present in graphical form the major threads of activity observed outside of the division and having a direct impact on the operations of units within the division. As with earlier figures of this nature, these two figures summarize major meetings, drafting of memos, presentations, etc. Since many of the incidents relevant to the circulation of operating constraints between internal and external units have been discussed in some detail previously, we shall only briefly highlight and reiterate several points in the discussion that follows.

To a large degree, the first three to four meetings associated with the FPG were in response to constraints being imposed on the group by the Peat, Marwick and Mitchell consulting effort. The major force that kept the division's fiscal policy group going during its first few months was this external pressure to get something together for the consultants. Likewise, the think tank group was initially set in motion (see ThT1) by a meeting held with Fred Williams. In general, during September and early

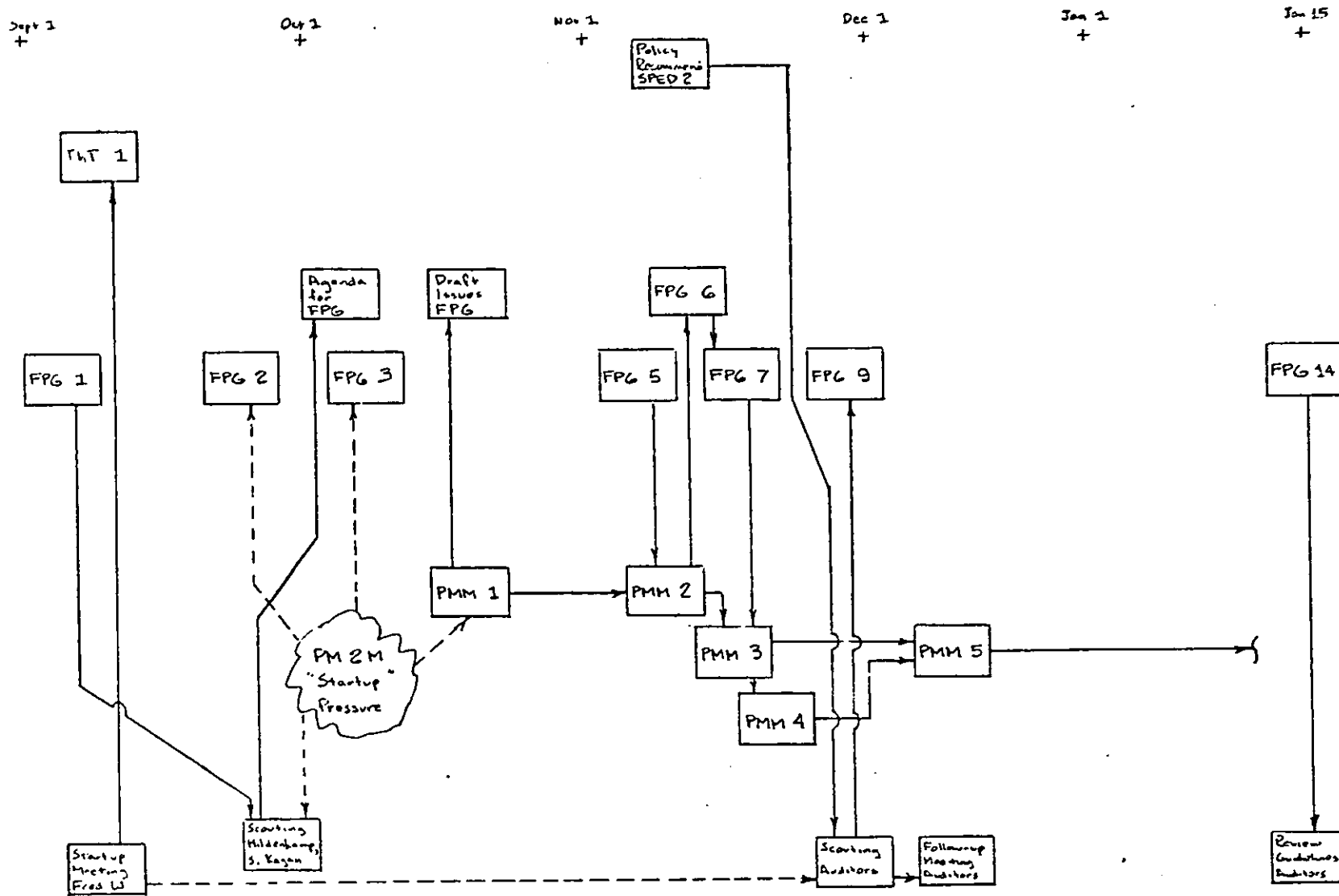


FIGURE 5.11: Major Special Education Fiscal Activities Peat, Marwick & Mitchell and Other Unites External to Division; September 1, 1976 to January 15, 1977

Jan 15
+

Feb 1
+

March 1
+

April 1
+

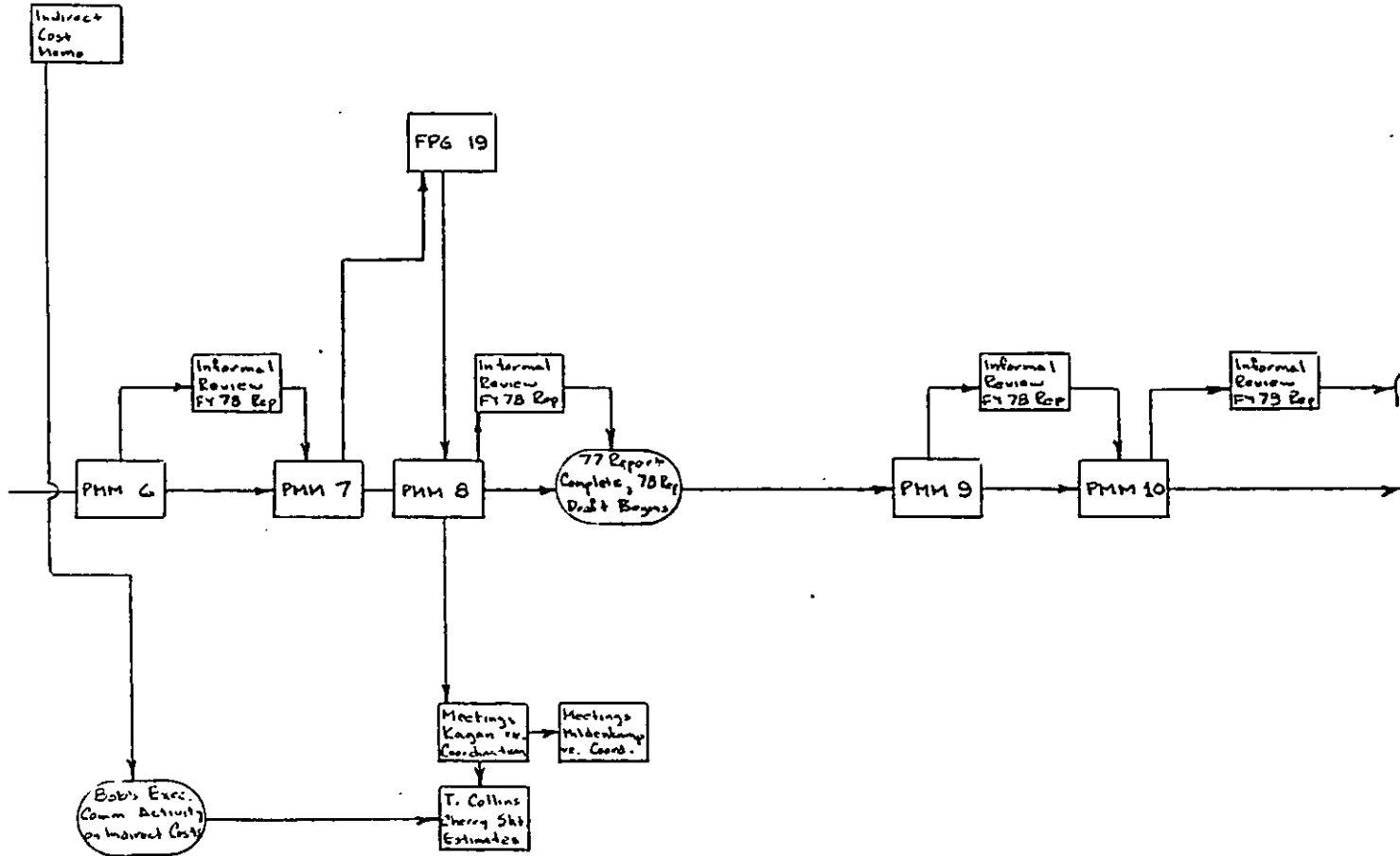


FIGURE 5.12: Major Special Education Fiscal Activities Peat, Marwick & Mitchell and Other Unites External to Division; January 15 to April 1, 1977

October, the units internal to the division were very much dependent upon energies of external origin to stay alive. During that time both the analyst and division management (Gibber in particular) worked hard to keep lines of communication open with external units in an attempt to keep internal units under some pressure and hence alive and well.

Circulation of Constraints. In the string of meetings labeled PMM2 through PMM10 representing the major department wide review meetings held by Peat, Marwick and Mitchell we find a prime example of the circulation of constraints between internal (divisional) and external (the consultants) operating groups. After nearly every PMM meeting, we find that the FPG met to consider the outputs from that meeting and then provided input back into the next meeting. Peat, Marwick and Mitchell kept on feeding the agenda of the FPG and conversely, the FPG kept on raising new issues for review by the consultants. Without this continual cross-stimulation, both groups would have probably been much less effective in accomplishing their jobs.

A more detailed consideration of one cycle of constraint circulation between the consultants and the FPG will illustrate the sometimes heated but usually constructive interaction that occurred between the two groups. As such an example we consider in more detail the series of events involving meetings PMM7, FPG19, and PMM8 as shown on Figure 5.12. On January 21, Steve Kaagan scheduled a "very important meeting of the Advisory Committee... to review a draft copy of the 1976-1977 end-of-year school district collection instrument."⁹¹ At that meeting held on February 4 (PMM7) the consultants announced that they wanted to "finalize" the design of the 1976-1977 end-of-year report. The FPG had given the draft report available to them

a cursory review, but they did not feel able to give a final review. A follow-up "nuts and bolts" meeting was called for February 9 (PMM8) so that all involved operating units could have a chance to complete a more thorough review and give final approval to the draft document. The ball was now in the fiscal policy group's court. If they wanted any concrete changes in the end-of-year document, they had to act soon.

At a meeting called on February 8 (FPG19) specifically to address the end-of-year report, the FPG drafted a list of some ten issues relating to the actual format of the report and some ten other issues relating to the instructions for filling out the report.⁹² In that memo, the FPG noted that "we would want to have these guidelines (instructions for completing the report) explicitly reference our own guidelines if not quote from them."⁹³ In addition to the guideline issue there were several format issues that the FPG considered fairly important to obtaining clean and consistent special education fiscal data.

At the February 9 meeting, the changes proposed by the FPG were presented. The goal of the consultants was to get the whole report finalized as soon as possible. The goal of the fiscal policy group was to make some changes in both the format and instructions that would undoubtedly take some more time and thought. In a confrontation that sometimes "seemed as if a war was going on,"⁹⁴ the FPG made a series of points that in effect passed a new operating constraint on the consulting team.

In the end, through this process of circulating constraints between the two groups, two much better products emerged. The end-of-year report benefited from the active input of a special education point of view and

the special education guidelines became explicitly incorporated into the end-of-year report.

Imposition of Operating Constraints on External Units. To complete the symmetry of the circulating constraints image, sometimes the FPG would impose operating constraints on other operating units in order to gain leverage in its policy goals. For example, the SMS team agreed to train both regional representatives of the department and local school administrators in the guidelines thereby insuring the promulgation of the FPG's guideline efforts. In fiscal year 1978, the Bureau of External Audit would be constrained to use the FPG's guidelines as its standards for the audits of the 1977 school returns. And most importantly, local school districts will be constrained to pay attention to the guidelines in filling out their 1977 financial returns. Furthermore, in fiscal year 1978 local administrators may even change the way that they collect their data or deliver services in order to be in closer compliance with the guidelines developed by the fiscal policy group. Of course, it is the hope of the fiscal policy group that, by imposing the constraints of guidelines on the localities, the FPG can positively (if only marginally) impact upon how special education services are delivered to children in the State of Massachusetts.

5.5 NORMATIVE ASPECTS OF THE ORGANIZATIONAL PERSPECTIVE

Having completed the laborious process of developing the organizational theory, conducting the case study, and modifying the original theory in light of the empirical findings, it would be nice if we could now say something about what one should do to better manage model-based policy design exercises. Although the case does point to some suggestions about how one should proceed to build models within organizations, these normative statements are not without a host of practical and theoretical problems of their own.

Normative Puzzles with the Organizational Theory

Whereas the rational perspective led to fairly clear normative implications; the implications of the organizational perspective are much less clear. The rational view dictates that all available options should be enumerated, all of their consequences evaluated, a value weighing given to all of the consequences, and finally a best choice made based upon the analysis of alternatives, outcomes, and evaluations. Sometimes these prescriptions can not be followed, but these difficulties arise from practical problems and not from puzzles with the fundamental normative content of rationality. Sometimes all of the possible alternatives shouldn't be considered because the cost of information is too high; there may be practical problems in coming up with a joint utility function that will satisfy several different interests; and so on. These are all obstacles to being rational but they are not confusions about the nature of the rational ideal.

On the other hand, the organizational view of decision making is first and foremost an attempt to accurately describe the processes involved in

decision making. Analysts who would draw conclusions concerning what constitutes a good decision or how one should make decisions within the organizational framework are left with few clear-cut answers.

One approach to this normative dilemma would be to ask how should an organization make rational decisions given that the processes described in the organizational theory actually do occur. That is, how should organizations with all of their idiosyncratic quirks make decisions that approximate the rational ideal. Such an approach would involve modifying the theory of rational decisions so that it can adequately capture the processes implied by the organizational theory. The limitations of problem directed search would be included by explicit calculations of the cost of information. The fact that organizations pursue implicit goals relative to their own survival rather than goals explicitly related to the public good would be accounted for by explicitly incorporating organizational survival into the objective function of the rational decision. The dynamics of uncertainty avoidance by negotiating with an organization's environment would be explicitly formulated and made a part of the expanded model of rationality.

However, this approach of defining good organizational decisions as ones that conform to a modified rational view is riddled by several puzzles. The exact definition of rationality dissolves once the description of organizational dynamics becomes complex. An elaborated rational theory contains so many ins and outs and subtle nuances that clear-cut statements about what a rational organization should do become obscured by the complexity of the elaborated rational model. One famous example of the potential paradoxes implicit in attempts to elaborate rational models is contained

in Arrow's work on inter-subjective utility. Arrow discovered that by evoking several simple and plausible assumptions about individual utility, it is not possible to rationally and unequivocally rank-order alternative states of the world when individuals differed in their individual preferences for these states.

Furthermore, careful analysts have argued that the basic principles of synoptic rationality may be defective as an ultimate normative model for decision making in public agencies. For example, Lindblom has argued quite persuasively in his work that attempts to centralize and rationalize the policy making process will only clog and deactivate a much more powerful and effective mechanism of "mutual accommodation" that allows parties with diverse interests to barter to mutually acceptable policy options through a highly political process. His work implies that public policy decisions should not necessarily strive to approximate a rational ideal. Instead public policy should be set through mutual accommodation occurring within a political marketplace of ideas.

Finally, there is the question of whether a rational model, fully elaborated to include organizational processes, would still retain the normative utility of a simpler rational perspective. The value of normative rationality is that it provides a set of consistent rules of thumb that can be used to simplify and make sense out of a host of complex situations. It serves as an Occum's razor, sorting out a flurry of detail within a complex policy decision and pointing to what should be the important underlying criteria for decision. If this simplifying framework becomes highly elaborated, containing a description of organizational dynamics and multiple

conditional relationships, the normative clarity may be lost.

It is beyond the scope of this work to answer the many puzzles that arise when one attempts to derive normative prescriptions from an organizational view of decision making. Instead, based upon experiences with the case, the organizational theory, and interactions between the two, a series of suggestions or rules of thumb are proposed for better managing policy modeling. Although normative nuggets are sprinkled throughout the case study, here we collect only several of these, limiting ourselves to a simple few that seem to span the major points learned in the case. No attempt is made to be exhaustive or to answer the nearly-impossible question of how useful these suggestions may prove to be in practice.

General Strategy for Better Policy Modeling

The overall thrust of the organizational perspective points to the following general strategy for better managing model-based policy design exercises:

Recognize that models treat only a narrow wedge of organizational activity. Capitalize on the strengths of model-building efforts and compensate for their relative weaknesses by nonmodel-building activities.

Since most analysts who build formal models have been trained in the relative strengths of their methodology and are well aware of the criteria for defining good models (or at least are aware of the controversies that exist over the definitions of good models), we shall not comment extensively on how to capitalize on the strengths of model-building efforts. Instead we shall focus on three broad compensating precepts for improving the policy modeling process.

1) Focus on Organizational Change. If there were a single law in the organizational theory it would be that policy is the routine exercise of organizational capabilities. As a first corollary, policy changes must entail organizational changes. Characteristically, formal models are sharply problem-focused and contain only abstract formulations of detailed organizational processes. The team of analysts that continues to think exclusively in terms of policy problems and fails to translate that thinking into concrete suggestions about how the organization must change runs the risk of being ineffective. Occasionally, a member of the host group within the agency will translate model recommendations into real organizational changes. But analysts who do not explicitly focus on organizational changes will leave the ultimate effectiveness of their efforts to chance.

2) Explicitly Manage Linkages Between Units. By their very nature, modeling efforts become housed in organizational units with low levels of operational responsibility. This tendency persists in spite of the fact that individual members of that group may have great operational responsibility in their other roles within the organization. The low degree of operating responsibility of study groups is a positive characteristic of such groups, allowing them to consider a broad range of issues and make most effective use of a formal model's strengths. However, unless analysts identify the relevant operating units to implement their recommendations and insures that policy results emanating from the model become diffused out to such groups, the ultimate results of the policy modeling effort will be significantly diminished. Furthermore, analysts must recognize that policy changes often must diffuse beyond the initial implementing unit. Failure

to explicitly plan for the complete diffusion and crystallization of policy innovations will detract from the effectiveness of the overall effort.

3) Pay Attention to Multiple Roles. This study suggests that teams of analysts must be both good model-building craftsmen and information brokers, scouting information from all corners of the organization, "leaking" preliminary policy results, receiving feedback from operating units, and translating abstract policy recommendations into the concrete agendas, time-tables, and vocabulary of relevant operating units.

These three precepts summarize a general strategy for better policy modeling. The case study also implies several more specific recommendations that lead to improved model-based policy design projects.

Specific Recommendations for Better Policy Modeling

The ten precepts that follow treat the same issues touched upon in the general strategy, but they provide more detail.

1) Pay Attention to Membership of Policy Study Groups. This precept is addressed to the more general concern of properly positioning a modeling effort within the organization. Overlapping memberships between policy study groups and implementing operating units is the single most effective mechanism linking operating units and study groups. Such overlapping memberships should be built into study groups from the start. When possible, top management should also be included in the membership of the study group to insure effective linkages throughout the entire organization and a coordinated dissemination of policy recommendations.

2) Build Strong Surrogate Goal Structures into Study Groups. Because study groups typically do not have heavy operating responsibilities, such

groups can become inactive when operational pressures mount in other corners of the organization. To compensate for this instability of study groups, pay much attention to structuring the groups activities (around such goals as model formulation, position paper writing, etc.) so that there will be continuity and a sense of progress from one meeting of the group to another.

3) Identify Operating Units Responsible for Policy Execution. In general study groups will not be the operating unit responsible for actually implementing policy recommendations. Unless the analysis team can specify which operating arms of the organization will execute the policies emanating from the model, such recommendations stand a good chance of resulting in little more than intellectually pleasing abstractions. If an operating unit does not exist that is concerned with the recommendations in the study, a new organizational unit must be created or an existing one modified to include the policy area under its aegis.

4) Maintain Bridges Between Study Group and Operating Units. It is convenient for analysis teams to make the (fallacious) assumption that organizational members of the study group will maintain all of the necessary communication flows between the study group and the operating units identified as implementors. The more the analysis team knows about routine operations, the better they will be able to effect significant policy changes. Techniques for maintaining such bridges include scouting interviews, "leaking" preliminary policy results to operating units, receiving feedback from operating units on emerging policy directions, and when possible having analysts serve as ex officio members of the operating units.

5) Plan the Diffusion and Solidification of Policy Innovations. Most

policy innovations in complex operating environment can not be implemented through the efforts of a single operating unit. The activities of the primary implementing unit will invariably impose operating demands on other units. The reactions of the non-implementing units can be critical in determining whether or not the proposed innovation succeeds in achieving its purpose. Explicit thought should be given to this process of policy diffusion early on in the policy design stages.

6) Elicit Feedback from Operating Units. This precept is a reiteration of the earlier one emphasizing the importance of building diffusion bridges between policy study groups and operating units. However, the emphasis here is on listening closely to the responses of the operating units to proposed policy changes. There is a strong temptation not to take the preliminary reactions of operating units too seriously as they may not be "up to speed" with all of the issues under discussion. Often first reactions of operating managers can give early warning of possible defects in emerging policy recommendations.

7) Be Wary of Recommendations Requiring Extensive Interunit Coordination. Although elegant solutions to policy problems can often be imagined if several operating units could be cajoled into a coordinated plan of action, such strategies are fraught with problems. There will be multiple operating units who will have to be persuaded and who will have to act in unison. In fact, recommendations requiring extensive coordination may often be recommendations for which there is really no possible implementing unit. There will be no implementing unit because the recommendation may "fall in between the cracks" of several units, being tangentially related to many but the

responsibility of no unit.

8) Assess Management's Complete Agenda. Because policy study groups often focus on one or several crisply defined policy problems, it is easy for teams of analysts to forget that these several problems are actually in competition for the scarce time and attention of key managers. This problem may be accentuated because analysts only interact with managers over the topics being treated by the study group and hence they may be ignorant of the broader agenda of issues that are currently receiving managerial attention. Brief interviews at several points in the study project will be helpful in keeping analysis teams aware of the complete range of managerial concerns. Such interviews can give analysts a good impression of what are some of the real but implicit organizational goals (by implication organizational goals are reflected in the time allocation of top management) and can help analysts to realistically assess what portion of managerial attention can possibly be allocated to policy problems under examination in the study group.

9) Insure Diversity of Analysis Team. An effective analysis team will encompass a wide range of skills ranging from those of model-building craftsmen to those of a person able to manage a conflict-ridden meeting. Teams of analysts should contain a mix of persons able to perform the wide range of roles necessary for a successful model-based policy project.

10) Be Alert to Environmental Disturbances. All of the above nine precepts have focused on ways to better manage the forces internal to an organization determining the success of a policy design project. That is, all of these suggestions have dealt with how to manage a study group and its

interactions with its bureaucratic environment. Often policy is determined by forces that are completely external to the host agency. Although these exogenous forces cannot be directly controlled by an agency's managers, careful attention can be paid to an agency's external operating environment in an effort to anticipate forces that may significantly impact on policy directions taken internally.

5.6 NOTES FOR CHAPTER FIVE

1. Edward B. Roberts. "Strategies for Effective Implementation of Complex Corporate Models," in Erwin Grochla and Norbert Szyperski. Modell-und Computer-gestutzte Unternehmung-planung. Köln.
2. This discussion of the various roles needed in formal modeling efforts corresponds well to the six "critical functions in the R & D process" that have been identified at M.I.T.'s Sloan school after much research into innovation in R & D groups. As an example of the literature in this field, see: George F. Farris. "Technical Supervisor: Beyond the Peter Principle." Technology Review 75 (March/April 1973)
3. The notion of telling a story according to several underlying themes was borrowed directly from Ahelson in an essay, "Psychological and Social Simulation," in Lindsey and Aronson, eds. Handbook of Social Psychology, 2d ed.
4. Governor Francis W. Sargent. FY 75 Budget: Summary of Programs and Recommendations, or The Budget in English. January 23, 1974.
5. R. Hilgenkamp. "Program Emphasis Document," memo from Executive Committee of Department of Education detailing how both state and federal dollars would be spent.
6. Joe Yannacci, chief accountant for the Division of Special Education estimated that he spent 15 percent of his time in transit between his office and the business office. Interview with Joe Yannacci, October 27, 1976.
7. Private conversation with Leo Turo, March 16, 1977.
8. The department committed itself to auditing the special education returns of 138 school districts. See G. Anrig. "Commissioner's Fiscal Year 1977 Operational Plan." September 1976, p. 11.
9. In the winter of 1976, a training session designed to train regional representatives in the use of end-of-year reports distributed over five hundred pages of explanatory and amplifying material over a three month series of bi-weekly sessions.
10. As noted earlier, in the fall of 1975, only two persons within the Division of Special Education knew even the most basic rudiments concerning the reimbursement system. There was literally no awareness at the level of bureau director or above concerning how the reimbursement system worked.
11. Source: Organizational Chart for Division of Special Education, Revised November 13, 1975.
12. Source: Second Quarter Financial Summary of Federal Projects Division of Special Education, prepared by J. Yannacci, chief accountant.
13. As noted earlier, only two mid-level managers within the Division

even knew what reimbursement was and they were nearly fully occupied with other responsibilities.

14. Source: "Five Year Analysis of Expenditure Trends." Bureau of Research, Planning, and Evaluation, Massachusetts Department of Education, 1976.

15. R.H. Audette. "Proposed Three Year Plan for the Division of Special Education." November 1975, p. 17.

16. Bambi Levine expressed this initial impression on the part of many division members in an interview, March 10, 1977.

17. Remember that in the "Management Improvement Project" of 1975, fiscal training was listed as one of the top five priorities. No one with enough time and expertise could be found to execute this "top priority."

18. "Senate Advance Special Education Bill." The Evening Gazette (Worcester) (June 28, 1972).

19. "Projected Initial Cost of Chapter 766." Massachusetts Department of Education. February 22, 1974.

20. "Unfunded Chapter 766: Who, Finally, Will Foot the Bill?" Boston Sunday Globe (February 24, 1974).

21. Ibid.

22. Interview with Howard Niblock, director of pupil services, Winchester Public Schools, October 1974.

23. See for example: "Way Sought to Ease the Impact, Cost of Special Education," and "Nine North Shore Communities Unite to Share Special Education Costs." Boston Sunday Globe (March 3, 1974); "Chapter 766: Special Ed Needs Special Funding." The Newton Times (April 1974).

24. Interview with Bambi Levine, March 10, 1977.

25. To a large degree, this description of the three thrusts is borrowed from an internal working memorandum: Hal Gibber (earlier draft by D.F. Andersen). "Next Steps" memo to Fiscal Policy Work Group. June 14, 1976.

26. This was listed as a priority objective in Commissioner Anrig's "Commissioner's Fiscal Year 1977 Operational Plan." September 1976, p. 12.

27. This first issue to be resolved was the so-called "full time equivalency issue." For a more complete discussion of this issue see Chapter 4, Section 4.3.

28. G. Anrig. op. cit.
- 29a. D.F. Andersen. "Special Education Model--Preliminary Thoughts." internal memo, October 6, 1975.
29. D.F. Andersen. "Fiscal Issues Associated with Chapter 766." memo to selected Divisional Managers, October 22, 1975.
- 30 Ibid., p. 2.
31. For a review of the management science literature on implementation problems see Michael Ginzberg. A Process Approach to Management Science Implementation, unpublished PhD dissertation, M.I.T., Sloan School of Management, 1975, chapter 1.
32. Ibid., chapter 2.
33. D.F. Andersen. "Some Reimbursement Issues," internal working memorandum. December 11, 1975.
34. F. Williams and T. Bradford. "End-of-Year Report Orientation Plan," memo to Dave Andersen, Jim Anderson, Dave Backlin, Jim Bradley, Dave Keeler, Leo Turo, Tom White, Joe Yannacci. February 2, 1976.
35. Ibid.
36. D.F. Andersen. "Overview: Fiscal Policy Group," internal memorandum to Hal Gibber. March 11, 1976.
37. H. Gibber. "Fiscal Policy Group Meeting," memo announcing the first meeting of the Fiscal Policy Group. April 1, 1976.
38. Ibid.
39. F. Williams. "School Management Services Planning Group," memo to D. Keeler, J. Flahive, J. Yannacci, L. Turo, and D. Andersen outlining recent decisions. April 2, 1976.
40. Author's notes on first meeting of Fiscal Policy Group. April 2, 1976.
41. Author's notes on meeting of Fiscal Policy Work Group. April 8, 1976.
42. H. Gibber. "New Meeting," memo to Fiscal Policy Group announcing agenda for review of full-time-equivalency issue. April 9, 1976.
43. D.F. Andersen. "Causal Influences in a Simple Aggregate Model of Program Fiscal Interactions," internal working memo. March 10, 1976.

44. This point was formalized in D.F. Andersen. "Fiscal Policy Options and the Management of Chapter 766." System Dynamics Group Working Paper D-2381, May 14, 1976.

45. Ibid.

46. Interview with R.H. Audette. March 29, 1977.

47. H. Gibber. "Maine Meeting Agenda." May 25, 1976.

48. H. Gibber. "Planning Sessions with Bob Audette, Dave Andersen, and External Coordinators," memo to Fiscal Policy Group and Management Team. June 1, 1976.

49. Tom Collins. "Revisions to Local Aid Reimbursement Calculations," memo to S. Kaagan, R. Hilgenkamp, and F. Williams. July 9, 1976.

50. R. Blustein. "Fiscal Training Sessions Scheduled," memo to Fiscal Policy Group. April 9, 1976.

51. B. Blustein. "Task of Extending Training on Fiscal Information to Other Division Staff (in Central and Regional Offices)," memo to Fiscal Policy Group, June 30, 1976.

52. Three such memos made to the Fiscal Policy Group's agenda: "Clarifying Statement for Review by Fiscal Policy Group--'Yellow School Bus Issue'," June 28, 1976; "Clarification of Issue: Allocation of Indirect Costs to SPED: How Do Costs on Schedule A Appear in the 766 Reimbursement Claim?" June 28, 1976; and "Issue of Potential Interest to Fiscal Policy Group," September 16, 1976; all memos from D. Keeler to H. Gibber.

53. Author's notes on meeting with F. Williams. September 1, 1976.

54. D.F. Andersen. "Notes on Special Education Transportation Reimbursement," memo to R.H. Audette. September 8, 1976.

55. The agenda of the group's meetings always highlighted the sense of building progress between meetings--see agendas for meetings with Bob Audette, October 15 and October 25, 1976.

56. Audette in an interview on March 27, 1976 noted that perhaps the most valuable aspect of the whole think tank exercise was the clarification of his own thinking that had occurred. Information for the previous meeting was structured, analyzed, and represented a basis for new discussion leading to a better "model" of the fiscal program system.

57. For example, of eight meetings of the think tank scheduled weekly between October 1, 1976 and mid November, three were cancelled because of unexpected bottlenecks in Associate Commissioner Audette's schedule.

57a. The options being considered within the think tank lacked a

certain degree of concreteness, treating fiscal policy of a more abstract level. See: "Examination of Implications of Fiscal Policy Structures," formal minutes of meeting of think tank. October 25, 1976.

58. D.F. Andersen. "First Draft of Some Issues Requiring Further Deliberation," memo to Fiscal Policy Group. October 26, 1976.

59. G. Thayer. "A Preliminary Look at Some Personnel Issues for End-of-Year Report in Special Education," memo to Fiscal Policy Work Group. November 4, 1976.

60. Author's notes on meeting of Peat, Marwick, and Mitchell advisory committee meeting. November 16, 1976.

61. Author's notes on meeting of think tank. November 18, 1977.

62. The complete arguments behind the fiscal neutrality proposals are presented in R.H. Audette. "A Proposal to Eliminate Fiscal Instability within the Educational Reimbursement System." January 1977.

63. The Morning Union. Springfield, Massachusetts. Friday, December 3, 1976.

64. This assessment of Anrig's basic reasoning was made by Associate Commissioner Audette several weeks after the December 7 meeting and after a follow-up meeting with Anrig. See Interview with Audette. December 22, 1976.

65. The quotations and abstractions referred to in this work are taken from a later revision of the original report. R.H. Audette. "A Proposal to Eliminate Fiscal Instability within the Education Reimbursement System." January 1977.

66. Interview with R.H. Audette. December 22, 1976.

67. Author's notes on meeting of the Executive Committee. December 7, 1976.

68. Irving L. Janis. Victims of Groupthink: A Psychological Study of Foreign Policy Decisions and Fiascos. Boston: Houghton Mifflin, 1977.

69. However, later on Gibber picked up this loose end and decided to pursue it in his own thesis research.

70. Interview with R.H. Audette. March 27, 1977.

71. Author's notes, meeting of State Board of Education. June 27, 1977.

72. In April of 1976, Audette had circulated a memo to local special education directors summarizing the "full time equivalency" decision made in a meeting attended by S. Kaagan, R. Hilgenkamp, and F. Williams on May 3, 1976.

73. H. Gibber had compiled a list of possible future tasks in a memo to the fiscal policy group entitled "Next Steps." June 30, 1976.

74. This point was forcefully made when the fiscal policy guidelines were first presented to the regional special education project directors. Author's notes on the meeting held May 2, 1977.

75. Author's notes on meeting of fiscal policy group. November 12, 1976.

76. Author's notes on meeting with Gibber. September 1, 1976.

77. In the Commissioner's Operating Plan of 1977, the Bureau of External Audit had committed itself to completing 138 audits of special education returns or about 90% of the monies spent state-wide. An audit effort of this scope had not been undertaken in the department's recent history. See: "Commissioner's Fiscal Year 1977 Operational Plan," p. 11.

78. Author's notes, meeting with F. Williams. September 1, 1976.

79. Author's notes on meeting with H. Gibber. September 24, 1976.

80. D. F. Andersen, meeting agenda with H. Gibber, September 24, 1976.

81. D. F. Andersen. "Notes for the Fiscal Policy Meeting, Friday, October 8, 1976", memo to H. Gibber and Fiscal Policy Group.

82. D. F. Andersen. "First Draft of Some Issues Requiring Further Attention," memo to members of Fiscal Policy Work Group, Gene Thayer, Gerry Mercadante, and Mike Heursen, October 26, 1976.

83. Author's notes from minutes of meeting of Fiscal Policy Work Group, October 28, 1976.

84. H. Gibber. Meeting agenda (with subsequent assignment of responsibilities) from Fiscal Policy Work Group, November 12, 1976.

85. See note #52 in this chapter for three such issues that had piled up over the summer.

86. Author's notes on meeting with F. Williams, December 15, 1976.

87. Author's notes on meeting of complete Fiscal Policy Group, January 12, 1977.

88. Author's notes on meeting of Regional Special Education Project Directors, May 2, 1977.

89. At a state-wide meeting of the local directors of special education held May 13, 1977, the work of the Fiscal Policy Group was presented in detail (see: "Special Education Fiscal Overview--Chapter 766 Reimbursements", Slides 1-22, presentation developed for that meeting). It was agreed that local directors would become more involved in future revisions of the guidelines.

90. E. J. Gotgart. "Technical Assistance on Guidelines," memo to Fiscal Policy Work Group assigning personnel to regional training sessions, April 11, 1977.

91. Untitled memo from S. Kaagan to members of Peat, Marwick, and Mitchell advisory committee, January 21, 1977.

92. "Agenda of Possible Issues Regarding Special Education Input to Design of the End-of-year report (FY 1977)," internal working memo of Fiscal Policy Group, February 8, 1977.

93. Ibid.

94. Author's notes on meeting of Peat, Marwick, and Mitchell advisory committee meeting, February 9, 1977.

95. Kenneth J. Arrow. "The General Possibility Theorem for Social Welfare Functions: Chapter 5" in Social Choice and Individual Values. New York: John Wiley & Sons, Inc., 1963, pp. 46-60.

96. For an elaboration of this argument see Charles E. Lindblom. The Intelligence of Democracy: Decision Making Through Mutual Adjustment. New York: The Free Press, 1965.

CHAPTER SIX

THE COGNITIVE STORY

Calling this chapter the cognitive story is a bit of a misnomer. The so-called cognitive perspective is really a blend of several diverse research traditions directly or indirectly based on cognitive psychology. The perspective taken in this chapter is one of several variants possible centering on the general theme of cognitive psychology. The theory originally presented in Chapter 2 was itself a blend of three threads of theory, 1) experimental evidence on how the human mind responds to choice situations and recalls information under conditions of uncertainty, 2) studies of systematic differences between individual decision makers with respect to their styles of decision-making and information process, and 3) literature on the sociology of knowledge--the study of how small groups tend to construct idiosyncratic and simplified images of reality as bases for collective decision making.

Also under the rubric of psychological theories of decision making, Axelrod, et al examine empirical techniques for encoding the "belief systems" or "cognitive maps" of decision-making elites.¹ Jervis examines how the cognitive process of perception (and misperception) can distort or facilitate the decision-making process among political elites.² Janis and Mann have examined in detail the impact of psychological stress on the quality of decision making.³ Finally, Etheredge examines how foreign policy decision makers project their own psychological orientation onto foreign policy situations.⁴ All of these studies have something in common with a rather broad-

ly defined "cognitive perspective" as does this chapter. But on the other hand, all of these studies do take a decidedly different look at decision-making processes.

Faced with such a potpourri of theoretical lenses, choosing a cognitive perspective proves to be a rather difficult task. In the course of the research, the perspective used in this chapter drifted closer and closer to a sociology of knowledge perspective--the study of how groups define and maintain shared images of reality. Several reasons explain this shift in theoretical perspective. First, the notion of socially constructed realities appeared to be a useful concept for bridging the gap between the micro-level of individual cognitive processes and the more macro-level of organizational processes. Holsti noted that research into individual cognitive phenomena and belief systems must eventually be related more broadly to organizational processes:

"Research on belief systems must ultimately be embedded in a broader context, and the problems of linking and interrelating theories and concepts that [relate] the individual decision maker... to the behavior of groups and organizations needs to be addressed directly."⁵

Second, the emphasis of this research is on ways to better manage policy modeling within bureaucracies. It seemed important that the concepts used in this chapter be able to span both individual cognitive processes and organizational behavior, for ultimately management is concerned with improved organizational performance. Third, the interview data collected in the research was highly amenable to an interpretation in terms of a sociology of knowledge perspective. Finally, and perhaps most important, I have a

strong personal affinity for the sociology of knowledge perspective as developed by Berger and Luckmann.⁶ The cognitive story begins with a closer examination of this sociology of knowledge perspective used as its frame.

6.1 A SHIFTING THEORETICAL BASIS FOR THE COGNITIVE STORY

As with the rational and organizational stories, we begin by reviewing the original cognitive theory as developed in Chapter 2--original, naive propositions derived from that body of theory.

Summary of the Basic Theory and Naive Propositions

Table 6.1 presents five propositions summarizing the basic cognitive theory of decision making as it was presented in Chapter 2. The first three propositions listed in Table 6.1 concentrate on the cognitive skills and the cognitive limitations of individual decision makers. The emphasis here is on how individuals process information, how individuals infer stable and consistent patterns from diverse experience by the selective recall of detail, and how individuals tend to make choices when faced with a multitude of possible options. The framework used in this chapter deemphasizes the study of individual cognitive skills and limitations.

The final two propositions emphasize the role of small group interactions in promoting consensus among decision makers and helping to create a cognitively simplified view of an otherwise complex decision-making environment. The notion of socially constructed realities is a central organizing concept in these final propositions. This portion of the original theoretical perspective is highlighted in this chapter.

TABLE 6.1: Propositions Summarizing Basic Cognitive Theory of Decision Making (Propositions summarized from Chapter 2)

- 1) Limited Information Processing Ability. The ability of the human mind to process simultaneous bits of information is limited. Our minds use many techniques to simplify alternatives and streamline information flows in making decisions.
- 2) Inferential Memory. Human minds neither store nor recall information in a passive fashion. Our minds continually strive to impose stable and consistent patterns upon experiences of all sorts.
- 3) Choice Based on Focusing, not Scanning. Choices are not made by scanning all of the available options. Instead decision makers tend to focus quickly on one or two plausible options.
- 4) Small Group Interactions. Reinforcements from peers are important factors contributing to the stability of perceptions and the ability to resolve uncertainty in a complex environment.
- 5) Reality Socially Constructed. To a large degree, the alternatives, consequences, and values weighed in the decision-making process will be determined by how group interactions structure or create their images of the decision-making environment.

Table 6.2 presents the five naive propositions summarizing how system dynamics models aid in cognitive decision making. Summarized from the body of theory presented in Table 6.1 and from an examination of the system dynamics methodological priors, these propositions formed the initial working hypotheses of the cognitive story. The original, naive propositions reflect the same emphasis on individual skills as is apparent in Table 6.1. As traced below, this emphasis has shifted during the course of the case study.

Elaborating a Sociology of Knowledge Perspective

This section explores several of the properties of socially constructed realities that are pertinent to the case study at hand. First, the mechanisms that contribute to the stability of cognitive realities within bureaucracies are enumerated and described. Second, patterns of variability in the types of cognitive realities held by different actors within a bureaucracy are explored, (for example, differences between how top management and the accounting department tend to view fiscal policy). Third, we shall discuss how the same mechanisms that tend to maintain and reinforce management's thinking about a policy area may also be used as mechanisms for promoting change in how management views policy areas. Finally, we shall discuss how changes in thinking, once initiated, can diffuse to various corners of the organization.

How managers, either individually or in groups, tend to think about policy areas tends to remain amazingly stable over time. Organizations contain powerful mechanisms that tend to reproduce patterns of thinking. If

TABLE 6.2: Original (Naive) Propositions Summarizing How System Dynamics Models Aid in Cognitive Decision Making (Propositions summarized from Chapter 2)

- 1) Expands Information Processing Abilities. System Dynamics models can simultaneously track myriad relationships between a large number of variables. By using a model, decision makers can track interactions between many more variables.
- 2) Aids Formation of Images and Analogies. Decision makers often make inferences based upon rather simple analogies. System dynamics models provide a rich set of images and analogies centering around the concepts of feedback.
- 3) Counteracts Simple Extrapolations. By arguing that system behavior depends upon causal structure rather than past behavior of the system, the analyst is led to a more sophisticated understanding of what causes system behavior.
- 4) Forces Value Trade-Offs. By forcing explicit causal hypotheses, the model counteracts the cognitive tendency to deny the existence of trade-offs associated with a set of alternatives.
- 5) Impact Depends Upon Social Positioning of Model (and Modeler). Models that present images of reality that are too far from the stable and persistent shared realities of the organization will tend not to be used. Such models will face resistance from strong social pressures to maintain shared definitions of social reality.

"tuned into" the same perceptions of reality but do not carry the official weight of policy artifacts. For example, meeting agendas and minutes serve as a common reminder of progress made, agreements reached, as well as issues remaining to be resolved. Planning priority documents as well as budgets projections provide unequivocal statements of what the agency hopes to accomplish in the near future and implicitly contain a listing of agency priorities. Position papers, PERT charts, and statements of objectives, projects, next steps, and milestones -- all of these serve to get all of the actors involved in a project thinking about the problem in a synchronized fashion.

Without policy and working artifacts it is difficult to imagine how commonly shared perceptions of problem realities could ever be maintained. Without such commonly shared problem realities any activities involving coordination within a large agency or across several agencies could scarcely happen. In fact, the absence of policy or working artifacts addressing a specific area or problem probably indicates that no organizational action is being taken in that area.

Finally, one man's (or organization's) working artifact may be another's policy artifact. An agency's finalized set of regulations (its policy artifact) may be considered a document easily subject to change (that is a working artifact) to the legislative committee drafting amendments to the legislation originally enabling the agency to draft the regulations. Likewise, a commissioner at his discretion may draft a working document outlining the budgetary procedures to be followed by his agency. To the heads of specific subunits within that agency, the commissioner's working document has the force of a policy artifact.

membership of the formal organization goes a long way toward determining who will be the relevant actors who interact with each other. The goals or operating constraints of the formal organization will determine what problems are treated. Through their interactions to meet the operating constraints of the formal organization, the organizations's members will need to construct socially shared images of certain problem realities. A common tactic employed by formal organizational units is to create policy or working artifacts to help structure their problem realities. These artifacts lay out the concepts and vocabulary that reinforce the solidity of the organizationally defined reality.

Hence the membership patterns and operating constraints of formal organizations insure that the artifactual and conceptual mechanisms for maintaining socially shared realities are well orchestrated. As outlined in the previous chapter, the positioning of a model within a formal organization is an important factor in determining its success.

* Proposition 6.1.D *

* Formal Organizations. The formal pattern of organization *

* within an organization determines many of the patterns of inter- *

* action between individuals. Common problem perceptions are often *

* created and maintained through these interactions. As outlined in *

* the previous chapter, the positioning of a model within an organi- *

* zation is a critical factor in determining its success. *

Not all interactions between individuals within public agencies occur because organizational members are gathering to meet the operating constraints imposed upon the agency. In fact, the vast majority of the interactions are informal. People get together over coffee. Ad hoc committees (drawn from several formal organizational units) meet to consider a common pressing problem. Social relations are cemented and a not insignificant amount of business transacted at office parties, inter-office volley-ball games, and over lunch breaks. These informal social relations are the lubricant (and often the power source) that allows organizations to function. A favor asked discretely of a friend in the right position can cut mountains of red tape and significantly increase the probability of a program component's success.

All of these informal social interactions involve communication between individuals. And it is in these communications that many common perceptions and expectations are set and the underlying nature of problem realities defined. Such informal social interactions are perhaps the most powerful mechanisms at work assuring the reproduction of established patterns of viewing problems and conceiving of possible solutions.

As with policy and working artifacts, it is often difficult to distinguish between formal organizational activities, where members are gathered to meet formal goals, and informal social interactions. When an accountant in the comptroller's office expedites a critical invoice for the commissioner's secretary is this the manifestation of a long established personal friendship or of an organization that is most effectively attaining its goals? The distinction between formal and informal interactions is

to a large degree arbitrary and semantic.

In formal modeling exercises, a most important form of informal interaction will be that between the analyst and managers within the agency. Through these informal interactions, the analyst will be able to build an atmosphere of credibility that can facilitate discussions over issues based within the model, allowing managers to learn about what is happening within the model and the analyst to more thoroughly understand the problem from management's point of view.

* Proposition 6.1.E *

* Informal Social Interactions. Through informal social inter- *
 * actions common perceptions and expectations are set and the under- *
 * lying nature of problem realities often defined. Informal social *
 * interactions between analysts and managers will be a key *
 * determinant of how successful a modeling project is in promoting *
 * changes in socially shared perceptions of problems and their *
 * solutions. *

Having examined some of the more common mechanisms that maintain socially shared realities, we turn our attention to some of the predictable ways that perceptions of problems vary within an organization. Within a given organization, not all actors share a common view of a given problem area. Consider the simple example of the enforcement of regulations. A clerk may view that regulation as a fixed policy and his job is to rigidly

enforce that policy. A mid-level manager may see his job as reviewing and clarifying regulations. In the process of considering revisions to the regulations, such a manager would have to maintain a more flexible view of the problem reality. Finally, top management might spend part of its time reviewing how whole bodies of regulations relate one to the other. In this case, an agency head may lack altogether the detailed knowledge of the clerk but may be thinking in much broader policy sweeps as he negotiates amending legislation to change the overall thrust of a body of regulations.

The clerk may see his job as the mechanical execution of fixed procedures. His policy reality consists of fixed regulations, a ream of forms to be completed, and interpretive explanations (mandated either formally or informally) outlining what may or may not be done. The middle manager may view the same policy problem as an exercise in systematic rational thinking, expressing legislative intent in a clear, non-contradictory fashion through regulations. The policy reality for middle management is more complex. It consists of broad policy intent as expressed in legislation, pressures from disparate units within the agency pursuing their own interests, and often a puzzling lack of sufficient information to make the objectively best decisions (by contrast, the decision situations facing the clerk are almost always clear).

To top management, the policy problem is essentially a political one. Their problem reality is peopled by disparate constituent interest groups as well as political in-fighting among agency heads as they jockey for budgetary increases of increased discretion and autonomy for their own

agency. His policy reality consists of bartering and compromise. The fiction of objectively best decisions that is maintained with some difficulty by middle management often dissolves into an ad hoc scramble to find an acceptable counter-offer today, before the close of the working day. However, these crucial moments of ad hocery must be smoothed over and rationalized after the fact so that the organization can continue to function in a routine and orderly fashion. Furthermore, once these routines have been established, they provide the constraints beyond which even top management can step only with difficulty.

* Proposition 6.2 *

* Variability of Cognitive Realities. The same problem appears *

* different when looked at from different levels and points of *

* observation within an organization. Attempts to change socially *

* shared perceptions of a problem must recognize that such socially *

* shared problem definitions are seldom uni-dimensional and a single *

* policy change may have to take on many different manifestations *

* within the organization. *

Even though such widely different images of the same policy reality exist at different levels within an organization, the existence of artifacts, vocabulary, and formal and informal interactions insure that these different realities are consistently integrated so that the organization can function as a whole. For example, when top management reach an acceptable compromise within the agency's broader political environment, a

meeting is called with middle management that sets forth a policy memo outlining broad policy directions. Based upon this policy artifact, middle management elaborates and rationalizes these policy directives by drafting regulations, setting priorities and budgets, assigning clerical staff to monitor the regulations, etc. By the time that policy filters down to the clerical level it has been so fully encased in working documents and so circumscribed by jargon and multiple rigid categories that the original fluid and amorphous policy directive appears to take on a solid and independent reality of its own.

Hence the same mechanisms that serve to maintain socially constructed problem realities can also help to maintain differentiated cognitive realities. Specifically, the differentiated and parochial goal structure of subunits within the formal organization assures that different actors within the organization will attend to different aspects of the policy problem and hence maintain different views of the policy reality. Also, different organizational units as well as different organizational levels (clerical, middle and top management) will have access to different policy and working artifacts and hence will maintain slightly different policy realities. Of course, differentiated access to reality maintaining artifacts assures that the vocabulary and concepts available at different points in the organization will also be differentiated.

These sharp variations within a seemingly unified perception of a problem have some rather practical implications for the management of policy modeling efforts. If the results from the modeling effort have been "translated" into the jargon and working artifacts familiar within

Once problem realities have solidified in the minds of clerical staff and middle management, the rather powerful mechanisms enumerated above will be working to sustain those realities. So, even if top management could conceive of novel policy innovations, there is a form of cognitive inertia that prevents top management from being totally flexible in its policy innovations. This cognitive inertia is analogous to (and perhaps even the cause of) much of the organizational inertia resulting from standard operating procedures and standard organizational repertoires that we explored in the previous chapter.

Thus far, we have been discussing how cognitive realities are maintained and differentiated throughout an organization. An equally interesting question is how can cognitive realities be changed? This question is crucially important to those managers and analysts who aspire to promote policy innovations within an organization. For once the process of changing cognitive realities is understood, then, headway can be made in implementing changes in organizational routines and procedures, eventually resulting in changed operating policies for the organization as a whole.

In speaking of changing cognitive realities, several distinctions need to be made from the start. On the one hand, we could be talking about changing how an individual manager thinks about a problem. On the other hand, we might focus on how shared perceptions of a problem area change within an organization as a whole. Although both of these views shall be of some interest to us here, the latter focus shall be emphasized in this study. How an individual changes his thinking patterns falls under the

aegis of the literature on cognitive psychology proper, the specifics of change being treated within the topics of creativity and learning. Although these are interesting topics to study in relation to decision making, here we are more interested in how socially shared realities change over time. The emphasis is on how a large number of individuals working together as an organizational unit can simultaneously and synchronously change their perceptions of a problem reality.

A second distinction is between two different sorts of change processes. The first is when an organization has no well formed perception of a potential problem area. In this case, the manager must create a new awareness. In the second instance, the organization is aware of the problem but for some reason the problem perception needs to change. Reasons for needed change might be that important facts are being ignored or the current problem definitions do not yield effective policy insights. Both of these cases will involve similar change processes, but the former case involves creating new problem realities to replace a blank spot in organizationally shared realities, whereas the second case requires that new problem realities replace and supplement already existing ones. Each of these types of changes present their own unique possibilities and problems. This study, because of the nature of the case under study, focuses on creating new, rather than replacing old, organizationally defined problem realities.

In general, one should expect that it will not be easy to change socially shared cognitive realities. As we have seen, nearly every aspect of a functioning organization helps to maintain, stabilize, and synchronize

the cognitive realities of its individual members. Included in these change resisting mechanisms are an organization's membership, goal structure and informal social interactions; the prevalent jargon and concepts in use; and finally all of the written output of the organization that preserves and reinforces the realness of the concepts and procedures that the organization uses to attain its goals.

One effective way to change shared cognitive realities would be to disrupt those same mechanisms that maintain the reality. If the artifacts, vocabulary and concepts, and organizational patterns within an organization could be unfrozen, changed as desired, and then frozen back into place, they would tend to reproduce different cognitive realities.

Of course there is a rather serious puzzle built into this simple prescription. How does one change the very mechanisms that are used to maintain and stabilize organizational realities? There is a chicken and egg problem here. Changed maintenance mechanisms would change how individuals viewed problem realities. On the other hand, individuals who had different views of the problem reality would soon change the reality maintaining mechanisms to conform to their new views of the problem reality.

For the purposes of discussion, we shall arbitrarily break this reality maintaining cycle and begin by first considering a change in the cognitive realities of one or more individuals. After discussing some of the means whereby several managers can change their cognitive realities, we shall explore further how these initial changes can diffuse through the rest of the organization.

of lenses that can show the problem from a new angle. A theoretical perspective provides a valuable normative prescription of where to look for the root of a problem. The theoretical structure that holds together this normative view of the problem reality is independent of the existing concepts, artifacts, and organizational structures that maintain the currently existing cognitive realities. By pursuing the steps necessary to complete a formal analysis -- be it a cost-benefit or simulation study -- the analyst can rearrange existing information to create a new image of the problem reality.

Furthermore, formal analyses often have a strong rational component to them. In fact, as we saw in the rational story, formal model-based analyses often fit perfectly the normative prescriptions of rationality. These prior tendencies toward rationality counteract the well-documented tendency of decision makers to over-simplify complex decision situations. Specifically, rationally based analyses counteract decision makers' tendency to avoid trade-offs, to create cognitive realities that are balances (i.e., these realities contain no situations where one preferred means does not lead to two ends, one of which is desirable and one of which which is not desirable), to ignore more than a few live alternatives, and so on.

Hence, by self-consciously adapting the theoretical perspective of model-based analysis, the analyst (or manager) can use the methodological priors of his technique to help construct novel images of problem realities. If the resulting images are exciting, if the analyst can convince several managers (hopefully top managers) of the usefulness of the new image, then

in the reality sustaining mechanisms can induce even larger changes in the realities of individual managers over time. Figure 6.3 summarizes in abstract form the circular interactions between cognitive realities and reality sustaining mechanisms.

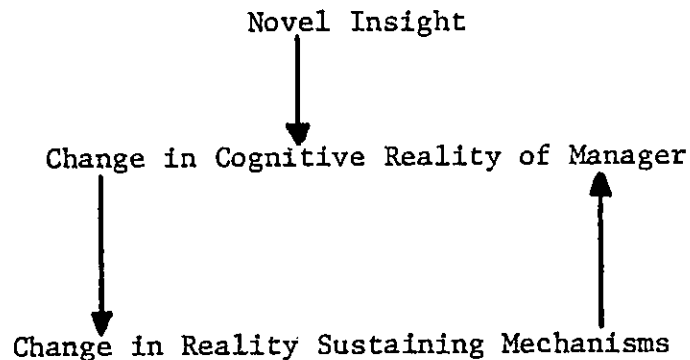


FIGURE 6.3: Circular Interactions Between Cognitive Realities and Reality Sustaining Mechanisms

The cycle of changes is touched off by some novel insight on the part of one or several managers. In order to understand the diffusion process, the source of this insight is not critically important. Suppose for the purposes of example, that a cost-benefit study commissioned by the head of an agency reveals that large potential savings could be realized in an area of activity that was not currently closely managed by the agency (for example, more rigorous collection of overdue parking tickets, or closer scrutiny of a contracting process).

This novel insight, as inchoate as it may be, triggers some changes in how the agency head thinks about his agency. A new unexplored corner is opened up in his thinking -- the beginnings of a new or enriched reality added. Perhaps if the contracting procedure were more closely policed, the savings gained could be used to deliver services to an unserved

constituent population. If these changes in thinking remain just speculations, then nothing substantial will happen. However, if top management begins to manipulate the mechanisms that pattern how the organization as a whole thinks about the problem area, then something may start to happen.

The agency head discusses his new ideas with the comptroller over lunch (informal social interaction) and the comptroller agrees to draft a memo outlining some feasible options to review the contracting procedures and draw up an agenda for a working meeting to discuss the proposed procedures (both working artifacts). All of these small changes in reality sustaining mechanisms eventually lead to a meeting of all of the division heads to discuss the new proposals for revamping the contracting procedures (or recouping the lost parking tickets, or...).

That meeting (a changed reality sustaining mechanism in and of itself) leads to yet other changes in the thinking of the manager. The suggestion was made to hire two new accountants to conduct a quarterly review of contractor's progress against their stated goals. It is estimated that this new branch within the accounting group could more than pay for itself by eliminating cost overruns. Another suggestion was made to revise the guidelines that control the bidding process. Based upon his newly updated vision of the problem reality, the agency head takes yet another round of action, calling meetings, revising guidelines, establishing new operating units, and in general changing the very mechanisms that have defined the reality of service contracting in the past.

manipulating some external reality sustaining mechanism. In turn, this change can catalyze new thinking on the part of a second manager (manager₂) who in turn further manipulates the artifacts, vocabulary, and membership and goal structure of the organization to induce yet further changes in how both manager₁ and manager₂ think about the policy reality in question.

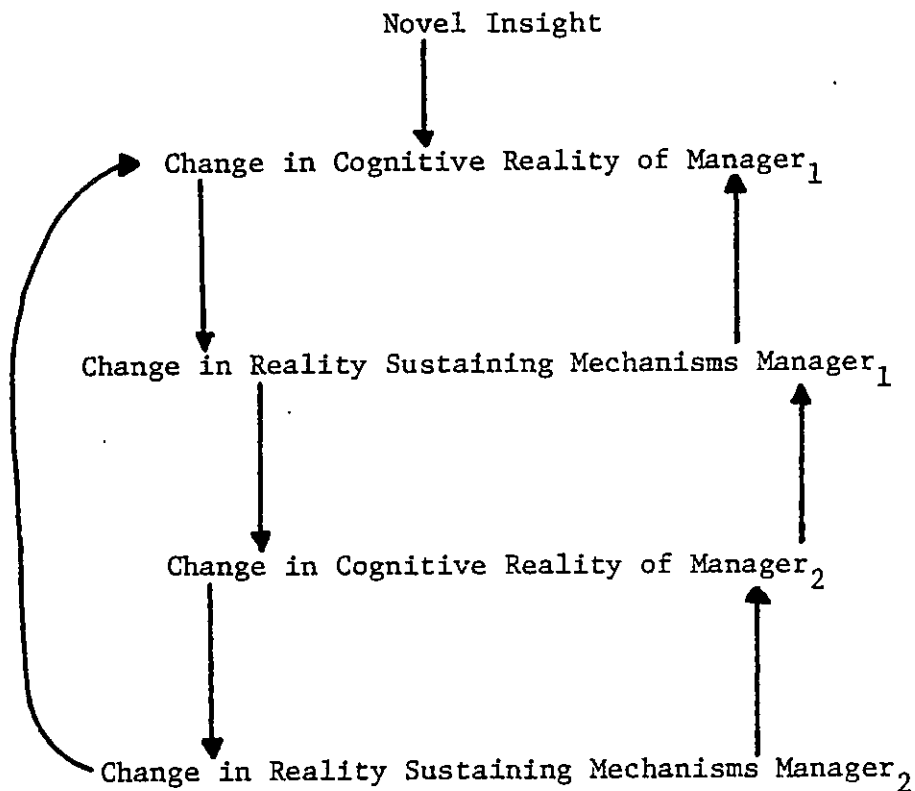


FIGURE 6.4: "Rippling Out" of Changes on Cognitive Realities and Reality Sustaining Mechanisms for More than One Manager.

A generalization of Figure 6.4 demonstrates that a novel insight diffuses throughout an organization via linked chains of changes in individual cognitive realities and changes in reality sustaining mechanisms. Changes in the observable, externalized reality sustaining mechanisms

provide concrete evidence that policy innovations are in process. However, the invisible changes in cognitive realities accomplished through learning behaviors on the part of individuals are critical and necessary to a sustained diffusion process. If a policy innovation exercise manages to change how several key individuals conceive of a problem reality but does not get down to the nuts and bolts of redesigning the reality sustaining mechanisms within the broader organization, the exercise will not be a success. Conversely, if a policy innovation exercise concentrates on redesigning forms, articulating policy priorities, and in other ways changing working artifacts and other reality sustaining mechanisms without significantly changing how key actors conceive of the problem reality, that exercise also will not succeed.

* Proposition 6.6 *

* Chain Reaction within Diffusion Process. A novel insight *

* diffuses through linked chains of changes in individual thinking *

* and changes in reality sustaining mechanisms. Policy modeling *

* efforts that focus on changing the thinking of individuals but fail *

* to concentrate on changing reality sustaining mechanisms will have *

* little chance of success. Similarly, policy modeling efforts that *

* focus on creating new concepts and changing organizational arti- *

* facts without paying explicit attention to how individual managers *

* are thinking will also have less chance of success. *

Hence a cognitive view of the decision-making process has broad implications for the management of model-based policy design exercises. Such policy design exercises must explicitly focus on both the thinking of key organizational actors and the multitude of mechanisms that any organization uses to reinforce and synchronize the thinking of its members.

6.2 A NOTE ON THE USE OF EVIDENCE IN THE COGNITIVE STORY

Questions of evidence will be especially problematic in the telling of a cognitive story about policy design. By its very nature, a cognitive story implies some discussion of the subjective mental states of individual managers and how these mental states change over time. Some attention must be paid to how individual managers react to working artifacts, create new insights, and translate these insights into organizationally based activity.

For the rational and organizational stories, a strategy of collecting unobtrusive measures of organizational activity would appear to be the residue that an organization leaves behind in the form of agendas, planning documents, minutes of meetings, and so on, it is possible to piece together a reasonably accurate picture of what alternatives were actively considered, what would be the projected outcomes of each of these alternatives, and which of these were selected as the best policy alternatives. Likewise, the goals, priorities, membership, and standard operating procedures of various organizational sub-units could be inferred from the detailed records of activity that an organization routinely maintains.

One could attempt to understand what managers were thinking at any point in time by two broad methods. The first tactic would be to directly interview managers while they are in the process of making a series of decisions in order to find out what they are thinking. A slight variation on this direct scheme would be to interview managers after-the-fact in order to ascertain what they thought they were thinking at the time. Such interviews will tend to be less interesting because of a tendency to forget

seemingly unimportant details and to make the process of "muddling through a decision" look less ragged than it may actually have been. On the other hand, it is a rare and perceptive interviewer who will be able to discern all of the important issues as they are happening and to ask pointed and insightful questions as decisions are being made. Hence, real time interviews will often appear to wander and not address themselves to some points that in retrospect appear to be critical. In this case, both real time and retrospective interviews have been employed in an attempt to ascertain what managers were thinking during the decision-making process.

A second strategy for understanding what decision makers were thinking is to collect indirect measurements and to attempt to infer what was on their minds from these indirect measures. For example, questionnaires could be circulated to key managers on a routine basis asking them how they are spending their time. The resulting list of projects and topics could be used as a proxy for what management was thinking about at that time. Another indirect strategy would be to collect the memos, planning documents, and letters that several key managers write concerning the decisions under question and assume that their writing reflects what they are thinking. Both of these strategies have the defect that what managers write about and spend their time on may not be accurate mirrors of what they think about or think is important. Yet a third strategy would be to spend a lot of time talking with and interacting with managers and to then record one's impressions of what management is thinking. Of course this strategy has all of the problems inherent in the bias of the ob-

server and recorder. This study has employed all of the three types of indirect measurements of managers' subjective mental states as outlined above. (For a more complete discussion of the evidence used in the telling of the cognitive story as well as a more complete comparison of that evidence base with the one used to tell the rational and organizational story, refer to Appendix B.)

The different availability (or lack of availability) of evidence to support the cognitive story will of necessity change the tenor of the cognitive story. All discussions of the subjective mental states of the individual actors will in some sense be inferences based upon indirect measures of one sort (for even taped interviews, the most direct measures employed in this study, are colored by an actor's self-reflection on what he was (or is) thinking at any point in time). To partially compensate for the necessary inferential nature of the cognitive stories, drafts of the cognitive story have been forwarded to each of the principal managers cited in this chapter, and their comments on the draft have either been incorporated into this final draft or have been reflected in footnotes. Beyond these attempts at "objectivity," the reader is cautioned concerning the puzzles surrounding evidence for cognitive stories and is directed to scrutinize the methods used to collect and analyze the data as summarized in Appendix B.

Furthermore, the "data puzzles" attached to the cognitive of decisionmaking represent only the tip of an iceberg. There is a rather profound difference between the organizational and cognitive perspectives that is rooted in debates about the very nature of social science. The

major difference in emphasis between the cognitive and organizational perspectives is between understanding how individuals think and attach interpretive meaning to events and explaining what are the causes of a certain chain of events. To a large degree, the cognitive view of decisionmaking concentrates on understanding how individual decision makers interpret events and attach meaning to those events. Based upon these meanings, how do managers settle upon a series of actions designed to reach some purposive goal? On the other hand, the organizational view of decisionmaking focuses on explaining how organizational capacities are translated into policy action. What causes an organization to search for new policy options? What causes that search to stop? What will be the impact of different information sources on that search process?

Pursuing the discussion of the qualitative differences between the various perspectives a bit further, it is interesting to note that the rational perspective in its own way is quite different from both the organizational and the cognitive. Whereas the organizational and cognitive perspectives aspire to describe how individuals and organizations actually do arrive at decisions, the rational perspective emphasized how both individuals and organizations should decide policy matters. The strong normative component of the rational tradition distinguishes it from the descriptive flavor of the other two.

Of course, both the organizational and cognitive views of decisionmaking do contain a normative component as does the rational view contain a descriptive component. But the point remains that the three perspectives chosen for analysis here are made of markedly different mixes of the

normative versus the descriptive as well as different mixes in their emphasis upon causal explanation versus interpretive understanding. We shall return to a further discussion of these distinctions as we attempt further comparisons across the three perspectives.

6.3 DIMENSIONS OF FISCAL COGNITIVE REALITIES

In this section we begin to apply the concepts of cognitive realities to the fiscal policy problems facing the Division of Special Education. The term fiscal cognitive realities or fiscal realities refers to the commonly shared perceptions within the division concerning what were the fiscal problems facing the division, what were the causes and solutions to those problems, and what actions could be done and were being done to solve those problems (if any). The remaining portions of the chapter will trace how both individuals and the organization as a whole created more fully articulated fiscal realities (experienced learning) during the period observed in the case study. This section portrays the state of fiscal realities at the beginning of the project. First, we shall examine early interview data as well as retrospective interviews to ascertain how certain key individuals were perceiving fiscal realities from the start. Second, we shall explore how fiscal realities were differentiated throughout the organization even at this early time. Finally, we shall examine the mechanisms available within the division to sustain fiscal realities at this early date. The lack of fully articulated and widely shared fiscal realities is seen to be closely associated with a complete lack of artifacts, vocabulary, or organizational structures necessary to sustain and synchronize fiscal thinking within the division.

Initial Characterizations of Fiscal Realities

The evidence used in this section stems principally from interviews, both retrospective reflections by individuals on how they thought that they were thinking at the beginning of the fiscal policy project as well

as real time assessments of what people were thinking. In April 1976 a group of key managers within the division were asked to broadly comment on what they felt to be the "context" (most broadly defined) of the newly emerging fiscal policy effort as well as what were the specific tasks that they saw as needing to be completed.

Given the broad nature of the question, these interviews contain great diversity of perspective with little overlap between any of the managers' thinking on what was important. Also, each interview in and of itself presents a rather logical and complete-looking picture of potential fiscal policy problems facing the division. However, in retrospect, these rather complete images now look more like conjecture than probing and insightful analyses of the issues at hand. Interestingly enough, these same managers when interviewed one year later tended to retrospectively characterize their substantive knowledge at the initial stages of the project as "goose egg," "zero," or some other indicator of minimal knowledge. But substantive knowledge is not the only type of knowledge relevant to decisionmaking. And in the important areas of organizational and personnel factors as well as possible political ramifications of fiscal areas, these decision makers displayed an early level of skill and sophistication (for these factors were common to most all of the decisions that they made). We shall broadly characterize the initial fiscal realities of these several key decision makers as being subdivided into the realms of substantive knowledge, organizational and personnel factors, and political ramifications.

Overall Impressions. Managers displayed a wide diversity in respond-

ing to an open-ended question concerning the broad "context" of the division's newly formed Fiscal Policy Group. Bob Audette, Associate Commissioner of Special Education, saw the Fiscal Policy Group as an opportunity for the division to seize a new initiative. In his words, "the tail is wagging the dog." That is, fiscal policies set outside the division were dominating program priorities set within the department.⁷

To Fred Williams, Associate Commissioner of Administration and Personnel, the importance of the Fiscal Policy Group lay in its potential impact on the "emerging roles and responsibilities of managers within the Department of Education."⁸ Regionalization of the staff and operating responsibility was an organizational priority of the Board of Education. By assembling a group of decisionmakers at the bureau director level, the Fiscal Policy Group could help to bridge a gap between central office policy makers and regional staff having responsibility for implementing these policies.

Hal Gibber saw the Fiscal Policy Group as an important way to bring together fiscal and program decision makers.⁹ Traditionally, these two arms of educational administration had not spoken to each other, and the efforts of both had suffered. Finally, Terry Bradford, Director of the Bureau of Management, saw the significance of the Fiscal Policy Group in its ability to give the division some control over the state's greatest investment in special education, the money reimbursed to cities and towns. To date, this fifty million plus dollars was distributed with no controls by the Division of Special Education.¹⁰

Political Aspects. Most managers were quick to comment on the political dimensions of the newly emerging fiscal efforts. Williams noted

that a primary responsibility of the Fiscal Policy Group should be to recommend new special education funding legislation to the executive committee.¹¹ Gibber stressed the increased scrutiny being placed upon all educational expenditures. If 766 could be made more cost effective, then special education would be in better shape politically at both the state and local levels.¹² Joe Flahive, one of the two fiscal "experts" in special education, saw fiscal decisions as directly determining a coalition of potential allies and opponents throughout the state. Certain policies favored richer towns, others the less wealthy. Once the department committed itself to funding guidelines, political coalitions would arise to support or oppose the department's decisions.¹³

Organizational and Personnel Issues. The bulk of these early interviews were spent discussing organizational issues. Williams, Gibber, Bradford, and Flahive agreed that a major obstacle to increasing divisional fiscal policy capacity would be a lack of leadership and skilled personnel within the division. Williams noted forcefully:

"The most important first step must be gaining a knowledge base within the division. The division must thoroughly understand the reports and formulas. This is an absolute prerequisite to getting anywhere. Of first importance is the clarification of full time equivalence and other concepts related to the end of year report. There is at most only one or two persons within the division who currently are conversant in these areas (Dave Keeler and Joe Flahive). The division must get over this hump. This critical first step should be completed in four to six weeks." 14

Beyond this "bottom line" observation, there was nearly endless speculation about the organizational implications of increasing fiscal capabilities within a program division. Consistent with his overall emphasis on regionalization, Williams saw the Fiscal Policy Group as a force

that could ultimately lead to interdivisional coordination. He envisioned that within six to nine months, an interdivisional planning group at the level of bureau directors could be promoting coordinated policy actions to be implemented regionally.¹⁵ Flahive, on the other hand, saw the possibility that ad hoc groups such as the Fiscal Policy Group could usurp decisions usually made at the bureau directors' level thereby leading to a "short-circuiting" of the department's normal operating procedures.¹⁶

Gibber saw the fiscal policy effort as an organizational bridge between fiscal and program units in the department. By providing for face-to-face contact and a commitment to common goals, strong working relations could be built between fiscal and program managers.¹⁷

Both Audette and Bradford saw the Fiscal Policy Group as a vehicle for changing the treatment of children in state institutions. If the state money sponsoring these pupils could be moved from a state line item account to a local aid account, then responsibility and funding for these students could be shifted to local agencies, thereby getting the state out of the business of direct service delivery. Audette was most aggressive in outlining the possible organizational implications of increased fiscal capacity within the division. In broad terms, he saw the local budget as a means for providing unified services to children across agency lines of responsibility. As a first step in this plan, local special education administrators and program directors would have to be trained in fiscal matters. He also proposed a host of other fiscally driven organizational innovations to promote unified service delivery at the local level.¹⁸

Substantive Issues. Whereas the political and organizational aspects of management's view of fiscal reality were well elaborated, managers had few comments to make on substantive details. When they did articulate fiscal problems or potential projects, they concentrated on extending the implication of issues already surfaced rather than opening up new fiscal areas that needed to be addressed.

Audette noted that the full-time equivalency issue needed to be clarified so well that eventually "special education administrators could fill out the end of year report themselves" (as opposed to having their business agents do it).¹⁹ Williams noted that the most important substantive issue was the tight management of federal funds. Federal funds were the "cutting edge" that would allow the department, working through its regional arm, to best attain its program objectives.²⁰ Finally, both Audette and Bradford commented on the substantive problems involved in moving money for children in institutions from a line item account to a local aid account.

Retrospective Assessment of Initial Fiscal Expertise. Near the end of the third phase of fiscal policy activity, division managers were asked to comment on the initial level of awareness of fiscal issues within the division in light of the events that had taken place during the intervening year and a half. These retrospective self-assessments confirmed a sharp lack of awareness of substantive issues at the beginning of the project.

Audette summarized the level of fiscal knowledge in the division as "zero, goose egg."²¹ Elaborating on this synopsis, he continued:

"There was an empty space, (we) weren't even sure what went in the space. There wasn't even a door. If there was a door you might have had a notion and tried to open it. It was a cavity and you walked around in there and had no sense of what in blazes fit into that space." 22

Bambi Levine, Assistant Director of Special Education, made a similar remark:

"We didn't even know how to ask the questions to get the right information. Nor did we feel comfortable enough in our knowledge base to challenge some of the decisions that were being made." 23

Likewise, Gibber noted that in the fall of 1975 fiscal problems were besieging the division on many fronts and that only two persons, neither of them top managers, knew anything at all about fiscal policy:

"The department was not doing very well in terms of answering questions on how school systems go about their reimbursements reports....we were running into a lot of problems with regionalization and regionalization was a board (of education) priority. So the Commissioner asked Fred Williams to expand the capacity of what the department was then calling school management services...to try to get some of that (fiscal) information out. And, the one person who was the tie-in (for the division of special education) was Dave Keeler. Dave Keeler was somebody working in the division in the area of transportation, somebody who understood the basic concepts of reimbursements, more so than anybody else here. He wasn't one of the bureau directors in top management, but he was kind of a liaison from the division on fiscal issues. Also, we had Joe Flahive. Dave Keeler and Joe Flahive, they were the only two people who really know what reimbursement meant." 24

Mechanisms for Maintaining Fiscal Realities. Prior to December 1975, the marked lack of a well-formed fiscal reality within the Division of Special Education persisted in spite of strong signals that fiscal factors were critical to the successful implementation of the law. The Massachusetts press was alive with comment over the unclear and inadequate fashion in which the law was being funded. Commenting on 766 in an inter-

view with the Boston Globe, William Cowen, Secretary of Administration and Finance, argued that the law would have a \$100 million price tag, most of which would be carried on the local tax base. He asserted that "coming up with this kind of program without financial backing is a fraud."²⁵ Officials from local cities and towns were no less vociferous in their opposition to the funding of the law. Malden Mayor Walter Kelliher called Chapter 766 "the most ill-conceived piece of legislation I ever saw. It shows a lack of fiscal responsibility at the governor's level and at the legislative level."²⁶ In June and July of 1975, the Boston Globe ran a series of lengthy articles focusing on the "financial impact of the law locally and statewide."²⁷ These articles, generally favorable to the program aspects of the law, expressed concern over the inadequate local funding and state reimbursement mechanisms in place to finance the law.

Local special education administrators were unsure of the specifics concerning how the law was being funded and were suspicious that the state would slough the cost of the new law off on the local tax base.²⁸

Some of these concerns did filter through to the awareness of individual managers, and the division made some partial steps toward addressing fiscal questions. Of the ten official policy clarifications issued by the Division of Special Education between March 1975 and April 1976, fully six of these addressed concerns over how individual program activities would be funded.²⁹ But all of these policies were relatively narrow responses to very specific questions. There was little conception of some of the broader policy concerns that underlay these specific questions.

The division was nearly totally ignorant of and isolated from the fiscal aspects of its operating environment. One explanation for this state of affairs would be that the division was so preoccupied with the program aspects of implementing the law that there were not sufficient resources to implement the fiscal policy. Audette, commenting on the fiscal policy effort, noted:

"I think that if we had attempted to do this (fiscal policy effort) two or three years ago, there would have been so many other things falling over our heads that we might not have been able to." 30

Levine reinforced this observation:

"I saw the division being much more focused on programmatic issues for a long time and almost ignoring the money issues and the cost issues--almost totally. That was part of the growth process while the main driving force for this division was to insure that programming existed across the state and to insure that kids were getting served. That was the overriding push that existed when the legislation was first passed." 31

A cognitive analyst would have emphasized that the division's lack of fiscal awareness was strongly reinforced by the near total lack of any of the mechanisms necessary to maintain a fiscal reality. Without these mechanisms, time spent on fiscal issues by individuals would be dissipated with no cumulative impact. A socially shared conception of a fiscal reality could not exist until policy artifacts, working artifacts, formal organizational units, and the appropriate vocabulary and concepts could be introduced into the division.

Policy Artifacts. By December 1975, as the division was preparing for the second year of the implementation of the law, hundreds of pages of official policy statements and regulations had flowed from the division.

These policy artifacts defined the concerns of divisional personnel. The most important of these was a lengthy volume entitled 766 Regulations, which elaborated upon the original enabling legislation. Of these 109 pages of regulations, only one short paragraph on page 8 referred to the funding of the law. This one paragraph stated succinctly that the division shall recommend withholding of funds for noncompliance with the regulations that followed.³² A second important policy document, the local plan for implementation, contained only a single allusion to fiscal concerns. Localities were required to report only the total special education budget for '75-'76 (requested or approved).³³ No attempt was made to tie this total budget figure to the detailed staff, screening, and pupil data required in the implementation plan.

Time and again, the voluminous policy statements issued by the division gave no hint of how the funding for the many complicated services being mandated was to be handled. Formal policy pronouncements by the division nearly denied the existence of a fiscal reality.

Working Artifacts. Likewise, the working documents circulating within the division tended to deny a strong fiscal dimension to the 766 implementation. For example, in November 1975, the division proposed a three-year operating plan. None of the six major categories proposed for managerial attention dealt directly with fiscal issues. Of the twenty-six pages of plans, only one paragraph dealing with "access to third party entitlements" could be construed as concerned with the funding of Chapter 766.³⁴ In August 1975, the Commissioner of Education submitted an operational plan for fiscal year 1976 detailing activities within each of the

divisions for the upcoming year. The fiscal end of special education received a one-line comment. The department committed itself to the "support of sound leadership and managerial skills and cost-effectiveness (as) integral objectives of the Chapter 766 Program Audit and Assistance team."³⁵ Agenda meetings and minutes did not allude to fiscal policy questions. There were literally no policy statements, documents, or other artifacts to reinforce a fiscal reality within the division.

Formal Organizational Units. The dearth of fiscal policy artifacts was reinforced by the absence of any formal organizational units charged with the management of fiscal policy. In September 1975, divisional management articulated the need for a formal in-service training in fiscal matters within the division.³⁶ However, even this minimal attempt at formalizing a mechanism for reinforcing a fiscal reality within the division never came to fruition.

Concepts and Vocabulary. In a retrospective interview, Gibber remarked that before the fiscal policy project, key personnel lacked "even base-line definitions of terminology" as well as a more sophisticated appreciation of the fiscal concepts that underpinned the terms:

"I feel as though I have personally learned a lot about the fiscal aspects of the implementation effort. Like, what does allocation mean? What does it mean when you say you can 'allocate certain costs over prototypes'? What are 'ceilings'? What are 'reimbursement windows'? --All of these terms, even base-line definitions of terminology. Also conceptually appreciating the importance of the relationship between fiscal and program studies--how a program decision could ultimately impact on our reimbursements limits within prototypes. In my own case, I had just been paying lip service to (this understanding). Now we are getting some insight into how what people try to do programmatically could go down the tubes if they don't get a handle on costs." ³⁷

Informal Interactions. The only mechanism working to maintain fiscal reality within the division was informal interactions centering on the activities of Joe Flahive and Dave Keeler. These were the only two persons knowledgeable in fiscal matters and from time to time they would raise issues that needed the attention of divisional managers. Issues brought to Keeler's or Flahive's attention usually traveled via informal relationships that they maintained with Leo Turo, the chief fiscal expert in the entire department, or with local business agents and special education administrators.

In sum, prior to December 1975 neither a well-formed fiscal reality nor any of the mechanisms necessary to sustain such a reality existed within the Division of Special Education. From a cognitive point of view, two important tasks were necessary. First would be the creation of a coherent fiscal reality on the part of several key decision makers within the division. Second would be the restructuring of artifacts, formal organizational units, concepts and vocabulary, and other mechanisms necessary to maintain a socially shared fiscal reality.

6.4 INITIATING CHANGE IN INDIVIDUAL COGNITIVE REALITIES

By April 1977, a fiscal reality was more fully developed within the division. Fiscal guidelines authored by divisional personnel existed. Fiscal training seminars conducted by special education personnel occurred regularly. Special education personnel were agitating for changes in the funding of the law. An organizational unit existed whose sole purpose was fiscal policy.

What had happened in the interim? How did individuals learn? How was individual learning shared, creating a larger socially shared awareness? This section is concerned with the question of how did individuals learn. More specifically, the section attempts to factor out and focus on the contribution of the system dynamics model and the broader modeling project to individual learning. In particular, the emphasis is on how Andersen, the analyst, and Audette and Gibber used the model to learn.

A Framework

If anything is known about individual learning, it is that individuals learn in myriad ways and that only several of these ways are even partially understood.³⁸ A definitive discussion of the learning of several key managers around fiscal policy issues would be both pretentious and not possible. Figure 6.5 presents a simplified schema of a cognitive learning process involving an individual, a formal model, and the relevant policy environment. This schema serves to structure the discussion that follows.

In Figure 6.5, the individual who is learning is a model builder. This restriction will be relaxed shortly. The principal source of information for the model builder comes from the policy operating environment.

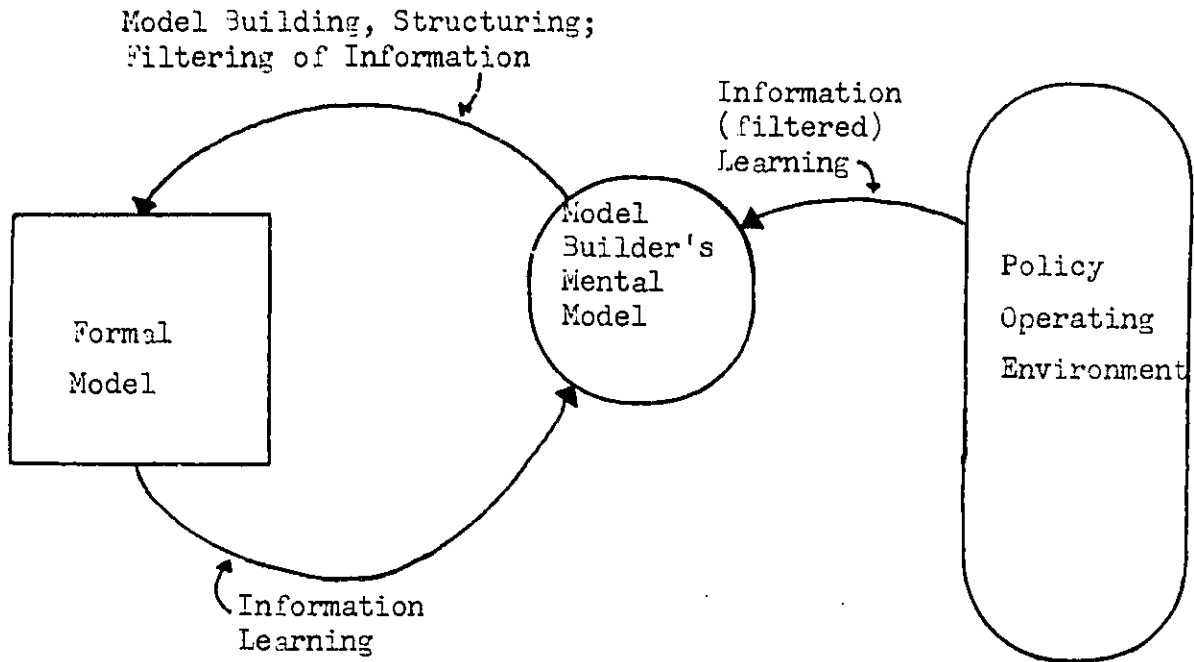


Figure 6.5: Schema depicting interactions between an individual, a formal model, and the policy environment.

By close attention to the policy environment, the modeler learns about the details of that environment. In observing the environment, the modeler selects a limited range of information for his active attention. These selection or filtering mechanisms are the same sort of cognitive filters that are active in most individuals.³⁹ Based upon the information perceived from his environment, the model builder constructs a formal model. The construction of a formal model involves even greater filtering and structuring of learned information as the details of the case at hand are constrained to fit within the prior structure demanded by the particular modeling technique. The payoff from constructing a formal model is that the model builder can learn more about the policy environment by gleaning information from the behavior of the model. In many ways the behavior of the model will be less intricate than that of the real operating environment, focusing on one or two well-defined aspects of the broader policy environment. Information learned from the model may guide the model builder to seek out different information from the policy environment to improve his understanding or to validate certain aspects of the formal model. For now we assume that the only action taken by the model builder is the construction of the formal model as an aid to his own learning processes.

Figure 6.5 leads to five interesting topics necessary to understand how a lone model builder uses his model-building technology to learn about a policy environment:

- 1) Environmental events. Since the primary learning comes from the operating environment, any discussion of individual learning must treat the salient characteristics of the policy environment and the individual's

relation to that environment. What is his role with respect to that environment? How much of her time does she spend directly dealing with that environment? What are the "hot topics" within the policy environment? Who are the actors principally responsible for dealing with those topics?

2) Motivation.* Two types of motivation are important. First, why is the individual motivated to study the problems particular to one section of the policy environment versus those arising elsewhere? Second, why does the individual choose to use a model to study the problems of his choice? This second aspect of the motivation question will become more important when the individual in question is not a model builder.

3) Mode of Learning.* Different individuals learn in different ways at different times. In this particular context we are interested in how an individual best learns about a specific problem area and how a formal model may facilitate those specific learning processes.

4) Model versus Non-Model. A difficult puzzle will be determining to what extent learning experienced by an individual can be attributed to the formal model and to what extent learning can be attributed to information gleaned from the policy environment. This question will be especially tricky, since information obtained from the environment is used to build the model. Furthermore, in practice, what is precisely meant by "the formal model" is somewhat fuzzy. One could consider the model to be

* In reviewing a draft of this chapter, several managers reported that the discussion of motivation and preferred styles of learning were so simplified as to verge on caricatures (although they thought that the caricatures were not inaccurate). This distortion through simplification is unfortunate. However, the purpose here is more to display the diversity of individual styles of learning, not to accurately portray in detail the learning style of any individual.

only a set of mathematical equations with an attached simulation or other form of output. To the non-technical observer, raw equations or output are not particularly informative. A definition of the formal model could be broadened to include policy reports generated as a secondary result of the more narrowly defined formal model. Or the most amount of learning could occur during the model-building process. Once the process of building the model is completed, the formal model with all of its secondary documentation could then be thrown away because the bulk of the learning would already have occurred. Although it is not possible to settle the question of whether learning is attributable to the modeling or non-modeling activities, this question certainly must be addressed in any discussion of the contributions of formal models to cognitive decision-making processes.

5) Time Dimension. A final topic of interest is the timing of learning. The first attempts to study a problem usually consist of the accumulation of facts and disjointed insights. Later on these insights become synthesized into more general descriptions of the problem and its causes. Formal modeling activities may be more or less important at each of these various stages of learning.

The five topics enumerated above would be sufficient for structuring a discussion of how formal models contribute to individual learning if we were to limit our attention to the case of a model builder using a model to enhance his own personal understanding. However, the more usual case finds such a model builder interacting with another member of an organization, usually referred to as a "decision maker."

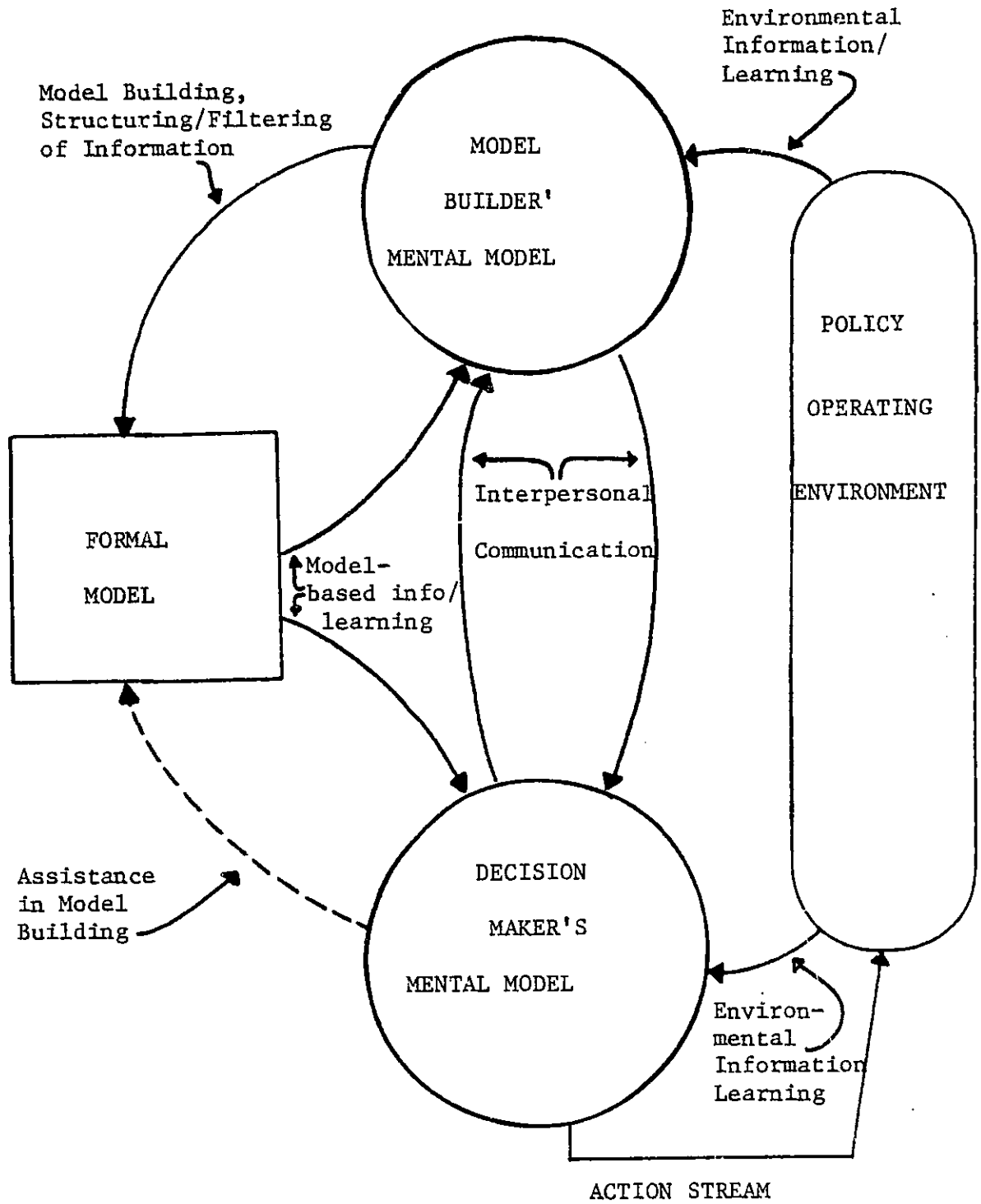


FIGURE 6.6: Schema Depicting Interactions Between Model Builder, Decision Maker, a Formal Model, and the Policy Environment

Figure 6.6 shows that the model builder receives policy information from an important additional source, interpersonal communication with decision makers. Decision makers receive information from three sources as well: directly from the policy environment, through discussions with the model builder (and other decision makers), and from the formal model itself. In addition to receiving information to enrich their mental models, decision makers assist in the direct construction of the formal model and can take direct action intended to alter some aspect of the policy environment. In the final analysis, a discussion of models and cognitive decisionmaking must be interested in the impact of formal models on the output action stream of decision makers.

The five topics used to structure discussions around Figure 6.5 still apply to discussions of Figure 6.6. However, in this elaborated case, two more topics must be considered.

6) Model versus Modeler. When a decision maker learns from the modeling effort: Can this learning be attributed to the formal model itself, to some secondary document based upon the model, or to personal interactions between the modeler and the decision maker? Is it the insights generated by the model or the persuasiveness of the model that led to the insight? This distinction will often be difficult to make because the modeler may be talking about the model. Again, it will not be possible to ultimately answer this question, but it must be addressed in any discussion of the contributions of formal models to cognitive decisionmaking.

7) The Action Stream. A final topic is the ultimate impact of the modeling effort on the actions of decision makers. This too is a difficult

question to address. How have the actions of decision makers changed due to learning and what has been the impact of the model on those change processes? Or perhaps, can a modeling effort significantly change how a decision maker views a problem area? These are the types of questions that need to be addressed under this final topic.

The Model Builder as Learner

One unintended consequence of most any modeling project is that the modeler, usually an outsider to the organization, learns quite a bit about the organization and problem under study. That is, the modeler, acting like a sponge, soaks up the immense amount of information necessary to build a model. Of course the sponge-like activities of the modeler have practical utility only if the modeler can structure that information in some interesting way and "wring it out" back into the organization. However, in this section we are primarily interested in the learning processes experienced by the modeler in the case study. Later we examine how that learning became plowed back into the organization -- hopefully to promote improved policies.

Motivation. Andersen's primary motivation was to build a system dynamics model. At the beginning of the project, he had completed two years of doctoral study in the system dynamics methodology and was eager to apply the methodology in an extended case within a public sector bureaucracy. From this application, he vaguely hoped that a thesis topic would emerge. His work with the accounting procedures in the division during the first phase of the project provided him with good entry into the organization as well as some working knowledge of the financial aspects

of 766. He was especially interested in educational policy and had previously worked with the implementation of Chapter 766 in a local school system.⁴⁰

Early on in the first phase of the Fiscal Policy Project, Andersen became convinced that the mechanism for funding reimbursements to local cities and towns for special education was an important area that was receiving inadequate attention within the division. By September 1975, he had become convinced that the reimbursement problem was highly amenable to analysis using the system dynamics methodology.⁴¹ However, at that time he could not clearly articulate what were the central problems that such an analysis would address.⁴² Hence Andersen was in a position of pushing for the development of a system dynamics model and at the same time needing to gather more specific information about the reimbursement process so that he could more clearly focus the model.

Throughout the spring and summer of 1976, Andersen experienced a tension. On the one hand he wanted to produce model-based results, and on the other hand he wanted to work on problems that were considered of central interest to divisional managers. Although he found the modeling exercises to be very insightful, he could seldom share his excitement with operating managers. Gibber retrospectively commented on Andersen's initial ambivalence about discussing policy issues directly in terms of the model:

"I think that the discomfort that you felt (talking about the model) was understandable, because I don't think that anybody, outside of several Fiscal Policy Group meetings, initiated discussions with you about the model. So what else could you be left with but some kind of inhibition about raising it. And the way priorities are ordered around here, once we got the Fiscal Policy Group started, there wasn't much time for intellectual discussion. (The model) is kind of an 'add-on' goodie that a lot of us would like to understand better." 43

This tension between conflicting motivations was relieved in September 1976 when a separate think tank group was assembled to explicitly consider issues raised within the model.

Environmental Factors. The key elements of the special education fiscal environment both within the department as a whole and the division in particular have been described elsewhere.⁴⁴ An unusual feature of Andersen's role with respect to the fiscal environment was that he was under contract to spend 100 percent of his time within the division concentrating on fiscal policy questions. Throughout the course of the project, he continued to work from two to three days per week within the division. This relatively large allocation of attention to fiscal matters stood in sharp contrast to other divisional managers who, because of other demands on their time, could often spend only 5 percent or 10 percent of their effort on fiscal matters.

Because Andersen was motivated to build a system dynamics model of reimbursement dynamics, he began to pay close attention to the crisis surrounding the fiscal year 1974-75 reimbursement computations as soon as it began to break. By December 1975, he had surfaced a list of issues that he wished to pursue, but at that time he was lacking both a detailed knowledge of these issues and an audience within the division. Based upon

the advice of Alan Frohman, senior consultant during the first phase of the project, Andersen shifted his focus of interest to the school management services effort (SMS) under Fred Williams. During these sessions he learned most of the substantive issues surrounding the reimbursement of special education. This knowledge was the detailed "nuts and bolts" awareness of how the reimbursement system actually worked. The broad policy implications of this detailed knowledge would not become clear until the fall of 1976, following a prolonged series of working meetings hammering out the issues and at times attempting to conceptualize reimbursement problems in terms of a formal system dynamics model.

Implicit Theory of Learning. Andersen's most effective method of learning an area was decidedly "bottoms up." When first confronted with an area, he would immerse himself in a flurry of detail until he was thoroughly confused. This confusion, marked by the proliferation of detail, triggered a search for organizing themes or structure. This search for structure involved a self-conscious attempt to put some distance between his own thinking and the flurry of detail. At the end of this structuring process, he would typically draft a memo, either to himself or to divisional managers, attempting to outline the structure that he saw through the detail. Sometimes these structuring memos would take the form of an agenda for an upcoming meeting, sometimes they would form a list of issues for further consideration, or sometimes they might contain a sketch of model structure or some points to be made in a short position paper.⁴⁵ Andersen relied heavily on these structuring memos to guide his own understanding of a problem area in an attempt to gain a broader

glimpse of the fiscal policy issues facing the division. The detail immersion process usually took the form of attending meetings or scouting interviews where the substantive details of an area were under discussion. The vast majority of Andersen's time on the fiscal policy project was spent in meetings or interviews where substantive issues were under discussion. 46

Model versus Non-Model. Without a doubt, the model contributed more to Andersen's understanding of fiscal policy issues than to that of any manager within the division. Since Andersen was most thoroughly trained in thinking in terms of the model, he probably spent more time thinking in such terms than did any other manager (to a large degree he was pushing this way of thinking within the division).

Even so, it is extremely difficult to say what learning, if any, can be attributed to the model and what learning should be attributed to non-modeling activities. In October 1976, Andersen noted that he felt that the broad fiscal policy implications of the study were apparent to him even though he had not set down a single line of computer code on the final model or made a single policy simulation.

Two weeks following this observation, the final model was up and running with most of the policy runs complete. Four weeks after that, a formal position paper, reproduced as Appendix A, was drafted and ready for review and further development by the think tank. Following Gibber's line of reasoning, it seems possible to argue that the model and the policy simulations were a kind of "add-on goodie" that did not contribute significantly to learning.

However, explaining away the contributions of the model as frosting on the cake does not work for at least three reasons. First, during the fall of 1976, the model had served to explicitly structure a series of broadly based policy discussions within the think tank. On October 15, the think tank had essentially finalized the structure of the system dynamics model as it appears in Appendix A.⁴⁷ On October 25, the think tank had spent several hours examining the model's structure and speculating on the policy implications of that structure.⁴⁸ Finally, on October 28, the Fiscal Policy Group entertained an informal presentation based on the merging model structure and had discussed the practical implications of the structure in terms of next steps.⁴⁹ These meetings had provided Andersen with an adequate opportunity to think through the fiscal policy system even before he resorted to simulations. Second, the activities of the fall of 1976 were based upon quite extensive model-based thinking during the previous summer and spring. A preliminary system dynamics model SPED1, had been constructed and analyzed in the early springtime.⁵⁰ That model had formed the basis for two days of extensive discussion in May 1976. Third, the SPED1 modeling exercise was itself backed up by over six months of extensive model-based thinking (and presumably some learning) on Andersen's part.⁵¹ If the model itself were frosting, there would appear to have been quite a bit of cake under it.

However, it is true that the model contributed very little to the learning of the details of fiscal policy that Andersen experienced. The details of fiscal policy were learned through meetings and interviews that any analyst could have attended to attain the same base-line of detailed knowledge.

The model was important as a normative frame that gave specific prescriptions concerning how information should be structured and made into coherent wholes. The system dynamics methodology provided the modeler with a set of colored lenses that directed him to look at the world in a certain fixed pattern. Confronted with a flurry of detail, it provided the critical organizing perspective that dictated what was and what was not important.

Most any formal modeling methodology performs a similar function. It provides the modeler with prior clues as to what to look for. However, other methodologies such as linear programming or input-output analysis would have directed the modeler to study different problems and to focus on other aspects of the problem area.⁵² Similarly other non-quantitative perspectives provide clear-cut organizing perspectives for making sense out of a flurry of seemingly undifferentiated detail. An organizational change perspective or a cost-benefit perspective presumably would have directed an analyst to concentrate on much different phenomena than would a system dynamics perspective.

The system dynamics perspective served to frame Andersen's thinking in two broad phases. In the first phase, the system dynamics methodological priors helped to set the broad arena of his inquiry. In the second phase, by iteratively thinking about the details of the real system and means of representing that system in a model, the broad arena of inquiry was "shaken down" into a few well-focused problems that he used to structure his thinking about fiscal policy. Each of these phases is described in more detail below.

The system dynamics methodology directs the modeler to define problems in terms of the behavior of several "important" variables over time. Furthermore, the modeler is obliged to hypothesize the structure that causes this behavior before his problem definition is complete. When specifying structure, the modeler is directed to look for closed loop feedback effects. That is, the boundary of his system must be drawn large enough to contain all of the structure that causes the problem behavior. The detailed structure must consist only of a small set of levels or state variables that describe the system at any point in time and their rates of change. The system's levels are connected to the system's rates through closed feedback paths.⁵³ By September 1975, Andersen had decided that the principal variables of interest to him were the statewide total reimbursements for special education over a five- to ten-year time frame. Once he had made this decision, the broad arena of inquiry was fixed. The boundary of the study would have to be broad enough to include the fundamental causes of rapidly increasing special education reimbursements. The model would have to track the growth of program variables (pupils and staff) as well as dollar variables. There would undoubtedly be interconnections between program variables and fiscal variables. This first phase, the definition of a problem arena, was completed by October 1975.

The second phase of inquiry -- condensing and specifying this broad arena into several specific problems with more concrete policy implications -- took over a year. There were two aspects of this second phase. On the one hand, Andersen needed a much more detailed knowledge of the system. On the other hand, he needed to make some decisions concerning how to best abstract and represent that system. For example, in earliest

sketches of model structure, he had over eight separate levels representing fiscal variables. In the SPED1 model, the aggregate budget level was represented by a single level. In the final version of SPED2 developed, he finally settled on a two-level representation. These aggregation questions were important because each level of aggregation implied a different level of precision or generality in the overall problem focus. Furthermore the appropriate level of focus could only be assessed based upon an intimate working knowledge of the special education reimbursement system and the specific problems inherent in that system. There was a continual interplay and tension between a need to understand the real world system better and a need to abstract and structure the detailed knowledge that came from looking at the world system. This interplay can be an important source of learning. Looking at the real system provides the substance necessary to abstract and structure. In turn, the process of abstraction and structuring provides direction to the modeler's search for relevant facts.

In sum, the process of thinking about a formal system dynamics model would appear to have had an important impact on structuring Andersen's thinking and facilitating his learning in the field of fiscal policy analysis. The model provided a normative framework that guided his thinking both in the early stages of problem finding and in the latter stages of refinement and specification of the problems under study. The available evidence suggests that the actual simulations added relatively little to his understanding but may have served some function in communicating his ideas or gaining interest in the project. His ability to learn from

the modeling effort is probably due to his prior familiarity with the basic concepts of the system dynamics methodology and his prior belief that looking at fiscal policy within the division through the lens of a system dynamics model would be a useful exercise.

R.H. Audette: Fiscal Learning and the Modeling Effort

During the third phase of the fiscal policy project, Associate Commissioner Audette became actively involved in the think tank, participating in the construction of the system dynamics model. Although Audette was not involved in the day-to-day operational development of policy options, his active participation and interest in the project was critical to sustaining the momentum of the fiscal policy project. Gibber saw the modeling effort as one of the important factors that insured Audette's interest in the fiscal policy project:

"The modeling stuff excited Bob as much as anything, because he thinks conceptually -- because the model's design is really a conceptual framework. It was one of the initial motivators for him to buy into the whole fiscal effort, recognizing the importance of it." 55

Here we are interested in how the modeling effort helped Audette to learn the fiscal policy area, thereby providing an additional momentum to sustain the overall fiscal policy project.

Motivation and Environment. Reviewing the division's progress over the three years since the implementation of the law, Levine saw that until October 1976, the emphasis within the division had been on providing programs and an ability to monitor program compliance with the law. Since these areas were getting under control, there was free energy within the division to move on to other (fiscal) issues. Furthermore, pressures were

mounting within the legislature and at the local level demanding more divisional attention to fiscal issues:

"I see legislative people, the league of cities and towns, the governor, and so on getting concerned and saying 'Hey wait a minute, aren't things really getting a bit out of hand?' Why is this (fiscal jumble) happening? What can we do to either stop or justify this dollar drain? And people were asking some really hard questions so that some very strong feelings began to surface to the effect that if we didn't begin to manage these issues, someone was going to manage them for us. Since we were not ready to say that we can't manage them, we had to take a look at them." 56

Audette was feeling these pressures from the division's fiscal environment and was aware of a need to allocate more of his time and attention to fiscal matters. But he needed a specific context within which to focus his efforts:

"I think that there was no lack of active interest on my part in the first place. What there was was a lack of a sense of how to attack the issue. There were some complex problems around the fiscal policy and reimbursement issues that really had not seemed to be things that I could deal with. Not in terms of native intelligence, but I just didn't know how to begin grappling with them. They seemed foreign to me. What I think that the modeling has done is to provide a context within which I could look at those problems." 57

Specifically, Audette felt comfortable looking at fiscal policy issues from a system's point of view. Levine noted that he probably enjoyed the unified view of fiscal and program issues provided by the system's point of view. Furthermore, considering programs in terms of dollars gave a solid "bottom line" to program considerations, allowing more concrete comparisons between different programs. ⁵⁸ Adding to the excitement of taking a "systems viewpoint" was the interest of participating in a model-building exercise. Audette noted:

"I find myself a little bit seduced by the simulation. It was sort of interesting, 'sexy.' Particularly since the simulation came out the way we thought they were going to come out. ...Just seeing it was exciting. There was a certain amount of gadgetry, gimmickery with the simulation." 59

Audette was attracted to the modeling effort because it gave him a convenient and exciting way to think about a series of important problems that had been building within the division for some time. The "big think" aspect of the system dynamics approach was compatible with how he preferred to learn. Furthermore, due to other demands on his time, Audette was able to devote less than fifteen percent of his total time and attention to fiscal policy matters.⁶⁰ The think tank exercise appeared to provide him with a quick overview of the most important fiscal issues in a relatively brief time.

Preferred Mode of Learning. Audette was a decidedly "top down" thinker. When faced with a problem, he would begin by articulating overall goals and objectives in most broad terms and would then proceed to detail what present and future steps could best attain those goals. For example, during one of the first meetings of the think tank, Audette articulated a set of eight broad goals that should guide fiscal policy development. He saw the goal of the think tank as coming up with concrete steps and options that would allow the attainment of those goals. A recurring problem with Audette's top down method of thinking was finding ways to bridge the gap between a broadly stated goal and specific steps grounded in how things currently operate. Audette noted that "sometimes when the problem is particularly hard to deal with, there is the need to bridge the distance between the idea and where you are."⁶¹ In order to

deal with this problem, Audette found it useful to rely on an external referent -- some person, group, or concept outside of his own thinking that would allow him to self-consciously reflect on how he was thinking:

"What I find myself doing is, when I'm having a problem and want to think it through, I need that external elaboration. Sometimes I even find myself talking to myself so I can hear what I am saying. Or I'm talking to you and just hearing myself talk to you helps me to think through something that I couldn't get a handle on." 62

As we shall see later, Audette found the modeling project especially useful because the model-building process was highly compatible with his own preferred patterns of thinking. As he noted:

"What your (Andersen's) working with me on this project did is that it provided that elaboration, a context to elaborate, that I couldn't have done by myself." 63

Action Stream. The overall fiscal policy project did have some observable impact on how Audette went about his job. He felt as if he had a handle on many of the complex fiscal issues that were besieging special education, and his presentations and discussions began to reflect a fiscal component.

As a natural reaction to Audette's taking a more active interest in fiscal matters, he observed that persons external to the division began to include the division more and more in fiscal decisions. Little by little, as divisional managers exhibited greater fiscal knowledge, they came to be consulted more often concerning fiscal concerns:

"Outside of the division there is a healthy respect now that says you do not create fiscal policy or don't tamper with fiscal policy as it affects special education without the program people really having a primary decision-making role.... I think that this is very, very different from what we have had. I think it is gradual. I don't think we are entrenched by any stretch of the imagination, but we weren't even in the game before." 64

At a more fundamental level, Audette claimed that his participation in the modeling effort gave him a new outlook that could be transferred to some old problems with which he had been grappling for some time:

"In a sense, I think that the model was terribly important to me. Frankly, it represented a very exciting breakthrough for me....What I think that I got out of that, even beyond the issues we have addressed, was sort of a series of 'protocols' for how to think about certain kinds of problems that I did not have before. And, it was as a result of that (exercise) that I could address some new problems in the future with tools for thinking them through and for having other people do tasks that I would not have had before." 65

When pressed further about these "protocols," it was not clear whether Audette was describing some new and different way of thinking about problems or whether he meant that when addressing new problems he could now add a fiscal dimension to his thinking. That is, in the future he would add one more broadly defined goal that would be concerned with the fiscal performance of the system when specifying overall system goals. In any case, as a result of the learning emanating from the fiscal policy project, Audette appeared to incorporate more of a fiscal dimension into his thinking about program policy.

Model or Modeler or Non-Model? There are several reasons why Audette may have responded so enthusiastically to the modeling project. Next to the modeler, Audette was most attracted to and hence became most involved in the modeling project. Second, Audette was attracted to the modeling project because the process of model building seemed to be highly compatible with how he preferred to think about problems. The system dynamics methodology claimed to take a systemwide perspective, and that notion appealed to his desire to think in terms of system goals at the broadest

level. More specifically, he found that the way that the modeler structured the model-building activities within the think tank seminars was highly compatible with his own preferred problem-solving patterns:

"I have thought through problems that were maybe as complex as the reimbursement one, but I did not pay so much attention to the process of how I thought it through. What this exercise with you (Andersen) has done is to cause me to pay attention to what it is I did and what it is that others did as we began to arrive at a conclusion....When we talked the thing through, you would chart some ideas. You would come back and force us to ask what we were doing. You applied a rigor to us that normally we normally do not do." 66

Apparently the most important aspect of the modeling project for Audette was that it provided him with structured visual feedback on his own thinking. By being able to sit back and observe how he was thinking, he could learn an area more effectively. In his own words:

"What your working with me on this project did is that it provided that elaboration -- a context to elaborate -- that I couldn't have done by myself and you left me not only with some solutions around the fiscal issues but with the capacity to probably do something like it again." 67

However, providing structured feedback is not an activity unique to system dynamics modeling. To what degree could one assert that this feedback was particularly helpful because it was structured around the system dynamics methodology? Audette did note that the most helpful organizers for his thinking were the system dynamics DYNAMO flowcharts. These visuals provided him with a concise summarization of some fundamental fiscal-program relationships. That is, these diagrams were the primary vehicles that he used to capture the "frame" or "context" presented by the modeling effort.⁶⁸ In another interview, Audette was asked to rank which

of the model-building activities he found to be most helpful in his own learning about fiscal policy. Consistent with the earlier observation, he ranked the construction of visual diagrams (causal loop diagrams and DYNAMO flow diagrams) as the most helpful activity that occurred. The second most important activity was the rereading and reinterpretation of the diagrams developed in the previous session. In this activity, the diagrams were serving a sort of "memory" function, allowing the think tank discussion to pick up quickly where it had left off the last time. The third most helpful activity for Audette was discussion within the group. In these discussions his own thinking was clarified by interaction with other members of the group. Of least importance was the actual performance of computer simulations:

"Simulation was the lowest---the simulations were important but they did not cause the breakthroughs in solving the problem. They were only testimony to basically what we felt. They were like a form of proof although certainly not proof." 69

Audette speculated that different persons learned in quite different ways and the aspects of the project that he found to be most helpful may be totally due to the "peculiarity of his own personality and the way he thinks." He believed that the strategy that was most helpful for him in learning from the model would not necessarily work for another person who preferred to learn differently:

"My guess is that any approach to help people's half-conscious ways of thinking through complex problems has to operate on the initial assumption that you don't know what the best way is for that individual to learn, and so you don't go in a unisensory way. You find out (the best way) as you are going along." 70

In sum, it would appear to be safe to assert that Audette did learn

quite a bit about fiscal policy from the overall project. His activities as a manager were modified somewhat by this learning as his presentations and policy recommendations took on a decidedly greater fiscal component. Audette is clearly willing to attribute much of his increased fiscal learning to the model-building project per se (at least in interviews with the modeler). In spite of his willingness and ability to clearly articulate how he thinks and learns, it is not possible to unequivocally ascertain exactly how the model did contribute to his increased understanding of a fiscal policy reality. The most important function of the modeling effort would appear to have been the creation of visual structured feedback within the think tank sessions. The actual computer equations and simulations were the least important contributor to his overall learning.

H. Gibber: Fiscal Learning and the Modeling Effort

Gibber's relationship with both the modeling effort and the overall fiscal policy project was different from that of Audette. Gibber never actively participated in the development of the system dynamics model. On the other hand, he was instrumental in the early formation of the Fiscal Policy Group and orchestrated its progress through most of the third phase of the fiscal project. He was much closer to the operational details of fiscal policy development but was not as close to the process of model design and abstract policy formation that took place within the think tank.

Motivation. Gibber had little fiscal training in his background. However, he was coming to realize that in an era of tightening budgets, fiscal matters would play an increasing role in the determination of educational policy. During his nine years in the field of education, he had

never seen close coordination between fiscal and program concerns.⁷¹ The manager of the future would be the one who could skillfully handle both fiscal and program issues. Against this rather diffuse understanding that fiscal concerns were becoming more important was Gibber's more pointed realization that with respect to Chapter 766 what "people try and do programmatically could go down the tubes if they don't get a handle on costs."⁷² Clearly future managers of education in general and special education in particular must come to understand fiscal matters. Gibber had a rather clear-cut professional motivation to become involved with fiscal policy concerns -- he understood the growing importance of fiscal concerns.

The fact that he never became actively involved in the process of model development reveals that Gibber was not as strongly interested in modeling per se as he was in the broad field of fiscal policy. Unlike Audette, he did not find the modeling project to be "sexy" and "intriguing." Instead he tended to hold that aspect of the project off at a distance, considering it somewhat "blue sky" work:

"It (the modeling effort) had kind of a subliminal effect for me, and I'll project and say for other members of the Fiscal Policy Group in that we said, 'Jesus, this is really kind of heavy conceptual stuff.' It initially seems mystical. I know it is important; it is this great intellectual challenge -- I want to take it upon myself to understand it." 73

He was more interested in the practical results of the modeling effort and less interested in becoming involved in the details of model construction.

Method of Learning. Whereas Andersen's most effective method of learning was "bottoms up," beginning with the details of how things were, and Audette's most effective learning came "top down," starting with an

articulation of broad goals, Gibber learned most effectively in an entirely different mold. He sought to bring the right people together in the right place and to learn from the interactions thus catalyzed. His skills were in the management of such groups and in the dissipation of conflicts that might arise. If a meeting were to wander from task, he would jump in and save it from impending confusion. In such a catalytic and facilitating method of learning, not only would the individuals present benefit from the discussion as well as the skills and capabilities of the discussion's participants. Through this learning he would be better able to catalyze future discussions.

Environmental Factors. Through October 1976, only a small fraction of Gibber's time and attention was diverted to the division's fiscal policy environment. For the months of September and October of 1976, he estimated that only 5 percent of his overall attention was spent on fiscal policy concerns, the bulk of the remaining attention being spent on the management of federal funds, coordination of the central office and regional office staff, coordination of the division's "level II" policy committee (consisting principally of the bureau directors), and routine office management.⁷⁴

Although his time and attention was being drawn in many different directions, Gibber along with other managers within the division sensed the increasing importance of the fiscal aspects of 766:

"...we were all sensing that this was a high-cost program, that the program managers did not understand the basic fiscal concepts and terminology and we all kind of intuitively knew that we had to get a handle on the increasing costs as we became more able to develop programs." 75

Furthermore, Gibber noted that early work with the fiscal policy project had:

"reinforced a philosophy on the part of key decision makers in this organization that special education was getting too big too fast and what it should be is something smaller focusing on serving unserved kids and kids with more serious problems." 76

However, Gibber's principal skills lay in the area of coordinating and facilitating the activities, and he learned about an area through his coordinator's role. So long as there was little ongoing activity to coordinate, it mattered little how aware he was of the fiscal environment because other more pressing activities would divert his attention from the fiscal policy area, preventing him from learning the area.

As fiscal activities picked up their pace within the division during the third phase of the project, they created a "critical mass" demanding more and more of Gibber's attention as coordinator and facilitator. By December 1976 and January 1977, Gibber estimated that approximately 20 percent of his time and attention was being devoted to fiscal policy matters, a fourfold increase from the previous September. The increased pressure from the fiscal environment leading to increased activity within the division drew more and more of Gibber's attention to fiscal issues. And from his involvement as coordinator, he learned more and more about fiscal policy.

Action Stream. The overall fiscal policy project did have an observable impact on Gibber's activities as a manager. That is, he began to spend an increasing fraction of his time coordinating and developing projects that had fiscal as well as program implications. Early on in

phase II of the project, he was instrumental in the formation of the Fiscal Policy Group. With Gene Thayer, he was instrumental in drafting the first set of guidelines that got the division involved actively in fiscal policy for the first time. Throughout phase III of the project, he spent considerable time coordinating the internal workings of the Fiscal Policy Group as well as coordinating its work with other fiscal units within the department. Toward the end of the third phase, Gibber began to make presentations outlining the fiscal underpinnings of the 766 legislation both to the department's regional personnel and to groups external to the department. Finally, Gibber decided to focus his own doctoral research on the funding of Chapter 766.

As with Audette, Gibber's involvement with the fiscal policy project did not significantly change how he managed or how he preferred to learn. Instead the substantive focus of what he managed and what he learned about shifted from program to fiscal matters. As a manager he still operated as a coordinator and facilitator; he still preferred to learn from the discussions that he helped to catalyze. However, after the project was completed, he had a better notion of how the world of fiscal policy was structured and he felt more comfortable in applying his skills to fiscal questions.

Model or Modeler or Non-Model? Gibber learned very little directly from the system dynamics model per se. Consistent with his preferred style of learning, when he learned from the modeling effort, he learned principally from personal communications with the modeler. As he stated succinctly, "the benefit of what you (Andersen) were doing with the model

was that it framed the issues and principally enabled you, because you understood it and what it said, to work with us."⁷⁷ His learning was facilitated principally through the "teaching component" of the effort whereby the modeler explained the implications of the model to the Fiscal Policy Group.⁷⁸

When pressed to articulate what contribution, if any, the model did make toward his understanding of fiscal policy, he responded that the model helped "to frame" the discussion:

"I think that it (the model) has kind of framed a lot of the concepts we have talked about. I think that this framing process is very important especially when you are dealing with a new subject area for people." ⁷⁹

In an interesting series of exchanges with Andersen, Gibber indicated that to him the "frame" provided by the model consisted mostly of a broad sketching of issues as summarized in the graphic output from the model and the DYNAMO flow diagrams:

ANDERSEN: "I want to ask you about that frame. What did the frame look like?"

GIBBER: The frame looked like -- I'm really testing my recall now -- what it did was make the point that over time, unless some controls were established there was always cost escalation. That over time, unless there were some cost controls established, this is what 766 was going to look like (sketching an exponential growth curve with his hand)...I can picture very clearly what the diagrams looked like (indicating the computer output) ...I guess I can relate better to the diagrams than I can to the conceptual underpinnings of the system theory... There was something else. Consistent with the theory, I cannot recall the specific pressure points, but I remember that consistent with the theory you laid out some options and some concepts like (pause) something having to do with the influx of students into the system -- how many kids were going to be referred. It is funny the mental process I'm undergoing now is that I keep flashing back to those diagrams and trying to see the words that were in the boxes.

ANDERSEN: Which diagrams? The ones that showed output from the computer??

GIBBER: No this is a different set. This is from the earlier things that you shared with us. I just know that they (referring now to DYNAMO flow diagrams) showed the relationship between costs and program decisions. And it really made the point to me. I don't remember the terminology, I don't remember the specific variables. But it showed me the relationship between programmatic decisions and fiscal implications of those decisions." 80 (emphasis added)

For Gibber, who did not participate in the model's construction, the model was not a device that helped him to think creatively about the field of fiscal policy. Instead, the model was a convenient heuristic device that helped him to frame some important issues in his discussions with the modeler. Beyond this vague framing function, wherein the model served mostly as an audiovisual aid, he learned little from the model itself. Consistent with his learning style, Gibber learned most about fiscal policy from informal discussions with the modeler and other members of the Fiscal Policy Group who understood the details of the funding of Chapter 766.

6.5 DIFFUSION AND CRYSTALLIZATION OF COGNITIVE CHANGE

The previous section has examined how the model contributed to Audette's, Gibber's, and Andersen's individual mental models. That section painted a scattered pattern. Learning was seen to result from a complex matching of an individual's motivation, preferred style of learning, familiarity with the modeling methodology, and his or her role with respect to the model and the fiscal environment.

Holsti has noted that a critical gap in the cognitive literature on decisionmaking is a cogent articulation of how individual learning and perception is connected to or in some way influences organizational outputs.⁸¹ The diffusion and crystallization of socially shared realities is one such bridge between individual cognitive factors and organizational factors. Innovations originating within the mind (usually of a key manager) become crystallized into larger operating realities, eventually resulting in organizational action. This section is concerned with mechanisms that promote the diffusion and crystallization of socially shared realities -- a critical bridge between cognitive innovations and organizational action.

Artifacts and Organizational Units

Statements of policy, regulations, budgets, agendas, and working papers are all organizational artifacts that serve to crystallize an organization's view of a policy reality. Through these artifacts, individuals can refer to a consistent and "objective" set of documents that define the organization's policy reality. Often these documents are drawn up and maintained by distinct organizational units. Hence the organizational units themselves are primary mechanisms for maintaining the policy

artifacts and hence the organization's socially shared policy reality.

Artifacts and organizational units are the most easily observed and "hard" mechanisms for maintaining socially shared policy realities. Informal interactions between individuals and shared vocabulary and concepts are also powerful but more "soft" mechanisms that insure that individual members of an organization share a common policy reality. These "soft" mechanisms will be considered in some more detail later.

In observing artifacts and organizational units within the Division of Special Education, we divide the discussion into three model-centric categories. Primary organizational units are those whose principal purpose is to consider policy explicitly using the model. Primary artifacts are simulations, flowcharts, and position papers based directly on the model. Secondary groups are not necessarily primarily focused on the model, but model recommendations are implemented through such groups and members of the primary units sit as members on the secondary units. Guidelines, regulations, and other documents drawn up by these units are secondary artifacts. Finally, groups whose membership does not overlap with the primary group, and who are pursuing problems not directly addressed within the model but of indirect interest to the issues within the model, are considered tertiary groups.

Primary Artifacts and Organizational Units. The think tank was the only unit meeting on a regular basis that could be considered a primary one. The modeler was an active member of that group, and the group's primary agenda was to understand and analyze fiscal policy using the model. In the previous section we have already examined some of the ways

that the model-building activities within the think tank contributed to Audette's and Andersen's understanding of fiscal policy. However, Levine, another member of that group, questioned how effective knowledge gained within a small group can be unless it is effectively diffused throughout the rest of the organization:

"The way I see that whole effort is as a very private development on the part of several people who participated in it and other people are dealing with the ramifications of what we were dealing with, but they weren't really a part of it. I don't have a sense that we were really ever able to share that experience with other people; so I don't think that other people will be able to see subsequent things as connected." 82

To Levine's way of thinking, there was a sharp trade-off involved between the creation of new ideas within such a primary group and the broader diffusion of these ideas:

"On the one hand, I've come to realize that a large group will never get to the same point we were at. There are so many individuals with their own points of view who can sidetrack the group. So there is a trade-off and I don't understand how one can deal with it. For persons who experience such groups it is extremely exciting, and one should not stop doing it -- one needs to seize those moments. What one does need to do is to examine how these experiences influence the decisions that one makes once he is outside that group. And that examination is something that we haven't yet done." 83

Unless the learning experienced within the think tank could be effectively diffused to other, secondary, groups within the organization it would be of little practical significance. The think tank group produced a number of documents and reports, primary artifacts, that helped to transfer the thinking that had gone on within the group. Among these were the causal loop diagrams, DYNAMO flow diagrams, computer simulations, and model-based position papers. As we have seen in the previous section, these documents served different learning purposes for different persons;

but for the most part, outside of the think tank, these artifacts took on value only as visual aids to help reinforce points being made in a presentation.

There may be one exception where an artifact created within the think tank did have considerable impact in diffusing the thinking that occurred within that group. Based upon the work within the think tank, Audette drafted a position paper on fiscal policy that was presented to the executive committee. At the executive committee meeting, Commissioner Anrig noted that Audette's proposed strategy of removing the fiscal incentive surrounding special education and emphasizing program monitoring (being program policemen rather than fiscal policemen) was politically dangerous. Audette commented on Commissioner Anrig's reasoning:

"Greg (Commissioner Anrig) doesn't believe that strategy one (removal of fiscal incentives) is salable. He fears that the legislature will only buy half of a load. The argument is that there are strong forces in the legislature that can put together the needed votes to change funding (with the tacit or active approval of the Department of Education), but this same coalition would or could not put together the needed votes to increase the Department's program-monitoring capability." 84

After this setback, Audette argued that it was critically important that the policy document be rewritten so that it could continue to be discussed in public:

"The document should be rewritten...It is important that these issues not be lost -- that we retain the ability to discuss the issues...Some of the issues contained in the position paper should be presented (to the legislature)." 85

The position paper was subsequently rewritten and Audette used it several times in fiscal presentations. The paper was reviewed by the Office of the Secretary of Education⁸⁶ and was the focus of an informal

four-hour discussion by the Board of Education in June 1977.⁸⁷ In a subsequent interview, Audette reiterated the importance of the artifactual nature of the position paper in promoting a divisional position among constituencies external to the division:

"It (the position paper) was a thorough, very thorough review of what the issues were...But that paper is an artifact. Fiscal policy guidelines are an artifact. The shape of the end-of-year report with Peat, Marwick, and Mitchell is an artifact. A whole series of things are artifacts that are related to this -- the work that is going on looking into the new LEA (local educational agency) planning document. There are a number of artifacts that show looking at both program and dollar variables and the relationship between the two." ⁸⁸

Secondary Artifacts and Organizational Units. In several instances, the modeler sat in regularly in meetings of groups and promoted implementation of the results being developed in the primary analysis. Various planning and policy documents were also related to these secondary (with respect to the model) efforts. In these secondary groups, the learning from the model was indirect and less intense but more operational and broadly based.

The most prominent example of a secondary group would be the Fiscal Policy Group. Here some of the thinking spawned within the think tank was mixed with real operating considerations and diffused and crystallized within a wider audience of divisional managers. Andersen, in a not totally conscious fashion, promoted notions being generated within the think tank within the Fiscal Policy Group. In a position paper to the think tank, Andersen had recommended the development of fiscal guidelines as an important next step in developing fiscal policy.⁸⁹ In an exchange with Gibber, Andersen muses about what were the practical outcomes of the

"system's theoretical work":

ANDERSEN: "the theory and its relationships -- what came out of it all? What did it all lead to?"

GIBBER: It led to the development of guidelines. It led to some implementable cost controls. It was the genesis of the Fiscal Policy Group...The relationship also framed or focused what I think has been a key concept underlying all of our work, which is the relationship between special education and regular education....

ANDERSEN: The reason I am interested in talking to you about the theory and the guidelines is that when I sit back and think about the whole effort, I realize that I've been talking guidelines (within the Fiscal Policy Group) like a broken record. When I sit back and am honest with myself, I am sort of puzzled about why I was talking guidelines and not something else....after awhile, say sometime after October, I was very sure that (guideline development) was the one thing we ought to do." 90

Obviously, the informal interactions between Andersen and managers within the Fiscal Policy Group were an important determinant in this case of how knowledge diffused from the think tank to the secondary Fiscal Policy Group. These informal interactions are discussed in more detail later.

In contrast to Levine's earlier observations on the circumscribed nature of the learning that went on within the primary think tank group, Gibber noted that the learning within the Fiscal Policy Group appeared to diffuse out to impact on the operating capabilities of divisional managers:

"There's a lot of learning that goes on within the (fiscal policy) group and that's something that I believe happens anyway, in terms of how people learn....It (the learning or group interactions) also enabled those of us who now have this new learning and understanding to interact with that sparse group of people in the department who already have this understanding...The initial formation of the (fiscal policy) group and the learning that the division's members of that group acquired enabled not only greater productivity within the group but also the establishment of relationships between this division and key constituencies." 91

Policy guidelines, position papers, planning memos, and other artifacts emerging within the Fiscal Policy Group served to synchronize and solidify the division's thinking about fiscal policy, to keep the Fiscal Policy Group together and on task, and to clearly communicate fiscal policy positions to constituencies outside the division. The most prominent among these secondary artifacts was the group's fiscal policy guidelines. These guidelines underwent over a dozen drafts, at each stage serving as the focal point as the managers present hammered through details and clarified their own thinking. Levine saw the guidelines as a central artifact holding the Fiscal Policy Group on task:

"I think that they (the guidelines) have been important in that they gave the group a very definite end-point for a period of time. There were definite timelines, elements that had to be addressed, fairly definitive steps. They caused us to interact with some people outside of the division -- Peat, Marwick, and Mitchell -- that was good. They (the consultants) would say 'we need this from you by such and such a time, in such and such a format.' So I think the guidelines have been almost the backbone of the group. They have caused the group to function as a group. We went through so much time when we were individuals and not a group at all; by having the guidelines, we could get past that stage..." 92

Of course, the overriding importance of the guidelines was that eventually they were printed and distributed to every local educational agency in the state as the department's policy on how financial expenditures were to be allocated to special education. Furthermore, these guidelines would be the basis of the standards used by the auditors who reviewed and verified special education expenditures. By creating a policy artifact, the Fiscal Policy Group not only increased and solidified its own understanding, it transmitted the understandings thus achieved as policy throughout the state.

Tertiary Artifacts and Organizational Units. Other groups within the department were meeting around fiscal policy issues with no members in regular attendance either from the primary think tank or from the fiscal policy group. These tertiary groups were pursuing agendas of their own that had no necessary relations to the issues being treated within the modeling effort. Yet from time to time, it appeared necessary to make an impact on these groups if the division's policies were to be fully implemented. For example, the position paper based on the model recommended that the fiscal guidelines be integrated into the end-of-year report and be coordinated with the external auditors. To be effective in its policy aims, the division had to insure that its newly emerging fiscal reality penetrated to some degree into the operations of these tertiary groups.

For example, if the concept of fiscal controls (developed in the primary think tank) was to be effectively implemented through guidelines (developed within the secondary FPG), then these guidelines should have been integrated into the format and instructions of the end-of-year report (being developed in a tertiary group). As pointed out by Gibber earlier, as a strong sense of a fiscal reality became firmly entrenched within the division, the division as an organization became a more effective, forceful, and knowledgeable organization in assuring that its own policy interests were met elsewhere within the department.

That is, the ultimate impact of building a fiscal reality among managers on final changes in organizational output operated through a rather lengthy chain of diffusion and crystallization of knowledge. In particular, ideas first germinated within a primary think tank diffused

and crystallized within a more broadly and operationally based secondary policy group of managers. In turn, the strengthened fiscal reality within this group of operational managers enabled the managers to make an impact on tertiary operating units (such as the unit redrafting the end-of-year report). At the end of this chain of events, real organizational outputs (in the form of a revised end-of-year report incorporating special education fiscal guidelines) were achieved.

Some of the most powerful agents facilitating the diffusion and crystallization of cognitive realities are the informal interactions between individuals within an organization and the concepts and vocabulary commonly available within an organization to articulate policy problems. We now turn to a closer examination of some of these "soft" mechanisms in the construction of socially shared realities.

Informal Interactions

Evidence from the case study suggests that informal interactions between the modeler and managers and between managers themselves may be the most important mechanisms promoting the construction of socially shared realities. Often working in the role of a teacher, the modeler must establish credibility among key managers within an organization. These informal relationships of credence and trust often become the bridges over which knowledge from a modeling project diffuses throughout an organization. Likewise, these same relationships enable the modeler to gain the critical insights into the operation of the real system, so necessary for the crafting of good models and policy insights. The modeler is like an information broker, picking up information in different corners of the

organization, structuring it (sometimes using his modeling methodology, sometimes not), and then "feeding it back" into the organization in the right place. The skill of the modeler or modeling team at handling these non-modeling, information-brokering functions is critical to the successful diffusion of knowledge throughout the organization.

Modeler-Manager Interactions: The Modeler's Viewpoint. Early on during the first phase of the overall project, Andersen reflected on the important roles of a modeler/consultant as an information broker:

"Due to his status outside of the organization, the consultant also takes on other roles: The convener, having the perspective to perceive a new connection being needed and convening a meeting or series of relationships that would not be established through normal operating procedures. The information link -- precisely because the consultant is an outsider, he will come across information in patterns not usual within the organization. The consultant then acts like a switchboard and 'plugs' these information sources in to each other." 93

Nearly a year later, Andersen noted that a similar set of "brokering" processes were highly instrumental in arriving at specific policy recommendations within the think tank:

"Thinking about the model has led me to some ideas concerning the arena within which I should be working. The specifics within that arena apparently do not come from the model itself....Which leads to the question, 'Where do those specific conclusions come from?' Some of them come from 'BROKERING' or the process of transplanting an idea from one context into another (taking an idea gleaned in one meeting and applying it in another). Some of the notions come from 'POSITIONING.' Through some chance (or purposive intention) I sat through Fred Williams' (SMS) training sessions last year (was critically positioned) and gained a familiarity with the end-of-year report. This was some sort of an enabling condition that allowed much of my current thinking to take place." 94

Recognizing the potential importance of informal relationships to

the policy design process and preferring to work through close informal relations, Andersen spent considerable time and effort developing and maintaining contact with members of the Fiscal Policy Group.

Modeler-Manager Interactions: Managers' Viewpoints. In a series of after-the-fact interviews, Andersen attempted to determine how several key managers had perceived his role within the organization. These managers identified roles quite different from the "information broker" type of role that Andersen himself had identified.

At a very basic level, several managers commented that Andersen acted like a symbol or place-holder that stood for "fiscal policy." In an environment where fiscal matters were not often considered, it was important to have something or someone continually reminding divisional managers of fiscal concerns. Otherwise, fiscal concerns would get pushed aside by other more immediately pressing matters.

Gibber articulated this place-holder role succinctly in September 1976 after the fiscal policy project had lain dormant for several months: "When I see you (Andersen) coming around, those certain fiscal wheels start to turn."⁹⁵ Gibber reiterated the same theme in January 1977: "I would 'cue-in' to your appearing (at the start of meetings) and that would motivate me to go get people together. Just in terms of getting things started on time, that's significant."⁹⁶

An extension of this rather passive place-holder role was more of a "facilitative and motivational role." Under this role Gibber included "keeping Bob (Audette) plugged in and even getting him to buy in from the outset," as well as keeping Gibber himself and other members of the

fiscal policy effort "on track" with so many other things trying to pull individual people away from it (the fiscal policy effort)."⁹⁷

Part of this "facilitative and motivational role" involved Andersen's specific behaviors within Fiscal Policy Group meetings, helping to focus on time-lines and getting closure on tasks. Levine notes:

"I also think that you were often helpful in reminding us that we were not on task, we weren't meeting timelines, we weren't dealing with relevant issues, we were leaving some out -- your style in helping the group to get itself together." 98

Gibber reiterated the importance of this focusing role in working sessions:

"In many instances you acted as facilitator of discussions. You played that facilitative role whereby people stayed on task, both in terms of the overall agenda of the meeting or in terms of your not giving up on a thought. You pushed the closure on decisions. I would say that that is a key role that you played when the actual work was being done." 99

Often the modeler took on a role within meetings that had a decided "teaching component" to it. Gibber found the teaching component to be a direct extension of the facilitator role:

"We (members of the Fiscal Policy Group) as a group of key managers have learned principally through our relationship with you and your participation in the effort...I would see you as the teacher of the group without mincing words." 100

Levine emphasized the teaching role because it allowed divisional managers to put some distance between themselves and fiscal problems arising in a "crisis mode":

"It's fairly clear to us that you have functioned as a very important resource to us both in terms of the information that you have and the skills that you have for synthesizing that information...We are always busy dealing with crises and you bring out some longer-run issues clearly in the midst of these crises." 101

Finally, Gibber noted that underlying all of these various roles centering on informal working relations was a "bottom line" of personal credibility. To Gibber, who preferred to learn through personal contact, personal presence was a much more important source of learning than abstract theories or concepts:

"If you didn't have the personal credibility with the people in that group, we never would have been where we are...I really want to make the point -- it wasn't the theory. It was your participation and forcing issues at key times." 102

The interview data just explored heavily weighted the influence of informal social interactions between the modeler and the key managers in promoting the diffusion and crystallization of a fiscal reality within the division. Andersen took this as evidence that the social aspects of modeling efforts within bureaucracies may be as important, if not more important, than the analytic or "scientific" aspects of the modeling effort in determining the impact of the overall effort on organizational policy. Andersen further explored this "social as opposed to science" hypothesis of model impact with Audette. Audette did not see the social aspects to be as important as Andersen was assuming:

"I think that the model was terribly important to me. It represented a very exciting breakthrough to me, very frankly. A social as opposed to science hypothesis which you raised I think is right, but I think what makes... (pause)...I really think the science is there too. What I think I got out of that beyond even issues we have addressed was sort of a series of protocols for how to think about certain kinds of problems that I did not have before... So, I don't think you are putting enough credit in the direction of the model." 103

Apparently, people like Audette who prefer to think analytically and conceptually in terms of models find using models to be "important," often

representing "exciting breakthroughs." People like Gibber who prefer to learn through personal contact find informal interactions with the modeler to be the most important mechanism promoting learning.

Informal Interactions: the Executive Committee Presentation. For the most part, the informal interactions between the modeler and the managers discussed thus far served to enhance fiscal learning. One interesting case exists where the informal interactions between managers and the use of the system dynamics model interacted to block effective communication and learning. In Audette's position paper to the department's executive committee in December 1976, the model was used as a vehicle for presenting the major points underlying Associate Commissioner Audette's notions of fiscal neutrality. The modeler opened the presentation to the executive committee with a discussion of the model followed by Audette's presentation of the major substantive points covered within his position paper. The discussion soon drifted into a discussion of the model per se rather than a discussion of the substantive issues being treated within the model. As Andersen noted in retrospect:

"At the presentation to the executive committee, an inordinate amount of time and effort was spent focusing on what might be called the 'validity' of the system dynamics model that lay behind the study and its conclusions. Such excessive focus on the model was unfortunate. Model validity crystallized as the commissioner's focus of concern. The substantive issues latent within the position paper (although they could easily have been discussed on their own merit) never received more than cursory attention in that meeting because the model served as a block to effective communication." 104

Levine notes the same problem with that meeting:

"We got sidetracked into spending the majority of the time in our weakest area, dealing with those issues with which we felt least comfortable -- in terms of the model. Because once we got into the model we were in trouble. We just got swept away." 105

Audette concurred that the informal interactions within the group coupled with an excessive focus on the model contributed to the unfortunate outcome of that meeting:

"There did appear to be a fundamental misunderstanding on Greg's (Commissioner Anrig's) part that assumed that the model was data based rather than logic based. Given that fundamental misunderstanding, the whole conversation just got off base and never did get back on the track." 106

In retrospect, it seems unfair to blame the model itself totally for the observed breakdown in communication. Just as informal interactions in other situations have enhanced the utility of the model, in this case the informal interactions that accompanied the presentation detracted from the utility of the model in making the presentation. As Andersen noted:

"The failure of the system dynamics model to promote reasoned discourse can be better explained in terms of the relations between the model, the modeler, and the members of the group than in terms of the model's quality or technical validity. The analysis team that had written the position paper being presented believed in its conclusions and they believed in the model as a useful tool for presenting those conclusions. For the first time, the modeler was using the model to present issues rather than to discuss issues. The modeler had no prior relationships with members of the executive committee and had little ability to anticipate their responses to the presentation. Consequently, the model was improperly used. The model served as a block to effective communication not so much because of problems with its technical validity, but rather because of problems with how it was presented to and used with a given group of decision makers." 107

Vocabulary and Concepts

The vocabulary and concepts commonly available within an organization for articulating problems largely determine what types of cognitive realities can be constructed and maintained within the organization. An important function that a modeling effort can play is to enrich the available images, metaphors, concepts, and vocabulary for discussing problems. In the case under study, the model enriched the concepts available within the division in several ways.

Variable Names. Perhaps the most obvious way that a model can be used to solidify a concept within the organization is to have that concept reified in one of the variables used within the system dynamics model. For example, the model reproduced in Appendix A contained several catchy (if not controversial) variable names, such as "Fraction Total Budget 'Jammed' into Special Education" and "Probability Repeal 766 Funding Formula." In addition the model contained many variables that reflected the standard nomenclature used to discuss educational finance within the department, such as "Per Pupil Costs Regular Day," "Special Education Excess Cost Per Pupil," and "Fraction of Claims Reimbursed under Special Education." By using the standard nomenclature, the model could be used as a training device, helping divisional managers to better understand the interrelationships between the many fiscal variables commonly discussed within the department. In addition, some variable names suggested some of the hypothesized mechanisms causing special education claims to grow -- such as "Effect of Budget Availability on Staff Allocation," "Effect of Staff Availability on Pupil Placement," and "Departmental

Control of Budget Allocation Process."

Concepts Coined in Model Write-Up. Besides variable names, the descriptive write-up of a model could be used to solidify fiscal concepts. For example, in the write-up to an earlier version of the model presented in Appendix A, several concepts were coined to understand some basic principles of the fiscal system.¹⁰⁸ Specifically, that paper explicitly discussed various "ceilings" on total pupils being served statewide and hypothesized that a very definite "fiscal limit" might exist, serving to limit the ultimate expansion of special education within the state. The model showed that current departmental management policies might lead to "overshoot," or the overexpansion of special education services beyond the "fiscal limit," thereby leading either to a repeal of the law or to a marked decline in the quality of special education services being delivered.

These broad concepts were initially quite helpful in focusing the thinking of divisional managers on fiscal matters. Faced with a confusing flurry of detail surrounding the funding of the law, these concepts gave the managers several stable points around which they could orient initial halting discussions of fiscal policy. For example, in a management retreat in May 1976, to initiate discussions of fiscal policy, nearly two days of wide-ranging discussion were loosely focused around the concepts of "program limits" and "fiscal overshoot" -- both concepts being directly derived from the concepts employed in the write-up of the first model.

DYNAMO Flow and Causal Loop Diagrams. Visual representations of system structure turned out to be extremely powerful aids in crystallizing

concepts about fiscal policy. As noted above, Associate Commissioner Audette was especially intrigued by the power of visuals displaying system structure. He found the definition of fiscal policy problems as the interaction of three sectors -- program, fiscal, and reimbursement -- to be a most helpful visual insight:

"The most convincing part of the modeling effort came from the essential framing of the problems -- the subdivision of the problem into the three basic sectors and viewing the problem from the point of view of interactions between the sectors. That is, the whole work laid out the major arenas of activity and their interactions. From there, all else followed quite easily. Once you get within the frame, it is quite hard to argue the results. The greatest and most convincing aspect of the work was to provide an organizing framework for the issues." 109

Simulations. Although divisional managers did not appear to find the simulation outputs the most useful aspect of the overall study, they did prove useful in displaying a longer time dimension to the problems of special education. Often the crisis orientation of divisional managers demanded that they consider policy issues within the framework of months or sometimes even weeks, seldom taking a multiyear perspective. The simulations, designed to study the implications of current funding schemes over a five- to ten-year time horizon, could open up new realms for consideration. When first presented with several preliminary simulations, Terry Bradford, then Director of the Bureau of Management, found the time horizon considered within the model to be "stimulating, no one in the department is thinking that way." 110

6.6 THE ROLE OF MODEL AND MODELER IN CHANGING COGNITIVE REALITIES

The case study suggests that modeling efforts can promote changes in an organization's cognitive realities in two broad ways. First, the overall effort can help individual managers to learn the area under study. Second, the model or actions of the modeler can promote the sharing of knowledge gained by individuals, thereby creating an ability on the part of the organization as a whole to deal with the policy area. The major points made within the case are summarized below.

As an Aid to Individual Learning.

Different individuals learn at different rates and in different fashions. The contribution of a modeling effort to managerial learning will vary from person to person. At the one extreme, looking at a policy problem from a modeling perspective can help persons intimately familiar with the modeling methodology to structure complex and fuzzy problems. To these persons, the rigor of a formal methodology provides them with a simplifying set of heuristics -- a pair of filtering lenses -- that help to distinguish the important from the trivial and bring order to a seemingly undifferentiated mass of facts.

At the other extreme, some managers find the presence of a formal policy model to be a distraction. It rankles them to have an analyst assert that a model can provide insights that are not available through ordinary intuition and clear thinking. For these managers, the use of a model can block effective communication and learning, their efforts being directed toward critiquing the model rather than learning from it.

In between these two extremes, one may find widely varying opinions

concerning how models are or should be useful. Some managers are attracted to the clean, rational-looking thinking associated with formal modeling efforts. They find this evocation of rationality helpful in structuring their own thinking about a complex set of problems. To these managers, participating in model construction exercises can be useful and intellectually challenging exercises. Both the structured interactions within the model-building sessions and the feedback that they receive on their own thinking are valuable tools for their own learning.

Yet other managers, because of other pressures on their time or because of their own preferred style of learning, tend to shy away from formal model-building exercises but do find the discussion of issues raised within the model to be stimulating and insightful. To these managers, model flowcharts and model output may be helpful visual aids in communicating the points made within the model, but for the most part, they prefer to learn from personal interactions with the modelers, learning quickly and intuitively from free-flowing and open-ended discussions.

Given the broad spectrum of impact of modeling efforts on individual managers and the relatively primitive state of our understanding of individual learning, it is difficult to establish lawlike truths about how modeling efforts facilitate individual learning, but the case study does suggest several generalities.

The case suggests that policy analysis efforts of the scope and magnitude of the one undertaken here (one modeler working half-time for approximately two years) are unlikely to change how managers fundamentally conceive of and solve policy problems. It seems unrealistic to assume

that managers will gain any fundamental new insights into how problems are solved in this short a time frame. However, it does seem realistic to expect that managers may change what factors they consider when contemplating a policy problem. That is, a "tops down" deductive problem solver will remain a "tops down" deductive problem solver. However, he may learn to consider new factors in his deductive problem-solving process.

Most managers who are unfamiliar with the technical details of formal modeling techniques have a highly affective component in their reaction to such models. On the one hand they may be attracted to the logical rigor and precision of a mathematical methodology or they may be highly resistant to what they perceive to be a "pseudoscientific" gloss of the technique. In between these extremes, managers may hold the model off at an unsure distance, treating it with undue (and dysfunctional) respect.

It would appear that all of these affective reactions to modeling efforts discourage a balanced appreciation of the strengths and weaknesses of formal modeling efforts. Formal models, in conjunction with other analytic skills and intuitions, can be a helpful tool in attacking policy problems. Affective reactions to models that create undue expectations or that prematurely disparage model results prevent models from being maximally useful. Forrester has noted that a balanced appreciation of the relative strengths and weaknesses of modeling efforts is a problem not only among managers relatively unfamiliar with the technical details of modeling efforts but also among many professionals trained in modeling disciplines.¹¹¹

However, the case does suggest that managers with all sorts of prior predispositions toward formal modeling efforts report that discussions and reports derivative from the formal model are helpful in structuring their thinking. This result suggests that as often as possible, persons wishing to maximize the impact of a modeling effort should translate insights generated by the model into discussions, working papers, and as wide a range of interactions and documents as possible to assure that a wide audience of managers become familiar with the results of the model. This generality supports Stearns', et al observation that consulting efforts focusing almost entirely on encouraging interaction between key managers around the issues that would be treated within a model but stopping short of the actual construction of a model can be highly effective in encouraging policy changes.¹¹²

This last point suggests that the skill of the modeling team at translating model-based insights into non-technical terms and promoting structured interactions between themselves and managers (the social aspects of the effort) are critically important in determining the success of the overall modeling project.

Creating Socially Shared Realities

Besides promoting individual learning, modeling efforts can be useful in diffusing individual learning, thereby creating a more broadly shared cognitive reality within the organization as a whole. The case study highlighted several different mechanisms through which modeling efforts facilitate the creation of socially shared cognitive realities.

Models as Artifacts. Especially in the early stages of the fiscal policy project, the system dynamics model served as an important focus for discussion and learning within the think tank. The model provided a unified and conceptually easy-to-manipulate image of the salient features of the fiscal policy reality facing the division. Model output and flowcharts proved useful in conceptually framing the fiscal system and synchronizing the thinking of key managers.

However, later on in the project, the images created by the model had to be "fleshed out" and considerably complicated by the inclusion of much more detail so that the broad policy conclusions emanating from the model could be translated into concrete policy activities. The model provided a broad framework; the details had to be filled in by supplementary documents and facts unrelated to the modeling effort.

As a Source of Vocabulary and Concepts. An important byproduct of the modeling effort was that it enriched the images, metaphors, and concepts available within the organization for articulating fiscal issues. Specifically, variable names used within the models themselves and phrases coined in write-ups of model structure provided divisional managers with much of the vocabulary initially necessary to discuss fiscal matters. Subsequently, model flowcharts and output linked together many facts and seemingly disjointed pieces of knowledge, providing some powerful relational concepts for a group of key managers within the division.

Informal Interactions. Interactions between the modeler and groups of managers proved to be a key mechanism whereby individual learning was shared within a group. Specifically, the case study highlighted several

functional roles performed by the modeler in promoting a diffusion and crystallization of fiscal reality within the division. First, the modeler served as an information broker, picking up pieces of information in one part of the organization, synthesizing this information (sometimes in terms of the formal model, sometimes not) and then feeding the information back into the organization at different points.

Second, the modeler served a symbolic and motivational role. Since his sole focus was fiscal policy, his mere presence served to remind managers, who might otherwise have their attention drawn to other pressing demands, that attention was also needed in the fiscal area. This role was especially important in the early stages of the project when managers knew relatively little about fiscal policy and when there were few cues internal to the division diverting their attention toward fiscal issues.

Third, managers identified the teaching role of the modeler as a critical one. In this role, the modeler helped to raise the group's awareness of fiscal issues by structuring issues, pushing for closure on issues, by directing attention to issues that may have been overlooked, and by clarifying relationships between facts.

Finally, the case suggests that the personal credibility of the modeler is a key determinant of his ability to promote shared learning through informal interaction.

6.7 NORMATIVE ASPECTS OF THE COGNITIVE PERSPECTIVE

To close out the cognitive story, we ponder what has been learned about how to better manage policy modeling projects so that decisions based upon such models will be improved. Based upon experiences in the case, a set of concrete recommendations for better managing policy models are presented. First, however, we briefly explore what it means to make "good" or "better" decisions from a cognitive point of view.

What are "Good" Cognitive Decision-Making Processes?

A common strategy employed among analysts of psychological decision making is to isolate one or more psychological properties of individual decision makers and then to demonstrate how these properties lead to poorer decision outcomes. For example, Janis and Mann examine the responses of individuals to various conditions of psychological stress. They find that various stress levels create situations ranging from "unconflicted adherence" to how things are currently done to "hypervigilant" perusal of available alternatives.¹¹³ In all of these cases, except for the golden mean of "vigilance," too low or too high stress levels inhibit good decision-making processes. (Good decision-making processes are those that include "thorough canvassing of alternatives," "thorough canvassing of objectives," "careful evaluation of consequences," "thorough search for information," "unbiased assimilation of new information," and "thorough planning for implementation and contingencies.") Similarly, Slovic reports a multitude of experimental results examining the ability of the human mind to accurately assess (in a statistically unbiased fashion) probability distributions, to distinguish between correlation and cause, and to

quantify uncertainty.¹¹⁴ In these experiments, the human mind is found wanting in its ability to function rationally (here defined in precise mathematical terms such as being able to estimate the center or tail of a well-defined probability distribution without bias). He concludes that trial and error decision making is highly dangerous in the nuclear age given that minds of political elites are such intrinsically limited cognitive machines.

In both of these cases, the implicit assumption was made that cognitive decisions are somehow "best" if they closely approximate what a neutral rational observer would choose given complete information, unstressful time to reflect, and a good ability to predict the outcomes of alternatives. In other words, the implicit norm for cognitive decision making appears to be the rational ideal.

It hardly seems necessary to point out that a rational ideal for cognitive decision making is not the only one possible. The Chinese, for example, appear to value the worldly experience and wisdom of the decision maker over the degree of rationality employed in the decision-making process. In medieval Europe, good decisions (if indeed anyone ever thought of himself as making decisions) were those that reinforced the Divine order as delineated by the Vatican. For us, good decisions are rational decisions mostly because we live in a culture that is preoccupied with the objective and the scientific--the rational.

The recommendations presented below are most probably also founded on the implicit assumption that better cognitive decisions are more nearly rational decisions. (I say "probably founded" because the implicit normative foundations of my own thinking are not always clear to me.)

Recommendations for Better Policy Modeling: A Cognitive Look

The cognitive view of policy design outlined above has practical implications for the art of model building within organizations. The following several points outline the practical implications highlighted in the cognitive story.

1) First and foremost, understand the structure of current cognitive realities and the strength of reality maintaining mechanisms. Policy innovations result from the interactions between current cognitive realities and the mechanisms necessary to sustain those realities. Effective policy changes can result only from the skillful management of these two classes of variables. The manager or analyst planning to effect model-based policy innovations would do well to heed several broad caveats:

--Explicitly seek out pressure points to break the mutually reinforcing patterns between cognitive realities and sustaining mechanisms. Sometimes this will involve finding a team of receptive managers to "host" a project, at other times it may involve redesigning a procedure or guideline to initially gain management attention.

--Do not underestimate the strength of reality maintenance mechanisms. Changes will not diffuse through an organization unless the working and policy artifacts, organizational structure, or vocabulary and concepts underpinning current perceptions significantly change.

--Plan the diffusion process explicitly and early on. It is unrealistic to assume that a good idea will catch on of its own accord unless someone (either the analyst, manager, or organizational hosts) explicitly manipulates the diffusion process.

2) Policy design must entail (and often begins with) changes in the

cognitive realities of individual managers. The practical implications of this generality are many and varied:

--At some point, an external analyst must either explicitly or implicitly assume the role of a teacher.

--Since changes in cognitive realities must be translated into changes in maintenance mechanisms, top management will be the most likely target for initial training (again either implicit or explicit training).

--Evoking a rational framework (and the attached mythos) is an effective means to secure initial cognitive changes. Specifically a rational framework:

i. Provides a normative framework that is somewhat independent of the existing reality sustaining mechanisms and hence has a high probability of generating novel insights.

ii. Counteracts cognitive tendencies to overly simplify complex decision situations, specifically forcing trade-offs (hidden by cognitive "balancing mechanisms") to be squarely faced, and surfacing a broader range of alternatives for consideration.

3) Explicitly manipulate the diffusion and crystalization of changes in cognitive reality.

--In general, the diffusion of cognitive changes will involve changes in organizational structure or goals since these are two of the most powerful mechanisms working to maintain the status quo.

--Exploit the following levers in managing the diffusion process:

i. Artifacts. A formal model may serve as an artifact to be used in helping to change shared perceptions. However, generally the model proper will be insightful only to the analyst and other

actors trained in the interpretation of model structure and output. In general secondary artifacts derived from the model (such as position papers based upon the model) or even tertiary artifacts indirectly derived from the model (such as specific policy proposals or position papers not explicitly mentioning the model) will be most useful in promoting cognitive diffusion processes.

ii. Organizational factors. Policy study groups can be powerful mechanisms to initiate creative thinking and to begin the diffusion of cognitive changes. However, such groups have characteristic organizational deficiencies (outlined in the previous chapter) and it is preferable where possible to manage cognitive diffusion through operating units within the agency. In general, exploit informal social groups as vehicles for gaining consensus and promoting changes in thinking.

iii. Concepts and Vocabulary. Whenever possible, crystallize major points into crisp concepts summarized by distinctive phrasing. The introduction of effective concepts, jargon, and vocabulary greatly facilitates the understanding of a complex policy area. When and if possible, build the appropriate vocabulary into the model and into the policy and position papers resulting from the model. Models (and analysts) who use the vocabulary prevalent within the organization stand greater chances of success.

4) Pay explicit attention to the many possible roles of the analyst.

The cognitive view of policy making outlines several roles that must be adequately performed simultaneously by an external team of analysts. The neglect of one of these roles decreases the probability of project success.

Note that roles do not necessarily correspond to individuals and that managers internal to the organization can often perform one or more of the possible roles.

- i. Technician-analyst. If analysts or managers use the prior view implied by a modeling methodology to generate new images of a problem reality, then they must be skilled in the use of that methodology. They must be able to restructure existing information into interesting and novel images through the creative use of modeling technologies.
- ii. Information broker. Much of the information needed to create novel problem realities is contained in unwritten form within the minds of individual managers. Often all of the needed information is widely scattered throughout the entire organization. A skilled model-based policy design team must be able to receive information from many corners of the organization, transform that information into novel problem realities through model design and then disseminate these new insights to yet other critical points within the overall organization.
- iii. Teacher. Finally, a team of model-based analysts must be competent as teachers. Teaching activities need not be of the formal classroom type, but if new cognitive realities are to be first created and later on diffused through an organization, considerable learning on the part of managers throughout the organization will have to occur. Hence a crucial role of the team of analysts (be it an explicit or only implicit role) will be that of a teacher.

6.8 NOTES FOR CHAPTER SIX

1. Robert Axelrod, ed. Structure of Decision: The Cognitive Maps of Political Elites. Princeton, N.J.: Princeton University Press, 1976.
2. Robert Jervis. Perception and Misperception in International Politics. Princeton, N.J.: Princeton University Press, 1976.
3. Irving L. Janis and Leon Mann. Decision Making: A Psychological Analysis of Conflict, Choice, and Commitment. New York: The Free Press, 1977.
4. Lloyd Etheredge, unpublished manuscript, forthcoming from MIT Press, Cambridge, Mass.
5. Ole Holsti, "Foreign Policy Formation Viewed Cognitively," Structure of Decision: The Cognitive Maps of Political Elites. Robert Axelrod, ed. Princeton, N.J.: Princeton University Press, 1976.
6. Peter L. Berger and Thomas Luckmann. The Social Construction of Reality: A Treatise in the Sociology of Knowledge. Garden City, N.Y.: Anchor Books, Doubleday and Company, 1967.
7. These and subsequent comments attributed to Audette in this section (Initial Characterizations of Fiscal Realities) are extracted from an early interview with Audette, May 13, 1976.
8. These and subsequent comments attributed to Williams in this section (Initial Characterizations of Fiscal Realities) are extracted from an early interview with Williams, April 10, 1976.
9. These and subsequent comments attributed to Gibber in this section (Initial Characterizations of Fiscal Realities) are extracted from an early interview with Gibber, May 13, 1976.
10. These and subsequent comments attributed to Bradford in this section (Initial Characterizations of Fiscal Realities) are extracted from an early interview with Bradford.
11. Williams, op. cit.
12. Gibber, op. cit.
13. Interview with J. Flahive, May 3, 1976.
14. Williams, op. cit., p. 4.
15. Williams, op. cit.

16. Flahive, op. cit.
17. Gibber, op. cit.
18. Audette, op. cit.
19. Ibid.
20. Williams, op. cit.
21. Interview with Audette, March 27, 1977, p. 14.
22. Ibid, p. 15.
23. Interview with Bambi Levine, March 10, 1977, p. 2.
24. Interview with Hal Gibber, January 7, 1977, pp. 19-20.
25. "Unfunded Chap. 766: Who, Finally, Will Foot the Bill?" Boston Sunday Globe, February 24, 1974.
26. Ibid.
27. "David, at 7, Can Crawl -- Because of Ch. 766," Boston Sunday Globe, June 22, 1975.
28. Interview with H. Niblock, Director of Special Education, Winchester Public Schools, May 1974.
29. See Policy Statements #766-75-1 through 766-76-10, Division of Special Education, Massachusetts Department of Education.
30. Interview with R.H. Audette, March 27, 1977, p. 2.
31. Interview with B. Levine, March 10, 1977, p. 4.
32. 766 Regulations, Department of Education, Commonwealth of Massachusetts, October 1975, p. 8.
33. Policy Statement #766-75-2, March 24, 1975, Division of Special Education, Department of Education, Boston, Mass.
34. "Proposed Three Year Plan for the Division of Special Education," Division of Special Education, Mass. Department of Education, November 1975, p. 16.
35. G. Anrig, "Commissioner's Fiscal Year 1976 Operational Plan," Mass. State Department of Education, August 26, 1975, p. 11.

36. D. Keeler, "Management Improvement Area: Fiscal Management Project," memo outlining how division should gain additional fiscal capacity, October 1975.

37. Interview with Hal Gibber, January 7, 1977, p. 4.

38. For example, Hilgard and Bower, Theories of Learning, Meredith Publishing Company, New York, 1966, outline fifteen separate theories of learning. Each of these fifteen is recognized as an incomplete description of the overall learning process.

39. Peter Keene, "The Implications of Cognitive Style for Individual Decision Makers," unpublished doctoral dissertation, Harvard Graduate School of Business Administration, 1973.

40. Andersen had worked for some six months on the implementation of Chapter 766 in Winchester, Mass.

41. Initial sketches of model structure were completed in September 1975. For example, see: D.F. Andersen, "Special Education Model Preliminary Thoughts" memo dated October 6, 1975.

42. Through the fall of 1975, several competing definitions of possible problems emerged. These are more fully reported in Chapter 4.

43. Interview with Hal Gibber, January 6, 1977, p. 11.

44. Chapter 3 plus the background sections of Chapter 5 describe the fiscal climate within the division and department during the early phases of the project.

45. Two examples of these "structuring memos" would be "Notes for the Fiscal Policy Meeting Friday, October 8," memo from D.F. Andersen to H. Gibber or "First draft of some issues requiring further deliberation," memo from D. Andersen to Fiscal Policy Group, October 26, 1976.

46. Of a total of 376 hours spent within the division between September 1976 and April 1977 (author's personal log), fully 248 of these were spent in meetings or scouting interviews.

47. Author's notes on meeting of October 15, also interview with R.H. Audette, October 15, 1976.

48. "Examination of Implications of Fiscal Policy Structures." Minutes of the meeting held October 25, 1976.

49. Author's notes on meeting of Fiscal Policy Group, October 28, 1976.

50. The results of these early analyses are summarized in D. Andersen, "Fiscal Policy Options and the Management of Chapter 766" System Dynamics Group Memo D-2381, May 14, 1976.

51. The first sketches of model structure were finalized on October 6, 1975.

52. For a discussion of how different methodologies frame different sorts of insights, see Donella Meadows, "The Unavoidable A Priori: A Discussion of Major Modeling Paradigms," The System Dynamics Method, Jorgen Randers and Leif Ewik (eds.). Oslo: Resource Policy Group, 1976.

53. This brief review of the system dynamics methodological priors is a summary of the discussion contained in Chapter 2.

54. The first sketches of system behavior and system structure are contained in D. Andersen "Special Education Model: Preliminary Thoughts," memo dated October 6, 1975.

55. Interview with Hal Gibber, January 7, 1977, p. 10.

56. Interview with Bambi Levine, March 10, 1977, p. 5.

57. Interview with R. Audette, March 27, 1977, p. 2.

58. Interview with Bambi Levine, March 10, 1977, pp. 6-7.

59. Interview with R. Audette, March 27, 1977, p. 12.

60. Interview with R. Aduette, November 3, 1976.

61. Interview with R. Audette, March 27, 1977, p. 10.

62. Ibid., p. 10

63. Ibid.

64. Ibid, p. 16.

65. Ibid., p 2.

66. Ibid., pp. 4-5.

67. Ibid., pp. 10-11.

68. Interview with R. Audette, December 22, 1976, p. 3.

69. Interview with R. Audette, March 27, 1977, pp. 12-13.

70. Ibid., p. 14.

71. Interview with Hal Gibber, May 13, 1976.

72. Interview with Hal Gibber, January 7, 1977.
73. Ibid., p. 10.
74. Interview with Hal Gibber, October 15, 1976.
75. Interview with Hal Gibber, January 7, 1977, p. 18.
76. Ibid., p. 14.
77. Interview with Hal Gibber, January 7, 1977, p. 11.
78. Ibid., pp. 3-6.
79. Ibid., p. 9.
80. Ibid., pp. 11-13.
81. Holsti, "Foreign Policy Formation Viewed Cognitively."
82. Interview with Bambi Levine, March 10, 1977, p. 10.
83. Ibid., p. 11.
84. Interview with R. Audette, December 22, 1977, pp. 1-2.
85. Ibid., pp. 3-4.
86. Interview with R. Audette, March 27, 1977, p. 17.
87. Author's notes on meeting of Board of Education, June 27, 1977.
88. Interview with R. Audette, March 27, 1977, pp. 17-18.
89. D. Andersen, "Policy Recommendations from a System Dynamics Simulation of the Special Education Fiscal Policy System," memo to R. Audette and Fiscal Policy Group, November 16, 1976.
90. Interview with Hal Gibber, January 7, 1977, pp. 14-15.
91. Ibid., p. 6.
92. Interview with Bambi Levine, March 10, 1977, p. 9.
93. D.F. Andersen, "Lessons to Be Learned from 766 Consulting Thus Far," personal memorandum, November 17, 1975.
94. D.F. Andersen, Journal entry, October 27, 1976.

95. Private conversation with Hal Gibber, September 21, 1976.
96. Interview with Hal Gibber, January 7, 1977, p. 3.
97. Ibid., p. 1.
98. Interview with Bambi Levine, March 10, 1977, p. 9.
99. Interview with Hal Gibber, January 7, 1977, p. 2.
100. Ibid., pp. 5-6.
101. Interview with Bambi Levine, March 10, 1977, p. 1.
102. Interview with Hal Gibber, January 7, 1977, p. 25.
103. Interview with R. Audette, March 27, 1977, p. 2.
104. D.F. Andersen, retrospective memo analyzing what happened in executive committee presentation, January 1977.
105. Interview with Bambi Levine, March 10, 1977, p. 12.
106. Interview with R. Audette, December 22, 1976, p. 5.
107. D.F. Andersen, retrospective memo analyzing what happened in executive committee presentation, January 1977.
108. D.F. Andersen, "Fiscal Policy Options and the Management of Chapter 766," System Dynamics Group Working Paper D-2381, May 14, 1976.
109. Interview with R. Audette, December 22, 1976.
110. Journal entry, March 11, 1976.
111. Jay Forrester, "Educational Implications of Responses to System Dynamics Models," System Dynamics Group Working Paper, D-2021, MIT, E40-253, Cambridge, Mass., May 30, 1974.
112. Stearns, et al., "Dynamic Consultation: A New Approach to Implementing Change in the Hospital Setting," unpublished manuscript.
113. Irving Janis and Leon Mann. Decision Making, p. 77.
114. Paul Slovic. "Limitations of the Mind of Man: Implications for Decision Making in the Nuclear Age." Oregon Research Institute Research Bulletin, #2, (1971).

CHAPTER SEVEN

CONCLUSIONS AND IMPLICATIONS

This study began with an interest with learning within organizations. Specifically, the focus was on how formal models can aid and abet policy learning within public sector bureaucracies. The practical purpose of this interest is to arrive at insights and rules of thumb that will allow both managers and analysts to better manage policy modeling within bureaucracies.

7.1 THE CONCEPT OF SEPARATE POLICY REALITIES: A UNIFYING CONCEPT

We have taken the tack of examining a single case from three quite different theoretical perspectives. Each of these three perspectives has created a separate policy "reality." By moving into each of these realities, the analyst (or decision maker) sees a significantly different world of policy development. Each of these worlds is created and maintained by separate concepts and vocabulary, concentrates on different aspects of the policy-making process, and leads to significantly different diagnoses of how models impact on policy processes as well as different prescriptions concerning what analysts and managers should do to better manage model-based policy design exercises.

Justifying Separate Policy Realities within the Case

The notion of separate policy realities needs some further explanation and justification. One way to justify the use of such a strong term-- separate policy realities--would be to claim that it is only a useful metaphor. But the case studies suggest that the notion of separate realities is more than just a metaphor. Each perspective treats identically the same

series of events. Yet each theory uses different vocabulary and concepts to interpret those events. Different evidence is highlighted by each of the three perspectives. Each of the three perspectives arrives at qualitatively different implications and conclusions concerning how to best manage policy modeling. Without a doubt, the policy realities created by each of the three perspectives are closely related to one another, but the significant differences between the theoretical, empirical, and normative implications of the three views warrant considering them as rather distinct policy worlds.

To examine these propositions, a preliminary test was performed on the evidence collected as part of the case study reported in this research. A representative sample of the pieces of evidence used in the case study was assembled and catalogued. The complete catalogue of evidence used in this test is presented in Appendix C. Then each piece of evidence was subjectively coded according to how well that evidence was covered by each of the three perspectives on decision making used in the case study. The broad coding rule was that a piece of evidence would be considered "directly covered" if that piece of evidence could be "explained well in terms of the theoretical terms of the given perspective." The general test would be the "extent to which the vocabulary employed by the theory seems to describe the activities summarized by the evidence." A piece of evidence was coded "indirectly covered" if "by inference it could be construed as supporting propositions and assertions made in the theory under consideration." Finally, a piece of evidence was broadly considered "not relevant" if "it seemed awkward to explain the activities implied by the evidence

within the theoretical framework under consideration." An extensive list of coding rules, presented in Appendix C, was used to amplify the broad guidelines presented above.

After the coding was completed, analysis was completed on the sample of data to examine the overlap of the coverage of each of the three theoretical perspectives. Of course, the preliminary results presented below would vary in detail depending upon the specific rules used in the coding procedure. However, tests with third party coders, also reported in Appendix C, seem to indicate that the overall pattern of results reported below do not change significantly given different subjective coding rules. That is the percentages of direct versus indirect coverage may vary from one coding scheme to another, but the conclusions (as opposed to the specific numeric values supporting one version of the conclusions) are not sensitive to different subjective coding schemes.¹

Direct Versus Indirect Coverage for Each Perspective

Table 7.1 reports how well each perspective covered the evidence for the selected sample of evidence coded. The rows show how well each perspective either directly covered, indirectly covered, or did not cover the total body of evidence. The columns show the percentage coverage by each type of evidence for the rational, organizational, and cognitive framework. The sum of each column must be 100%

The overall pattern of evidence coverage seems quite clear. Each perspective directly covered some fraction of the evidence (in this case about 25%) and left a somewhat smaller fraction of evidence not covered.

	Rational Framework	Organizational Framework	Cognitive Framework
Evidence Covered Directly	n=16 25%	n=16 25%	n=18 28%
Evidence Covered Indirectly	n=33 52%	n=42 67%	n=41 64%
Evidence Not Covered	n=15 23%	n=5 8%	n=5 8%
	Total=64 Rational	Total=64 Organizational	Total=64 Cognitive

Figure 7.1: How Well Each Perspective Covered the Evidence (selected sample of evidence)

The majority of the evidence was indirectly covered by a given perspective. One improper use of Table 7.1 would be to try and interpret the reported results as a "horserace" between the various perspectives, attempting to determine which perspective is somehow best. This interpretation would be invalid for several reasons. First the exact percentages presented in Table 7.1 could change if different subjective coding rules were to be used, thereby possible changing the winner of the race. Second, Table 7.1 gives no indication of the relative importance of the pieces of evidence covered by each perspective. It is possible that the rational perspective covers

the most critical pieces of evidence whereas the organizational perspective covers evidence that really seems quite inconsequential (or vice versa). To understand the real importance of Table 7.1, we must examine the amount of overlap in direct coverage between the three perspectives.

Non-Overlap in Direct Coverage. Figure 7.2 reports the overlap between evidence directly covered by each of the three perspectives. This figure is a detailed breakdown of the first row of Table 7.1. For example, of the 16 items directly covered by the rational perspective in Table 7.1, 7 of these were directly covered only by the rational perspective, 8 were covered jointly by the rational and cognitive frameworks, 1 was covered jointly by the rational and organizational frameworks, and 0 were covered directly by all three of the perspectives. The point of Figure 7.2 is that, to a surprising degree, the three perspectives directly covered independent bodies of evidence. There is relatively little overlap in pieces of evidence covered jointly by more than one perspective.

A second point is that direct coverage of the evidence increases dramatically when more than one perspective is used. Greater insight into a much broader range of evidence occurs when multiple theoretical perspectives are employed in the analysis. Not reported in Figure 7.2 is some indication of which perspective appears to cover the most critical pieces of evidence nor how much overlap there is between evidence indirectly covered and how indirect coverage increases with the use of more than one perspective. The reader interested in pursuing these issues in more depth is referred to Appendix C.

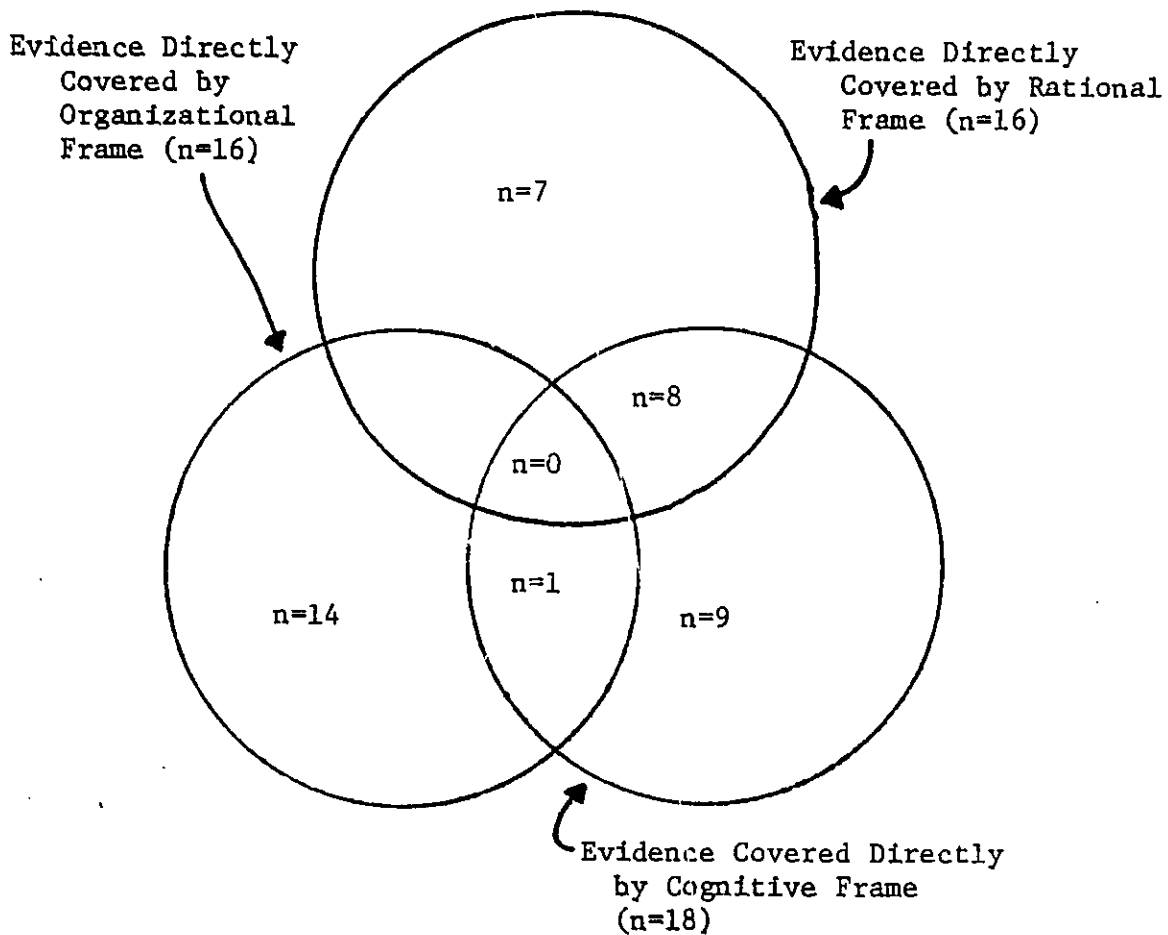


Figure 7.2: Overlap Between Evidence Directly Covered by Each of the Three Perspectives (total universe of evidence pieces covered by one or more perspective = 40 out of total of 64)

Although the discussion in this section was of necessity confined to the specific case of evidence collected and analyzed within this case study, it would appear highly probable that the underlying generalities concerning empirical coverage and overlap associated with multiple theoretical perspectives on a single case would hold true for a wide class of social scientific research problems. Specifically, the empirical importance of using multiple perspectives to cover a wider body of evidence might be valid under a wide range of possible social scientific inquiries.

Broader Justification for Separate Policy Realities

At a more fundamental level, a building body of evidence in the field of ethnomethodology lends credence to the observation that individuals living through the same series of events do experience markedly different realities because they describe the world using different concepts, attach different meanings to events, pay attention to (screen out) different events, and adhere to different prior conceptions of what should or should not be done under different circumstances.² In addition, Berger and Luckmann, in their pioneering work in the sociology of knowledge, have suggested that the context or reality of all human activity is essentially constructed and maintained by social interactions.³ Human activity at all levels is motivated by and gains meaning from socially constructed realities that may vary from culture to culture, from one social unit to another, or even from one individual to another. Finally, investigations in the fields of linguistics and ordinary-language philosophy imply that human language, the range of images, concepts, vocabulary, and grammars available to articulate ideas, and its interaction with established patterns of human activity may be the ultimate source of these different socially constructed realities.⁴ Underpinning most all forms of social (policy) analysis are implicit notions of justice, equality, and rationality that provide culturally defined norms of what defines "good" decisions, "fair" laws, or "equal opportunity."

The notion of separate realities may be unappealing because, in the field of policy analysis, one might hope to approximate a scientific ideal of "objectivity," thereby avoiding the relativistic morass that would arise from a highly subjective, multiple-reality view of social policy inquiry.

However, recent work into the nature of scientific inquiry itself raises doubt whether any science, from the hard physical sciences on down to the softer social sciences, can avoid questions arising from multiple definitions of reality and the conflicts that arise between scientists inhabiting different "scientifically-defined" realities. Kuhn has captured this notion of multiple scientific realities within his own notions of "cross-paradigm conflict."⁵ Most recently, Lakatos and Alker have probed the impact of sociological factors within a research community on defining the research paradigm or world view that serves as a basis for sustaining different views of the same set of phenomena.⁶ To claim the three theoretical perspectives used in the case study actually create different realities for viewing the policy-making process would indeed appear to be more than just a useful metaphor.

However, it would be extremely near-sighted and unimaginative to suggest that the three realities defined by the three theoretical perspectives within this study are without points of tangency and overlap. Each of these realities intersects significantly with the others. They are not simply disjoint and separate views. It is important to note that they sometimes give differential interpretations to the same events, yet at the same time can be put together to yield deeper insights and richer understandings than are available by using the perspectives one at a time. Each reality complements the others. Together they are stronger, richer, and more suggestive than taken one at a time.

When To Use Multiple Perspectives

The fact that different theoretical perspectives give rise to separate policy realities and the fact that these policy realities are often highly interrelated and complementary raise several interesting practical problems. For example, when is a single perspective sufficient? If more than one perspective is warranted, how many different views are enough? Which views should be taken?

To a large degree, the answers to these questions will depend on the type of organization under study. An example will help make this point. If one were to study the processes causing all members of an army batallion to have highly shined shoes and causing some members of the batallion to salute others, then one presumably would not have to erect a highly complex multi-perspective theoretical frame to explain this behavior. A single perspective that simply treats patterns of authority and compliance within military organizations would appear sufficient for most purposes to explain the problem behaviors. On the other hand, if one were to explain the degree of shininess of the shoes of a university faculty and patterns of deference within the faculty, one would undoubtedly be faced with a more complex situation that could be explained usefully from many points of view. Multiple competing theories of motivation could be brought to bear on the problem, each leading to significantly different insights.

A second factor that helps to determine how many perspectives are enough and which ones should be chosen is the purpose of this analysis. Undoubtedly, market research devoted to understanding the causes of changing footwear patterns among various strata of professionals might be looked at

usefully from several points of view. On the other hand, attempts to keep university personnel from walking through the poison ivy patch behind the gymnasium in sandals would not need several highly elaborated models of motivation.

The problem of when to use more than a single perspective is a practical one. However, the use of a multiple perspective approach raises interesting theoretical and practical questions at several levels. Hence, we shall organize our conclusions broadly on three levels. First we examine the implications of the case study and the three perspectives chosen for the purpose of better managing policy modeling within public sector bureaucracies. At a second, more general, level the multi-perspective approach appears to raise some interesting questions for the conduct of applied social sciences research in general. We shall dwell briefly on the implications of the three case studies for these broader questions. Finally, several directions for further research are pointed out.

7.2 CONCLUSIONS ON HOW TO BETTER MANAGE POLICY MODELING

The case studies contain many implications, suggestions, and rules of thumb for the better management of policy modeling within public sector bureaucracies. These conclusions are presented in four levels, ranging from the most simple, a possible listing of "Do's and Don'ts" derived within the study, to the most involved, a guide to using more than one perspective in an intelligent and integrated fashion.

Level I: Do's and Don'ts for Modelers and Decision Makers

One way to conclude the three case studies would be to list the precepts about managing policy modeling associated with each of the three perspectives. Essentially, this conclusion would involve recapitulating the last section of each of the substantive chapters. This type of conclusion seems unimaginative and flat for several reasons.

First, such a sharp listing of do's and don'ts is really too clean and neat a way to cap off the three case studies. It gives the illusion that more is known about the general process of managing policy models than probably is. A neat looking list of generalized precepts belies the fact that the case observations were based upon a single series of events within the Massachusetts Department of Education. Only three case stories were told, but as has been noted previously, several other interesting case stories could also have been told.

Second, a simple listing of precepts creates a very flat, atheoretical, cookbook approach to the management of policy modeling. Such an approach almost completely ignores the many intriguing aspects of the multi-perspec-

tive approach that underpins the design of the research.

Finally, the collected precepts would probably not add much to what has already been said within the substantive chapters. More important than understanding a set of summary precepts is understanding the subtleties of the theoretical perspective that generated such precepts. Furthermore, it would seem important that analysts and decision makers gain an ability to recognize some of the biases associated with different policy-making perspectives so that they can take a more varied and robust approach to policy analysis.

The interested reader is directed to the last section in each of the substantive chapters (Chapters 4,5, and 6) for a listing of the practical do's and don'ts associated with each of the perspectives.

Level II: Self-Conscious Awareness of Perspective Chosen

At the next higher level of sophistication is the observation that the perspective taken by analysts and decision makers preselects or screens what facts they consider, what vocabulary they use to articulate problems, and how they conceive of policy options and their possible solutions. The analyst who is self-consciously aware of what perspective he has chosen and the characteristic biases and slants associated with that perspective may be better able to correct or compensate for the "weak spots" in his chosen perspective thereby creating more broadly-based and robust policy analyses.

This general point has been made several times before. In a whimsical but informative piece, Etheredge undertakes to analyze the problem of

sloppy, unreturned cafeteria trays in the senior high school lunch room.⁷ Using a sophisticated array of no less than 7 theoretical approaches to the problem, Etheredge arrives at 7 sets of policy conclusions for attacking this thorny problem. The lesson is clear, the perspective taken does effect the final conclusions. Self-conscious reflection on the perspective chosen sheds considerable light on the genesis and the quality of the final conclusions.

On a more serious note, in his analysis of the Cuban missile crisis, Allison noted that one major advantage of using a multi-perspective approach is that it allows analysts to be "self-conscious about the nets they employ" while examining the very serious matters of foreign policy.⁸ His own extensive analysis of the Cuban missile crisis is devoted to a detailed examination of how different theoretical policy-analytic perspectives lead to different implications.⁹

With respect to formal modeling, Urban has observed that an important first step in a successful policy-analytic modeling project is the analyst's own examination of his "priors."¹⁰ During this critical stage, the analyst examines the problem at hand in close conjunction with the prior assumptions made within each of the various methodologies that the analyst has at his disposal. At this point, the analyst must find a best "fit" between the problem under study and the priors of the technique to be employed. Better policy models result when the analyst has the ability to self-consciously reflect on the perspective from which he approaches problems.

Carrying some of Urban's observations forward, Meadows has examined some of the most commonly occurring formal approaches to policy analysis in

a comparative analysis of the prior assumptions underlying each of these "research paradigms."¹¹ Finally, Andersen has examined four case studies showing that for the case of policy analytic models, the perspective chosen can lead to concrete differences in the final policy results attained.¹²

All of this literature reinforces the broad "level II" conclusion of this study that self-conscious reflection on the analytic perspectives chosen can create richer and more successful policy analyses.

Several concrete strategies suggest themselves as ways to promote policy modeling efforts with greater capacities to self-reflect on the analytic perspective taken. At a most obvious level, contract managers could require that external analysts include a brief analysis of the methods and approaches that they will employ in any work within the agency. This weak measure would give non-technically sophisticated managers within the agency a better idea of the approach being taken by external analysts.

Brewer has emphasized the establishment of broader and more strictly scrutinized professional standards within the professional policy analytic community as one method of improving the quality of formal policy modeling.¹³ Such standards, which would presumably stand independent of any particular approach or methodology, would allow more careful comparison between the various possible approaches and methods thereby making the peculiar biases and prior assumptions embedded in each more readily apparent.

In general, a heightened self-awareness of the analytic perspective taken requires a rather subtle ability on the part of both managers and analysts to reflect on the deep assumptions implicit in one's point of view. Such efforts at self-awareness involve an ability to self critique and to

self correct. Besides the problems of researchers not being able to easily recognize the limitations of their own perspective-specific realities, there are numerous practical problems with having analysts who enter into commercial relationships with clients completing a critical self-evaluation of their own basic perspective.

To implement greater self-awareness of the analytic perspective taken, it would appear necessary to rely on external mandates (routinely written into contracts for example), third party evaluators, or more widely recognized and agreed upon professional standards within the policy analysis community.

Level III: Guide Work Using Multiple Perspectives

The second level of conclusions suggests that at some point during an exercise in analysis both analysts and decision makers reflect on the basic assumptions inherent in the perspective taken. A more sophisticated approach yet would be to build in an on-going tension between two or more analytic perspectives. Strategies of this sort build in the necessary organizational and cognitive machinery within the analysis effort to assure that several cross-perspective views are continually entering into the decision-making process.

Garet describes one such case where this strategy of building in multiple perspectives appears to have been attempted.¹⁴ During the 1970's, the federal government funded a series of demonstration projects in education innovation that were meant to provide continuing services to children leaving the "Head Start" program for pre-school disadvantaged children.

Each project within the "Follow Through" demonstration project was required as part of their contract to complete a self-evaluation. In addition to these on-site evaluators, the federal government funded a massive third party statistical comparative analysis of all of the sites to be completed by ABT Associates of Cambridge, Massachusetts. Yet a third firm The Huron Institute of Cambridge Massachusetts, was retained to constructively critique the analysis being completed by ABT Associates and to provide another perspective on the ABT analysis for the agency sponsoring both the Follow-Through program and the third-party evaluation. Finally, Garet, a member of the staff at The Huron Institute, was retained to complete a reflective analysis of Huron's role in critiquing the role of ABT Associates while they were completing a third-party evaluation of the actual Follow-Through program. The numerous layers of self-reflection within this particular project may make the whole project look a bit like a house of mirrors, but experiences gained from experiments such as these may also provide valuable insights into how to maintain a tension between perspectives to achieve better policy analyses.

Several other strategies besides the complex ombudsman arrangement reported by Garet can be imagined for promoting the mix of multiple perspectives in the course of an analysis. Roberts reports that by assembling a team of analysts from multiple diverse disciplinary backgrounds, policy analysis tends to be catalyzed and enriched by the diversity of perspective taken on the problem.¹⁵ A strategy consistent with Lindblom's notion that policy results from a complex bartering or "mutual accommodation" between diverse interest groups would be to make analytic capabilities available to

interest groups of different persuasions.¹⁶ Presumably, different interest groups would apply diverse analytic perspectives to a single problem area.

Level IV: Understand Relations Between Perspectives

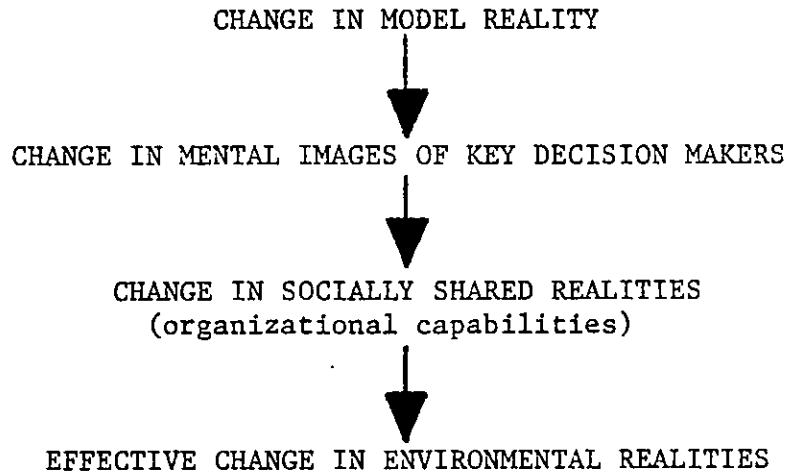
The level three conclusion and its relation to the fourth and final level of conclusions can be better understood through analogy. The multiple policy-analytic perspectives are like lookouts that have been stationed on mountains around a city in the valley to track, analyze, and understand movements within the city. The policy area under study is exactly those movements being understood within the city. The suggestion made above boils down to the simple observation that a more complete analysis of movements within the city can result when lookouts are placed on two or more mountain tops. Obviously, events that may be out of the line of sight of one lookout (because of some obstacle blocking his path of vision) may be easily observed by another. Clearly, the more lookouts that one has, the better will be the coverage of activities within the city. However, too many lookouts may eventually become redundant. Furthermore, trying to understand too many only partially related reports may be confusing. A wise strategy for getting best coverage of the city would be to use as few lookouts as possible, assuring that they have been strategically placed so that all events missed by one lookout will surely be observed by another. In order to implement this most efficient strategy, it will be necessary to understand the exact relationship of the various lookout stations one to the other.

Returning to the world of policy analysis, in order to be most efficient

in the use of multiple perspectives, it will be necessary to understand the exact relationships of the various analytic perspectives one to the other. That is, these perspectives are not independent. An integrating framework is needed for knowing something about the ways that these perspectives overlap heavily in some areas and are disjoint in others. At this fourth and perhaps most subtle level of using multiple perspectives, analysts and managers must be more than aware of the basic assumptions in their perspectives. They must do more than pick several perspectives in a somewhat arbitrary fashion for guiding their research. At this level of multi-perspective analysis, managers and analysts must exhibit an ability to self-consciously reflect on their frames of reference and also understand how this frame of reference relates to other possible frames.

A most simple example of the type of "framework of frameworks" needed begins with the observation that the three policy realities treated in this study's cases are hierarchically related. For example, the task reality most usually and directly changes by the actions of organizations (they promulgate policy guidelines, enforce mandates, conduct training workshops, etc.). In turn, organizational capacities are usually changed by one or more individuals who have a better idea. That is, a key manager will have a key insight that will be processed through the organization and result in a new operating goal or procedure. For example, the Associate Commissioner decides rather abstractly that the Division should move into program monitoring. After several years and much activity, the organization begins to respond to this goal and to develop new procedures toward its realization. Finally one important function of mathematical policy models is to change

the thinking of top management. So there is a strong necessary pre-conditioning whereby change on one level of organizational or personal reality is necessary before change on the next level can occur. Put graphically,



To effectively manage formal models that are intended for policy creation is to effectively manage multiple levels of reality that are related in a definite hierarchical pattern. If the complex chain of changes beginning with the model and resulting in real operating changes is not managed then the chances of effective policy changes are substantially reduced. This rather obvious fact, that several perspectives are linked and all are necessary, goes a long way toward explaining why it is so hard for single theories of decision making and model use to give a "good" picture of how to manage model development within bureaucracies. The essential difficulty lies in the fact that the relevant policy-making realities are multiple, often idiosyncratic to individual managers, incomplete, and overlapping.

By displaying this hierarchy, we realize that to better manage model-based policy design, the analyst must understand his personal relation to

these multiple realities. He must be aware of what levers and buttons he has available to him that may influence each level of reality. Furthermore, he must have a subtle and integrated feel for how all of the various and important realities are hierarchically hooked together.

By conceiving his task exclusively in terms of understanding the task environment, or only the organizational reality, or only the mental realities of key managers, the analyst will leave several key functions unmanaged thereby decreasing the probability of a successful model-based policy creation.

This brief sketch of an integrating framework is obviously incomplete, but it points to the possible types of cross-perspective integrative insights that might emanate from such an undertaking. What is needed is a set of heuristics telling both managers and modelers when to switch from one perspective to another, when to conceive of themselves less as cognitive learners and more as agents of organizational change, for example. Skilled managers and modelers have such heuristics built in to their instinctive understanding of how bureaucracies function. At each moment in time, they seem to instinctively know how to blend rational with organizational with cognitive with political factors. An integrating framework that could sketch some of the more obvious relations between the various perspectives and provide the novice manager or modeler with rules of thumb for how to best "juggle" the multi-perspective nature of policy modeling efforts would be an important contribution.

The task of understanding how the multiple possible perspectives on bureaucratic decision fit together would be a most difficult one. It is

possible to hint at some of the problems that will arise while attempting such an effort.

Temptation to Create a Premature Synthesis. It will be necessary to resist a temptation to prematurely create a synthetic perspective thereby losing much of the richness of the individual perspectives. Returning to an earlier analogy, this strategy of searching for neat and closed synthetic perspectives would be like amassing all of one's lookouts, previously stationed on different mountains, on a single location and having them build a tower and mount a telescope on top of that tower. Without a doubt, this strategy would yield greater resolution and detail of insight from the one synthetic perspective, but the power of multiple cross-checks on missing or blocked information would be missing.

Problems with the Sociology of Research Paradigms. Scholars or analysts who pursue policy problems often identify themselves with a certain approach often associated within a research community. The self-reinforcing nature of such research paradigms may create two types of problems for the creation of cross-perspective frameworks. First, there is the possibility that analysts trained within a specific tradition of analysis may not recognize that they are pursuing perspective-specific approaches to policy problems. A common misconception among the social sciences is that the purpose of social scientific policy analysis is to somehow track down "the truth" about policy problems. Analysts who conceive of their work in purely scientific terms may be less able to recognize how their conclusions are intimately tied to the initial perspective with which they approached the problem.

The second problem, closely related to the first, is the problem of perspective-bound imperialism. This is the phenomena wherein proponents of one perspective claim such increasing generality and power for their perspective that eventually they believe that they can subsume all other analytic perspectives as a special case. For example, a student of Newtonian mechanics could make the claim that all motion (at velocities considerably smaller than the speed of light) could be analyzed in terms of classical dynamics. In a moment of perspective-bound imperialism, such a student could claim that the motion of a ballet troupe could be analyzed in terms of Newtonian mechanics. Without a doubt, the rather mammoth and uninteresting task of describing ballet motion could be undertaken within a Newtonian framework. The imperialistic claim of all inclusiveness is not strictly untrue. However, it is reasonable to assume that a choreographer would have a perspective much more well-suited to describing the same phenomena. So claims that a single perspective can subsume a broad range of disciplines are not necessarily untrue, they are mostly uninteresting and unimaginative.

7.3 BROADER IMPLICATIONS FOR CONDUCTING APPLIED SOCIAL RESEARCH

The generic structure of the situation under study in our three case studies occurs commonly in applied social scientific research. This research is attempting to understand how to better manage, manipulate, or control a complex social process that can (and has been) described from multiple theoretical perspectives. A wide range of interesting problems fall within this same generic problem class. Examples include, attempts to manipulate (improve) urban housing patterns through urban renewal projects; attempts to increase productivity within research and development laboratories through better management techniques; attempts to improve student learning through more effective teaching techniques; and even attempts to get cafeteria trays returned from the high school lunch room through actions by the administration.¹⁷

The research reported in this study suggests that significant benefits may accrue in research designed to solve this generic class of problems if a multi-perspective approach is taken. If fully elaborated for any specific case fitting this general class of problems, a multiple-perspective approach raises interesting puzzles and promises interesting results along several dimensions. Some of the generic puzzles and promising avenues of inquiry raised by multiple-perspective research are briefly summarized below under the categories of research methodology, theory building, empirical work, and normative analysis.

Implications for Research Methodology

There are several common and related types of research methodologies

within the social sciences. One is to pick a theoretical perspective and attached methodology and then go out and find a slew of cases that somehow "fit" the perspective and make a desired point. Conversely, researchers often begin with a class of problems and search for a perspective and methodology that again somehow "fits." The many cases are always fitted (sometimes jammed) within the single perspective. Yet another, the case study approach, selects a single case and a single theoretical perspective from which to study that case.

In any of these cases, there is a definite self-selection going on between the several cases and the chosen perspective. This self-selection process is highly functional because it assures that the researcher is using a methodology and theoretical perspective that has some chance of making sense out of the cases (or evidence or data).

The chosen perspective and methodology is like a cookie cutter and the point of the research is to make as much of the evidence (the dough) as possible fit into the shape of the theoretical cookie cutter. The dough that gets slopped over the edges is lost to the analysis (becomes a portion of the unexplained variance or some such thing).

A different research methodology suggested by the multiple-perspective approach is to use fewer cases (or data points) and more perspectives. By forcing a single or several cases into several rigorous perspectives, the problems with self-selection between evidence and theory and methods become less severe and there is some possibility of making use of some of the lost evidence (lost cookie dough) that can not be readily accommodated within a single perspective. Such an approach would certainly generate much more

tension between theory and evidence. For a given case there would be a higher probability of multiple explanations of a single set of events and a higher probability that points of conflict might arise between the theory and the evidence. Students of scientific inquiry have noted repeatedly that a healthy tension between theoretical propositions and empirical evidence is a necessary pre-requisite to advancing scientific knowledge.¹⁸

However, anyone who has ever watched young children indiscriminantly slamming at a sheet of cookie dough with cookie cutters of all sizes and shapes knows that there are problems inherent in the multiple-perspective approach just suggested. Most specifically, there are problems with how to evenly apply two, three, or more theoretical or methodological perspectives to a single case. Evidence useful within one theoretical framework sheds little light within another. There are practical problems with the sheer amounts of time and effort necessary to make sense out of several cases when viewed from several points of view. Finally, there is the problem that multiple perspectives on the same problem are cognitively unpleasing. Differential interpretations never seem to lead to closure or complete insights into what is really going on within a complex social system. Carried to an undisciplined extreme, a multiple-perspective approach could leave the social scientist with an undifferentiated jumble of both empirical and theoretical propositions with no clear-cut points emerging from the analysis. At present, there are not enough cases where attempts have been made to apply multiple perspectives to single cases to know whether the research strategy sketched above is capable of generating new insights into how to better manage or control complex social phenomena that may be described

through several theoretical lenses.

Implications for Theory Building

The examination of a single or a few cases from several perspectives would appear to be a fruitful approach to new theory building. The intersection of two theoretical perspectives often points out interesting questions and provides leads for enriching or extending either or both of the original perspectives. A second perspective points to "holes" in the first and often suggests fruitful lines of inquiry for filling those holes. A brief look at the theoretical points of overlap between the rational, organizational, and cognitive views of decision making used in this research illustrates how this theory building may be possible.

Rational-Organizational Overlap. A simultaneous look at the rational and organizational views of decision making raises questions concerning the relative role of normative versus descriptive theorizing. The essential question that arises when these two views are considered together is how do organizational factors facilitate or impede rational decision-making processes? Put another way, how would a normative rational theory of decision making have to be elaborated and extended to include an accurate description of processes known to operate within bureaucracies?

In fact, this very same line of questioning appears to have catalyzed much of the research into organizational decision making at the Carnegie school in the late 1950's and early 1960's. Simon and his collaborators began by creating an organizational critique of rational decision-making theory. Eventually, their critiques and extensions became so extensive

and elaborated that a new view of decision making emerged. This view saw decisions as resulting from routine organizational processes rather than from the rational processes posited by the classical rational view of decision making.

Cognitive-Organizational Overlap. The organizational perspective explains decision outcomes in terms of the routine functioning of organizational units. The cognitive-perspective attempts to understand decision outcomes by understanding the cognitive processes of individual managers. The central theoretical question raised by considering the overlap between these two approaches has been raised by Holsti.¹⁹ That is, how do cognitive processes lead to or impact upon organizational processes? Preliminary results presented in this study, suggest that the theory and concepts inherent in the fields of ethnomethodology and the sociology of knowledge may provide one means of bridging the gap between individual cognitive processes and organizational outputs. The concept of a socially shared reality maintained by describable and observable reality sustaining mechanisms may be one critical link connecting the organizational and cognitive perspectives. This insight, generated by simultaneous contemplation of the two perspectives will need further empirical corroboration.

Rational-Cognitive Overlap. The social theorist who searches for new insights by examining the rational and cognitive perspectives simultaneously will find two essential theory-generating questions. The first is how do cognitive processes either inhibit or facilitate rational decision-making processes. This question, quite similar to the one pursued by the Carnegie school with respect to organizational processes has already received con-

siderable attention.²⁰ Another interesting theory-generating question would be, how can a rational perspective enhance or inhibit either individual or organizational learning? That is, by self-consciously donning a set of rational lenses for looking at a policy situation, can decision makers arrive at insights that might have escaped them otherwise? If rationality can improve organizational or individual learning, is it because the rational perspective acts as a natural antidote to known cognitive tendencies to simplify complex situations and avoid trade-offs? Or is it due to some sort of "halo effect" that surrounds rational-looking thinking in a society that is obsessed with the scientific method and other rationalistic approaches to problem solving? Little theory exists to explain why bureaucrats should pursue rational analyses of policy outcomes. The inherent value of rational thinking appears to be accepted prima facie with little examination of the impacts of rational lenses on organizational and individual information filtering and structuring processes.

The above three paragraphs have used the example of three perspectives on the decision-making process to demonstrate how using multiple perspectives when approaching a complex area in the social sciences can lead to interesting theory-generating questions. By implication, the argument is made here that a multiple-perspective approach applied to other social scientific problem areas can lead to similar interesting theory-building questions.

Implications for Empirical Work

In conjunction with the methodological and theoretical benefits that seem possible using a multi-perspective approach, several interesting

empirical questions and insights appear to arise from such an approach. A multi-perspective approach forces the researcher to rely upon several overlapping and only partially related streams of evidence. It becomes difficult to avoid the realization that different theoretical perspectives cover different bodies of evidence and that some bodies of evidence seem to be directly relevant within one theoretical perspective and at best extraneous within another.

Specifically, when a broad range of evidence is collected from a single case study some interesting empirical generalizations having significant implications for theory building arise. Each theory either directly or indirectly can explain or cover most all of the evidence. However, each theory directly covers (explains well, provides vocabulary useful in understanding) only a fraction of the total evidence and leaves some fraction of the total body of evidence uncovered (does not explain well, does not provide vocabulary useful in understanding). Furthermore, each theory highlights different aspects of the total body of evidence. Finally, taken together several theoretical perspectives provide a better explanation and understanding of the evidence than any single perspective. These empirical insights into the nature of the relationships between theory and evidence, if proven true, would appear to argue strongly in favor of adopting a multi-perspective approach as often as possible.

Preliminary results derived from an analysis of the evidence used in the three case studies in this research suggest that there is substantial non-overlap in the three theories' coverage of evidence (for a more complete discussion of these results see Appendix C). Of course, greater direct

coverage of inconsequential evidence is not particularly significant. As has been argued earlier, whether or not it is practically important to use a multiple-perspective approach to gain increased coverage of the evidence depends on the purpose of the analysis and the nature of the organization being studied. However, this case does suggest that for analysis completed in the public sector, non-military bureaucracies, a multiple-perspective approach will yield additional insights for most purposes.

Questions concerning when the additional work of a multi-perspective empirical effort are justified are worthy of additional research.

Normative Implications²¹

A most difficult area of inquiry in social scientific research, where a multiple-perspective approach may be of some help, is the area of drawing normative implications from research--what does the research say about what one should do to better manage or control a complex social system? Again we use the case just completed to illustrate how a multi-perspective approach can help to shed light on some of these thorny normative puzzles.

There would appear to be few unclear normative implications hidden away within the rational perspective. The rational theory is rather heavy-handed and explicit concerning what constitutes a good decision process, what constitutes a bad decision process, and what one should do to make better decisions.

However, when one considers what the organizational and cognitive views have to say about how one should make better decisions, one finds herself on murky ground at best. It is difficult to contemplate "good"

organizational or cognitive decisions without contemplating how to approximate the rational ideal. To a striking degree, the cognitive and organizational perspectives seem to focus on how individual or bureaucratic information processing abilities tend to produce deviations from rational choice. The normative foundations of these other decision-making perspectives, the defining standard of good decisions, would appear to be based squarely, if only implicitly, on notions of rationality.

The real problem with such implicit normative content within social theory is that it tends to obscure questions concerning what is a "good" or "bad" process and how one should proceed. With respect to rationality and decision making, it is not at all clear that rational decisions are necessarily best decisions in all circumstances. Is rationality a massive culture-bound standard, or is there some fundamental connection between rationality and human thought? As Oscar Wilde quipped,

"I wonder who it was defined man as a rational animal. It was the most premature definition ever given. Man is many things, but he is not rational."²²

Single perspectives carefully selected to fit well-groomed data bases do not surface questions concerning the source and validity of the fundamental normative viewpoint underlying a given theoretical perspective. Without the cross-perspective tension created by a multiple-perspective approach to social research, there is little impetus to explicate and examine the fundamental normative assumptions underlying most all social theory.

For decision making, the most basic normative puzzles focus on questions of rationality. Other policy analytic exercises are founded on notions such

as equality and justice. As with rationality and decision making, multiple-perspective approach to social policy research may be helpful in explicating the normative content of social theories aimed at improving the performance of social systems through improved practices of management and control.

7.4 DIRECTIONS FOR FUTURE RESEARCH

An interesting piece of research should raise nearly as many questions as it answers. Because of its rather broad, hypothesis-building focus, this research also raises a host of questions needing further work. Some of these areas in need of more investigation are listed below. Some of the suggested topics are specific extensions of the work begun within the case study. Other suggested topics involve a broader range of inquiry that might be launched from the present work.

1) Retrospective Evaluation of this Case Study. One interesting aspect of this case study was the collection of "real time" interviews and information from decision makers on what they were doing during the course of the fiscal policy project and what they intended to do in the near future. The whole analysis would be strengthened considerably if some time were spent with these same decision makers evaluating their own performance retrospectively. As part of this retrospective interviewing process, divisional decision makers could be asked to comment on the three views of the case study as they appear in this volume. An additional layer of confidence in the study's results could be obtained by incorporating decision makers' reflections on the analysis completed thus far into future versions of the research.

2) Duplicate Studies Verifying, Modifying, and Extending Propositions Derived thus far. Some of the specific propositions raised in this research would appear to warrant further examination and elaboration. For example, the impact of the organizational capabilities of study groups on the ultimate success of model-based policy design might be an area worth

examining in greater detail because of the promise of several useful and specific insights into how to better organize and manage modeling projects. Likewise, the research into mechanisms for sustaining socially shared realities is far from complete. To a large degree, the final emphasis on the sociology of knowledge perspective was a surprise even to the author and consequently the systematic collection of evidence to support the propositions concerning reality sustaining mechanisms was in many cases more suggestive than definitive (relying almost exclusively on open-ended taped interviews). Finally, the notion of organizational learning, so graphically highlighted by the extended time frame of this case study, appears worthy of further study. It would be a significant result indeed, if research could make some wise comments on how to improve organizational learning--on how to make smarter bureaucracies over time.²³

3) Integrating Framework for the Three Perspectives. As suggested earlier in this chapter, the most interesting use of the multiple-perspective approach would arise when analysts and decision makers alike begin to understand better how the insights generated within each perspective are mutually complementary and how to blend the insights gained from each perspective. Although some hints have been given concerning how to accomplish this task, the bulk of the work is yet to be completed.

4) Broad Work on Multi-perspective Empiricism and Methodology. To date, most all of the work integrating across perspectives has been theoretical. Repeatedly, theorists have tantalized the research community with the promise of intriguing results that may arise from cross-perspective work. However, as of yet the arduous task of field testing many of these theory-based

notions has not been undertaken. One problem is the added amount of effort needed to examine a given number of cases from more than one theoretical perspective. Another set of problems centers on how to conduct such cross-perspective research. The fundamental logic of such a research approach is still unclear. Each perspective is based upon a different set of assumptions and meaningful cross-perspective comparisons are difficult to draw. One interesting but not altogether satisfying conclusion is that different perspectives give different results. The implication here is that rigorous comparisons across perspectives (or even disciplined discussions) are not possible. One would hope that more penetrating insights than these could be reached via cross-perspective dialogues.

5) Broad Work on Cross-perspective Normative Analysis. Normative puzzles about what makes good and bad decisions have continued to be baffling throughout the course of this inquiry. Interestingly enough, this is not a practical problem. In the field, real-world analysts and decision makers do not spend a lot of time puzzling over what is a good or best process for making a decision. In fact, it always seems easy to recognize a good decision when one happens along, and if a decision process appears to be bad, it is usually easy to critique the decision process and say what went wrong. Normative puzzles appear to be a disease endemic to academicians who feel obliged to be explicit about what they mean by "good," "bad," "better," or "best." Academic policy analysts are like so many art critics who continually grapple with the defining standards for artistic performance, but it is the artists themselves, often ignorant of the precise standards by which their work is judged, who do the creative work that reforms the

standards. Nevertheless, it seems that normative questions somehow should be important and some additional thought is needed concerning how a cross-perspective approach could help elucidate many of the normative puzzles that plague social scientific research.

7.5 NOTES FOR CHAPTER SEVEN

1. A more complete discussion of inter-rater reliability in the experiment reported below is contained in Appendix C, Section C.3.

2. For example, see: Roy Turner, ed. Ethnomethodology. Middlesex, England: Penguin Education, 1974; Harre and Secord. The Explanation of Social Behavior. Oxford: Basil Blackwell, 1972; Anthony Giddens. New Rules of the Sociological Method. London: Hutchinson & Co., Ltd., 1976.

3. Berger and Luckmann. The Social Construction of Reality. Garden City, New York: Doubleday & Company, Inc., 1967.

4. For examples of work in this vein, see: Benjamin Lee Whorf. Language, Thought and Reality. Cambridge, Massachusetts: M.I.T. Press, 1956; Ludwig Wittgenstein. Philosophical Investigations, 3d ed. The Macmillan Company, 1969; and Hana Pitkin. Wittgenstein and Justice; On the Significance of Ludwig Wittgenstein for Social and Political Thought. Berkeley: University of California Press, 1972.

5. Thomas Kuhn. The Structure of Scientific Revolutions, 2d ed. Chicago: University of Chicago Press, 1970.

6. Lakatos. "A Methodology of Scientific Research Program," in Lakatos and Musgrove. Criticism and the Growth of Knowledge. Cambridge, England: Cambridge University Press; and Hayward Alker. "Research Paradigms and Mathematical Politics." (forthcoming)

7. Lloyd S. Etheredge. The Case of the Unreturned Cafeteria Trays; An Investigation Based Upon Theories of Motivation and Human Behavior. Washington, D.C.: American Political Science Association, 1976.

8. Graham T. Allison. "Conceptual Models and the Cuban Missile Crisis." American Political Science Review 63 (September 1969) p. 715.

9. Graham T. Allison. The Essence of Decision: Explaining the Cuban Missile Crisis. Boston: Little, Brown and Company, 1971.

10. Glenn L. Urban. "Building Models for Decision Makers." Interfaces 4 (May 1974) pp. 1-11.

11. Donnella Meadows. "The Unavoidable A Priori: A Discussion of Major Modeling Paradigms." The System Dynamics Method, Proceedings of the 1976 International Conference on System Dynamics, Geilo, Norway, August 8-15, 1976, pp. 161-240.

12. D.F. Andersen. "How Difference in Analytic Paradigms Can Lead to Differences in Policy Conclusions--Two Case Studies." The System Dynamics Method, Proceedings of the 1976 International Conference on System Dynamics, Geilo, Norway, August 8-15, 1976, pp. 241-264.

13. Gary Brewer. "Professionalism, The Need for Standards." Interfaces.

14. Michael Garet. "Organizational Roles and Large-Scale Evaluation Research: Lesson from the Huron Institute's Involvement in Follow Through." Cambridge, Massachusetts: The Huron Institute, August 1976 (preliminary draft).

15. This observation was made in a lecture by Roberts in January of 1974. In that talk he was discussing the multi-disciplinary nature of the research team completing the work reported in, Systems Analysis for Regional Policy: An Application to River Basin Planning. H.R. Hamilton, et al. Cambridge, Massachusetts: M.I.T. Press, 1963.

16. Charles E. Lindblom. The Intelligence of Democracy: Decision Making Through Mutual Adjustment. New York: The Free Press, 1965.

17. In particular this last problem has received extensive cross-perspective treatment in Etheredge, op. cit.

18. This view, known as refutationism, has been most recently advanced by Karl Popper. Conjectures and Refutations: The Growth of Scientific Knowledge. New York: Harper and Row, Co., 1963.

19. Ole Holsti. "Foreign Policy Formation Viewed Cognitively," in Robert Axelrod, ed. Structure of Decision: The Cognitive Maps of Political Elites. Princeton, New Jersey: Princeton University Press, 1976.

20. For a review of some of the cognitive critiques and extensions to rational decision-making theory, see: D.L. Andersen. "Theories of Decision Making: An Annotated Bibliography," Sloan School Working Paper, WP 943-77. Cambridge, Massachusetts: M.I.T., Sloan School of Management, 1977, p. 27.

21. Michael Garet, in numerous private conversations, has continued to emphasize the puzzling normative questions implicit in this research. Many of the puzzles sketched here can be traced to those discussions.

22. Oscar Wilde. The Picture of Dorian Grey. New York: Lancer Books, 1968, p. 50.

23. Lloyd Etheredge has sketched the rudiments of a preliminary research program for investigating the literature on organizational learning in The Analysis of Executive Branch Learning in the Long-Run: Process and Barriers. (preliminary draft) A proposal to NSF, July 1977.

APPENDIX A

POLICY RECOMMENDATIONS FROM A SYSTEM DYNAMICS SIMULATION OF THE SPECIAL EDUCATIONAL FISCAL POLICY SYSTEM

A.1 DISCUSSION

The following points for discussion are based upon a system dynamics simulation of the reimbursement process for special education in the Commonwealth of Massachusetts. The model is based upon qualitative information gathered through a host of discussions with persons throughout the division, especially a series of working meetings with Bob Audette and Bambi Levine stretching from the end of September until the present. These results should be viewed as an exercise in deduction. If the basic assumptions that are going into the model are all correct, then the policy results coming out of the model must be accurate. By using the computer simulation, we can input a host of different assumptions about how the system actually operates and then observe whether or not the overall behavior of that system is what we would expect. Proposed policy changes can also be implemented on the modeled system in a laboratory approach to fiscal policy design. If policies that we would expect to work in the real world do not work in our model, then there is considerable cause to rethink our reasons of why the real world behaves as it does (NOTE: It may turn out that upon further examination, we conclude that our original intuition is correct and that the model is not valid—but then the resulting critical examination of the assumptions underlying our beliefs would be a valuable exercise in and of itself.)

A.2 POLICY RECOMMENDATIONS

A. In broadest terms, there are two separate classes of concerns surrounding fiscal policy development. The first of these is the overall stability of the fiscal system. Strong pressures currently exist within the incentives of the reimbursement system that will insure a continued growth in reimbursements over the next few years. Such a growing system is fiscally unstable. The second class of concerns deals with how fiscal policies can promote desired programmatic trade-offs in the service of children with special needs (e.g., will the overall system provide more intensive service to fewer children or less intensive service to a broader range of children).

B. Fiscal Stability should be the first priority of the Division over the next year. Several factors mitigate upon strong emphasis on fiscal stability within the near future:

--The Department has already taken major steps to insure the establishment of a strong special education program in the Commonwealth. These gains may be lost unless the fiscal system can be stabilized.

--Further "fine tuning" of the programmatic end of Chapter 766 through increased program control measures (such as the perfection of the program audit instrument) will be overwhelmed by the instability of fiscal affairs.

--Current activity elsewhere within the Department (solidification and growth of the Office of Local Aid and School Management Services, as well as the Peat-Marwick-Mitchell effort at reform within the End-of-Year report) indicate that decisive action by the Division at this time could lead to substantial fiscal gains over the next year.

C. In the short run (3-5 years) fiscal stability can only be attained through strong fiscal controls. Increased emphasis on program standards and program controls can be helpful, but they can not reverse the "cost jamming" trend currently facing special education. The Division must take a leadership role in implementing strong fiscal controls such as the following:

(1) Promulgate guidelines for fiscal year 1977 that detail (for all expenditure function codes) exactly what costs may and may not be charged off to special education. A preliminary draft of such guidelines must be prepared by January to be included in the Peat-Marwick revision of the End-of-Year report to be distributed next March.

(2) Promulgate policy for fiscal year 1978 that details (for all expenditure function codes) exactly what costs may and may not be charged off to special education. Clearly, this policy will be a revision of the guidelines for fiscal year 1977.

(3) Revise format of the End-of-Year report to insure that items #1 and 2 can be effectively implanted.

(4) Coordinate the guideline development with the Bureau of External Audit to insure that such guidelines can form the basis for field audits of LEA reports. (A clear, program-based set of such guidelines do not currently exist.)

(5) Insure the occurrence of aggressive and timely audits of the FY 77 special education reimbursement claims.

(6) Spearhead the training of R.E.C. personnel and LEA SPED directors (as well as LEA business agents and superintendents) in the guidelines.

A host of other policy recommendations might reinforce the above six. However, the above six recommendations are considered a necessary minimal core if the Division is to attain fiscal stability within the next three to five years.

A.3 SUMMARY OF POLICY TESTING VIA SIMULATION

The following sections describe in summary form the analysis completed on a simulation model of the reimbursement system (SPED2). The model contains three sectors, a program sector, a budget setting sector (for LEAs), and a state reimbursement sector. The structure of the model is explained in section IV and the detailed analysis of various policies is presented in sections V through VIII of this report. Three broad types of policy controls were tested within the model: Program Standards, Program Controls, and Fiscal Controls. The effects of each of these policy levers upon the reimbursement system is presented below.

Program Standards (see Complete Analysis pp. 22-23)

By program standards are meant those activities of the Division of Special Education that define programmatic goals of excellence to be attained by LEAs throughout the state. Included in such activities are the preparation and updating of an explicit set of program regulations for 766, the promulgation of such regulations through regional workshops and training, the establishment of standards for teachers in special education, and the promotion of a common set of goals through collaboratives, professional groups, and interest groups in a state-wide basis. The current modeling effort assumes that the Division has been highly efficient (80% effective) in providing leadership in the definition of program standards on a state-wide basis right from the beginning of the

law's implementation. The current section explores the consequences if the state had been less effective in its leadership in program standards right from the beginning.

--Program standards are the key to a successful 766 program. Under no cases examined did the 766 program "get off the ground" programmatically when the department was assumed to be only 20% efficient in its leadership within program standards. In all cases, the inertia of how things had been done in the past dominated over program innovations.

--The 766 fiscal system still experienced unstable growth even in the light of relatively low program growth due to a lack of program standards. That is, although low program standards were sufficient to halt the growth of program innovations, they were not sufficient to halt the growth of cost jamming and unstable budget growth.

--The existence of high program standards exacerbated the rate of growth of cost jamming and budget growth. That is, although budgetary instability existed even with low program standards, higher program standards accelerated the unstable growth of budgets.

Program Controls (See Complete Analysis pp. 20-22)

Program Controls encompass those activities undertaken by the Division to insure the programmatic compliance of LEAs with the program standards defined by the Division. Examples of program controls include review and certification of the LEAs annual implementation plan, review of educational plans by Divisional regional personnel, complaint management systems, and most notably the execution of system-wide program audits. The standard run of the model assumes that the department is initially less efficient at program controls (initially 40%) but at two

years after the implementation of the law, program control may be suddenly stepped up to 80 or 100%. The following results of model analysis are worthy of note.

--Since the current model deals primarily with fiscal matters, it is important to note that program controls will undoubtedly lead to advantageous program results that can not be adequately captured within the current model. However, the current model does indicate that increased program controls do lead to a slightly worsening adequacy of special education staff to pupil ratios in LEAs. This effect is primarily due to an elimination of staff jamming into special education (such as the reassignment of reading teachers to special education). This effect is not highly visible until after 5 to 9 years after the law's implementation.

--Complete program controls (assumed equal to 100% after second year of implementation) can not lead to a stabilization of special education budgets and will do little to minimize cost jamming. That is, attempts to regulate 766 through programmatic means alone (complaint management, program audits, increased regional monitoring capacity, etc.) will be beneficial within the overall fiscal picture but will not be able to turn around or even halt cost jamming and fiscal instability.

--A slight deterioration from complete fiscal control (from 100% to 80%) leads to a fiscal situation that is nearly the same as the relatively uncontrolled situation (40%).

Fiscal Controls (See Complete Analysis pp. 14-20)

The principal conclusion of this entire analysis is that the Division should undertake fiscal controls such as those outlined in section II.C within the next year to attain fiscal stability. The current model

assumes relatively low initial fiscal control on the part of the department (25%) with that fiscal control being suddenly stepped up to 60% or 90% after the second year of implementation of 766. The following changes in overall system behavior resulted from the strengthening of departmental fiscal controls.

--90% fiscal controls initiated two years after the implementation lead to a stabilization of program costs at nine years after implementation. The stabilized costs are approximately 60% less than those reached with low (25%) fiscal control. The amount of staff and pupils served is no lower than in the baseline case. These cost savings are realized by a turn-around in cost jamming less than one year after the new controls are instituted. Excess costs continue to decline for the next four to five years with the leanest special education budgets ever appearing approximately six years after the law's implementation (and hence four years after the implementation of new controls.)

--A 60% value of fiscal control, again instituted two years after the law's implementation, can lead to similar but less substantial cost savings. The growth in cost jamming is effectively halted after two years, but an actual turn-around in cost jamming (and resulting leaner budgets) will not occur.

--Instituting fiscal controls has slightly deleterious effects on the staff to student availability indices after four to nine years. However, these negative effects are not greater than similar negative effects observed due to more stringent program controls.

--The complete impacts of tightened fiscal controls on programmatic variables can not be fully assessed within the current model.

Joint Control Policies

The overall best system performance was obtained when improvements in both fiscal and program controls were instituted after the second year of the law's implementation. The "best" policy group tested involved 90% fiscal control and 80% program control instituted at year two. High program standards (80%) were assumed from the start of the best policy runs. If joint policies are set into action, satisfactory system performance can be obtained with less than complete program and fiscal controls because the two sets of policies are mutually reinforcing.

Finally, the ability to test for effects of bias in the reporting of pupil data for reimbursement purposes was programmed into the present model. At present, the effects of such bias have not been explored.

A.4 STRUCTURE OF THE SPED2 MODEL

The model employed in this study is a system dynamics simulation of the special education reimbursement system. Such a model begins with an analysis of the underlying causal mechanisms that cause one or more key variables to change over time. In this case, the most interesting variables were aggregate representations of pupils, staff, and budgets pertaining to special education. The interesting changes were growth, decline, or mutual adjustment between these three primary types of variables.

The system dynamics methodology attempts to identify sets of causal relationships that are mutually self-causing. For example, an increase in the number of staff identified as "special education" staff will lead to a growth in the claimed special education budget. In turn, an expanded special education budget will make it easier for the director of

special education to maintain a larger staff and in some cases marginally expand that staff with respect to other regular day services. Hence, an initial expansion of the SPED staff can lead to even further expansion in the near future. Taken together, all of the causal relations put into the model form the basic assumptions of the model. They are assumptions because the modeler may have misperceived, misrepresented, or omitted one or more key relations. For this effort, the assumptions put into the model were gleaned from interviews throughout the division, especially those with Associate Commissioner Audette.

Once all of the assumptions have been precisely specified, they may be written down in the form of computer code. The complete computer code for the SPED2 model along with an ordinary English interpretation of what the code means is presented in the Appendix of this report. The computer simulation merely unfolds the consequences of these many assumptions over time. One may also assume changes in policy or in the policy making environment at some specified points in time. By rerunning the simulation with different assumed policy conditions, it is possible to test for the effect of different policies on the simulated system. Such policy tests are presented in the sections that follow.

Figure A1 presents the basic structure of the SPED2 model in simplified form. Three sectors are considered: a program sector, a budget setting sector, and a reimbursement sector. The dotted lines represent the flow of key information elements between the various sectors. For example, the budget setting sector received information concerning staff distribution and the relative "richness" of regular day and special educational reimbursements. Based upon these informational inputs, the

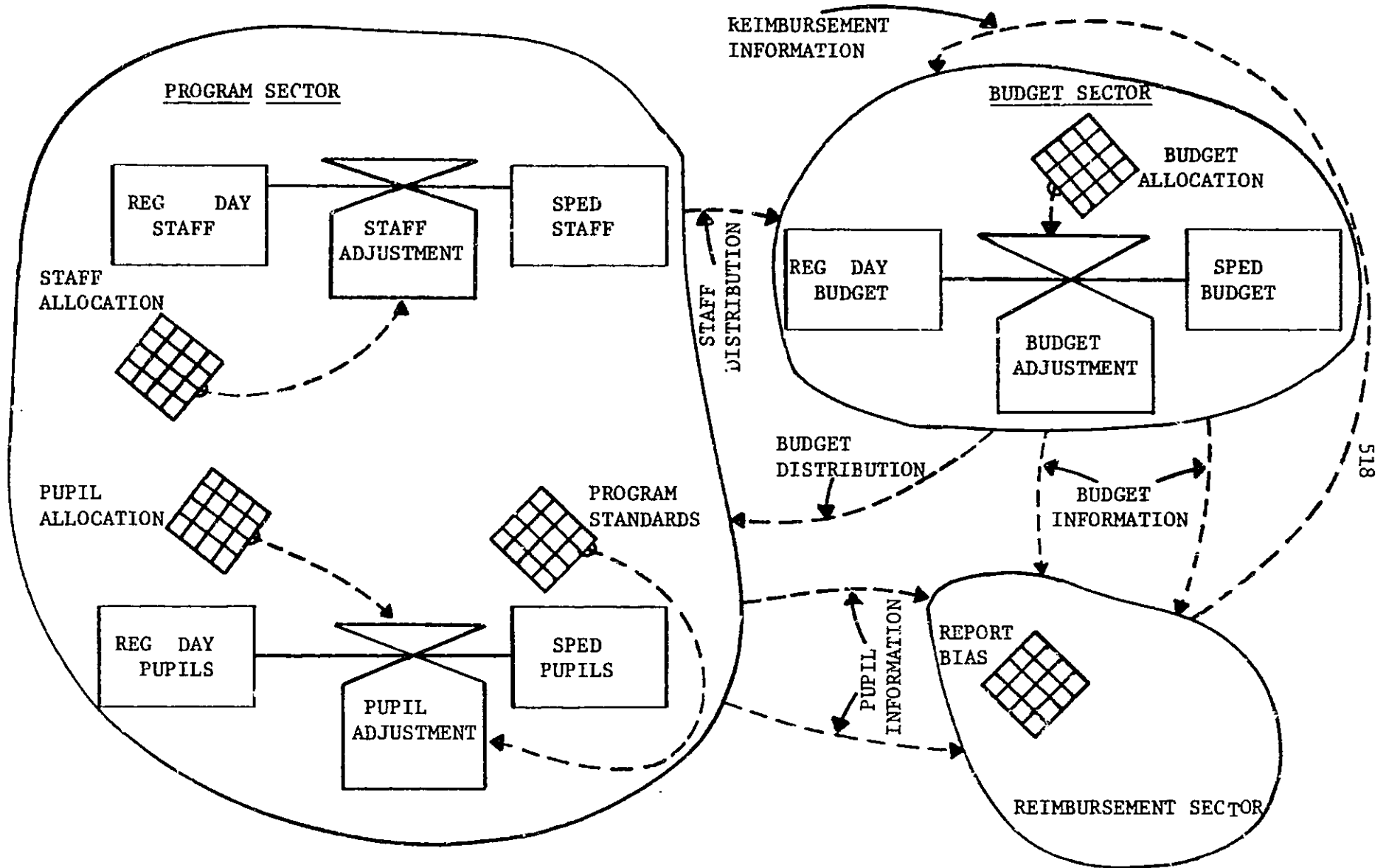


FIGURE A.1: Principal Sectors, Levels, and Control Points in SPED2 Model

budget sector divides the total budget between regular day and special education. The reimbursement sector receives pupil and budget information and uses the 766 reimbursement formula to compute regular day and special education reimbursements.

The boxes shown in Figure A1 represent key accumulation or level variables within each sector. The faucet like symbols represent flows between these levels. For example, the Pupil Adjustment flow may decrease the number of regular day pupils and increase the number of SPED pupils or vice versa. Note that for the sake of simplicity, this model assumes fixed staff, pupils, and budget. The model only treats the relative adjustment of these variables and does not allow for a growth or decline in budgets. This assumption may be easily relaxed at a later date. The model also assumes that the budget is expressed in constant (non-inflated) dollars and that economic conditions (such as rising unemployment, overstrained local tax bases, etc.) are not relevant for the purposes of this model. Again, these assumptions may be easily relaxed. Furthermore, the model assumes that the state is willing to provide a constant pool of dollars (equal to exactly 30% of total reimburseable expenditures at the initial equilibrium). Of course, changes in the willingness and or ability of the state to support various levels of educational expenditures under various funding formulas could also be explored through extensions of the model.

A serious limitation of the current formulation is that it aggregates all staff and pupil movements within a single program sector. In order to more fully explore the questions of rich towns versus poorer towns and how the overall reimbursement pie gets divided, it would be

necessary to reproduce at least two similar program and budget sectors-- one for the richer towns and one for the poorer towns. Such questions of disaggregation may be carried out as far as deemed necessary to obtain useful policy insights. However, the current model, with its highly simplified structure of assumptions is still able to yield considerable interesting and non-obvious insights into the nature of fiscal policy on a state-wide basis.

Finally, Figure A1 contains five cross-hatched diamonds that represent the five policy points that were tested for sensitivity and effectiveness within the model. For the purposes of the analyses discussed thus far, the two control points on staff allocation and pupil allocation were lumped together into "program controls". Program standards primarily impacted upon the flow of pupils between regular day and special education. The budget allocation control points acted upon the flow of dollars between the regular day and special education budgets. The possibility of testing for bias in the reporting of pupil data was programmed into the reimbursement sector, but its effect has not yet been explored.

Figure A1 merely displays the principal levels, flows (or rates) and control points that are treated within each sector. It does not explicitly show the complex web of causal relations that exist between these major variables. Table A2 briefly summarizes the variables that are assumed to be important in determining the causal relations between the major variables in each of the three sectors.

PROGRAM SECTOR

BUDGET SECTOR

Pupils in Regular Day	Budget in Regular Day
Pupils in Special Ed.	Budget in Special Ed.
Pupil Adjustment Rate	Budget Adjustment Rate
Total Pupils	Total Budget
Distribution of Pupils	Distribution of Budget
Effect of Staff Availability on Pupil Adjustment	Claimed Budgets
Effect of Budget Availability on Pupil Adjustment	Perceived Reimbursement from Special Education
Department Pupil Standards	Perceived Reimbursement from Regular Day
Traditional Pupil Standards	Relative Attractiveness of Special Ed. Claims
Operating Standards for Screening Pupils	Inflation Effect from Attract- iveness of SPED claims
Staff in Regular Day	Departmental Control of Budget Allocation Process
Staff in Special Ed.	Fraction Budget "Jammed"
Staff Adjustment Rate	
Total Staff	
Distribution of Staff	
Effect of Budget Available on Staff Adjustment	
Staff Required to Meet Current Pupil Load	
Time to Adjust Staff	
Staff Adequacy Index	
Departmental Control Staff Allocation	

REIMBURSEMENT SECTOR

Per Pupil Costs Regular Day
Per Pupil Costs SPED
SPED Excess Cost Per Pupil
SPED total Excess Costs
Total Reimbursement Available
Reimbursement Remaining for Regular Day
Total Claims for Regular Day
Fraction Reimbursed Under Regular Day Claims
Fraction Reimbursed Under SPED Claims

TABLE A.2: Major Variables Appearing in Each Sector of SPED2 Model

All of the above variables are interconnected through a structural web of mutual causation. Changes in one variable have effects upon other variables that in turn have effects on yet other variables. In many cases, these chains of causality are structured in such a way that changes in a given variable eventually feed back through several other variables to reeffect the original variable.

Figure A3 illustrates several important feedback loops within the SPED2 model. Claimed Special Education budgets are determined by three factors. Actual SPED budgets reflect the Special Education budget that would obtain if LEAs claimed only dollars spent under the strictest definitions of what are allowable costs. Inflated budgets reflect the LEAs attempts to make Special Education budgets look larger because of the attractiveness of SPED claims due to the larger percentage reimbursements given for special educational expenditures. The third, fiscal control variable, represents the department's ability to have claimed costs reflect actual expenses incurred rather than inflated claims of expenses incurred. If claimed SPED budgets go up, then SPED reimbursements will also give rise given current reimbursement policies. This rise in SPED reimbursements further increases the attractiveness of filing SPED claims because dollars returning through SPED claims is rising and dollars returning through regular day claims is on the decline. The increased attractiveness of SPED claims further reinforces the propensity of LEAs to inflate special education budgets--thereby completing the feedback loop.

Similarly, increased Special Education budgets reinforces the ability of Special Education administrators to maintain large Special Education Staffs. In some cases, the increased availability of Special Education

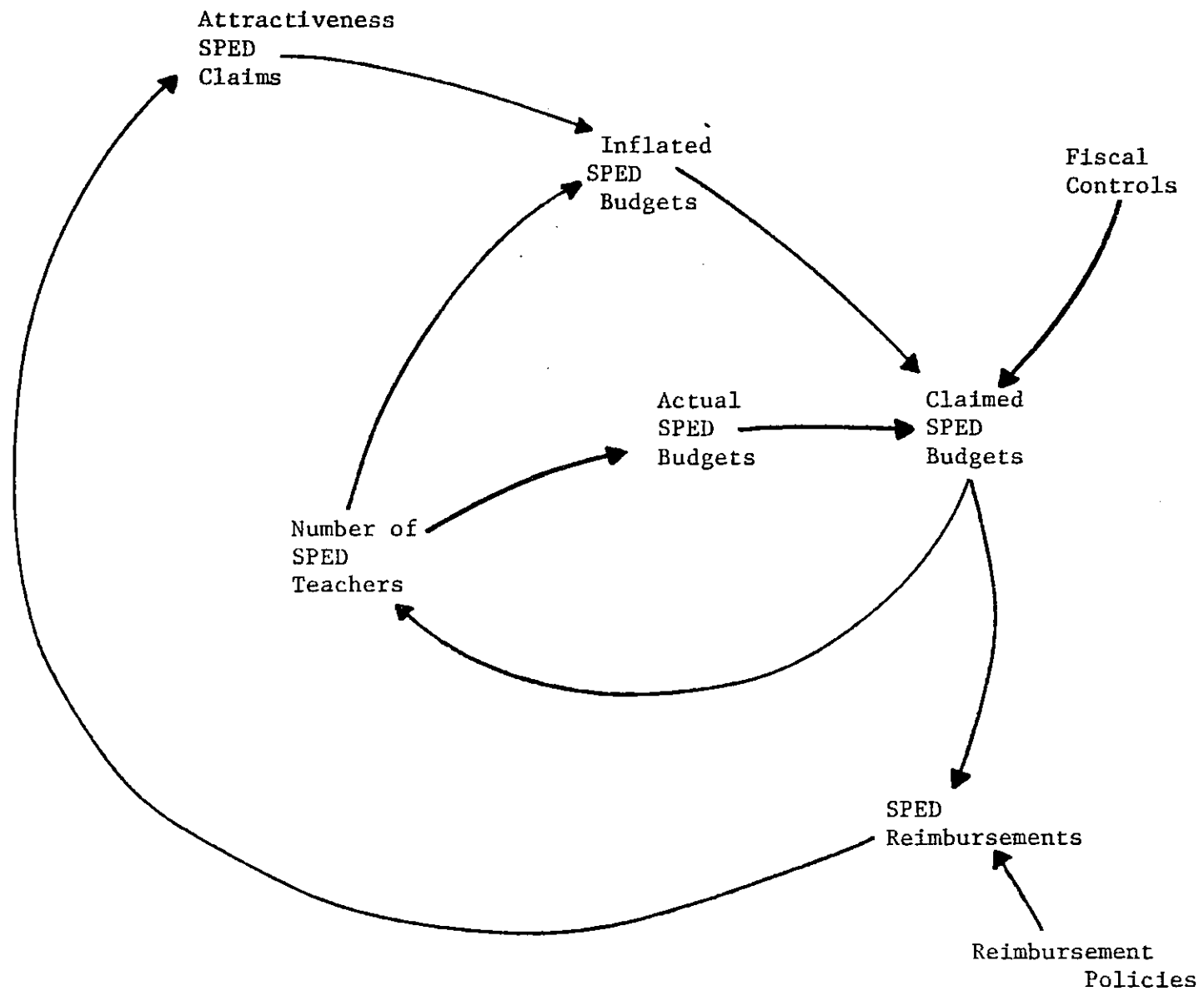


FIGURE A.3: Several Important Feedback Loops Within SPED2 Model

budgets will even allow Special Educational staff to expand relative to regular day staff. Completing the feedback loop, the growth in special educational staff can further reinforce the growth in claimed budgets through increases in both the actual and inflated versions of the Special Educational budget.

Of course, the above description is simplified. Many other loops are simultaneously operating within the model that will tend to check these two "viscous cycle" loops. That is, the two loops shown in Figure A.3 would lead to sustained and continuing growth unless checked by other causal forces within the system.

Figure A4 gives a more complete representation of the major feedback loops that exist within the complete SPED2 model. Most of the loops within the Program Sector are self-regulating. That is there is a strong tendency for the fraction of pupils in Special Education to adjust to the amount of staff available. Behaviorally, this amounts to the observation that an already overworked Special Education staff will be less willing and able to take on an additional student load. Conversely, an over-staffed special education department would in all likelihood be able to "strum up" enough business to keep themselves busy.

The self-regulating properties of the program sector also work in the opposite direction. If there is an excess of pupils identified as having special needs within a system, over time the amount of available staff will tend to expand to meet the need (even though this expansion may ultimately be subjected to economic constraints).

Under the current reimbursement system, the reimbursement and budget sectors do not tend to be self-regulating. Instead, the reimbursement

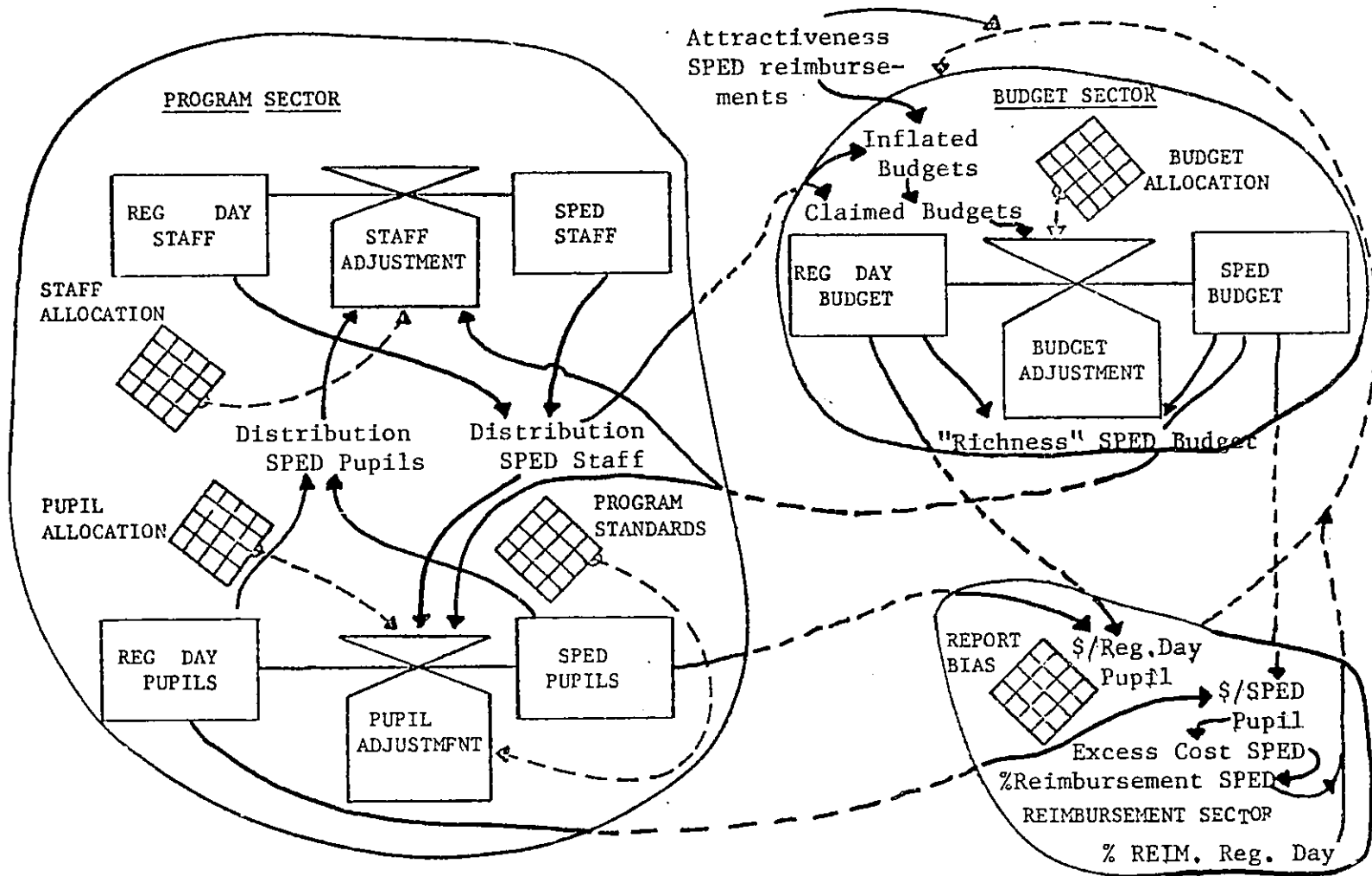


FIGURE A.4: Principal Feedback Paths in SPED2 Model

sector is structured in such a way as to encourage the flow of budgetary dollars out of regular day into special education. This effect occurs because the current reimbursement formula provides for a much higher percentage reimbursement of special education claims. Furthermore, since both special educational and regular day reimbursements come out of a single fixed pot with special education's share being portioned out first and what is left being given to regular day, any increase in special education reimbursements leads to a decrease in the percentage reimbursement given to regular day expenditures. A "double bind" situation emerges. As special educational reimbursements rise, the attractiveness of regular day claims declines even further as less state money is available to fill regular day claims.

So unless the department can exert strong fiscal controls, LEAs will continue to feel strong pressures to inflate their special education budgets in order to maximize their state aid. Because growth pressures underlying the unstable increases in special educational budgets and reimbursements claims reside within the structure of the budget setting and reimbursement sectors, it is not logical to expect that corrective measures taken in the program sector will be able to arrest the unstable budget growth. Only strong fiscal controls instituted within the budget setting will be able to stabilize the 766 reimbursement picture.

In the sections that follow, several computer experiments with the simulated 766 reimbursement system are explored. These experiments reinforce the result that fiscal stability can only be attained through strong fiscal controls exerted within the budget setting sector.

A.5 ANALYSIS OF FISCAL CONTROL POLICIES

All of the policy analysis that follows is based upon the simulation model SPED2 that is described in section A.4. The only difference between various versions of the model presented is that different versions are run with different values for four different "control parameters" within the model that represent the Department of Education's ability to control different points within the system. Each control parameter varies from 0% to 100% with 0% representing no control on the department over the point in question and 100% signifying complete departmental control by the Department over the actions of LEAs for the point under consideration.

At each such control point, it is assumed that the Department would like to see certain standards or guidelines adhered to and LEAs would tend to pursue a slightly different set of standards that might be in their own rational best interest. For example, in the budget setting sector, LEAs might risk submitting a relatively higher, inflated special education budget to attain higher reimbursements than the department would like to see. The actual claim submitted will be a weighted average between the two extremes one defined by Departmental policy and the other by the rational self-interests of the LEAs. The control parameter determines the relative given to each component of the claim in the LEAs final claim.

The four control points examined in the following sections explore

- 1) Department control of budget allocations.
- 2) Department control of staff allocations.
- 3) Department control of pupil allocations.
- and
- 4) Department control of program standards.

For the purposes of analysis here, control points 2 and 3 will be considered together as "Department program control".

A standard run was completed against which future policy changes might be compared. A simulation of the standard run is shown in Figures A.5A and 5.B. The Standard run assumes a high department control of program standards (equal to 80%). The department's control of program is set at only 40%. Finally, the department is assumed to have only 25% control of budget allocation procedures within LEAs. These values were chosen as reference values against which policy changes might be compared.

Figure A.5.A shows three major system variables plotted against time over a ten year time horizon. From year zero through year one, the system is in initial equilibrium. Five percent of the total student population is being served through special education, and ten percent of the total staff and budget are being allocated to special education. At year one, two things happen, both meant to represent the sudden introduction of a law such as chapter 766. First, the marginal reimbursement for dollars spent in special education jumps from 30% (the original equilibrium) to 100% (The amount under 766 given no "state limits" on excess costs). At the program standards or definitions of what is special education takes a step increase from 5% (the original equilibrium) to approximately 12%.

This system is considerably more sluggish in its response to these sudden changes than was the actual special education system. After the first year, the total budget allocated to special education has jumped by approximately 30% and the number of pupils identified as having special needs has jumped approximately 60%. These growth rates do not appear too large in comparison to the actual growth rates experienced during the first year of 766. The growth observed during the first year continues for the entire ten years of the run. Only the pupil sector appears to

stabilize at approximately 15% (some three percentage points above the "standard" program definition).

The strong and continued growth in budget can be attributed to two principal factors. First, the staff actually allocated to special education shows a steady growth as special education administrators experience both an increased pupil load due to the new higher standards for pupil service as well as a fattened special education budget for meeting these additional pupil loads. The second factor contributing to the observed growth in budget is a propensity to inflate special education budgets on the part of special education administrators and business agents in order to maximize state aid. In Figure A.5.A, the difference between fraction staff in SPED and fraction budget in SPED represents the relative effects of inflated budgets on total SPED reimbursements.

Figure A.5.B shows the performance of several key indicators of the performance of the fiscal system for the same standard run shown in 4B. The variable, Fraction Total Budget "jammed" into SPED, explicitly represents the gap between staff allocations and the corresponding budget allocations. By year ten, nearly 13% of the total system's budget is being "jammed" into the special education budget in an attempt to maximize reimbursements. Note that jamming takes a sharp increase from zero to three percent at year one when the law was implemented. This jump is totally due to the enriched reimbursements made available with the implementation of the 766 reimbursement formula. A second variable, % Reimbursement for Regular Day Expenditures, declines over the entire ten year run. The initial equilibrium value is equal to 30% reflecting the assumption that the state is willing to provide a constant amount of state aid equal to

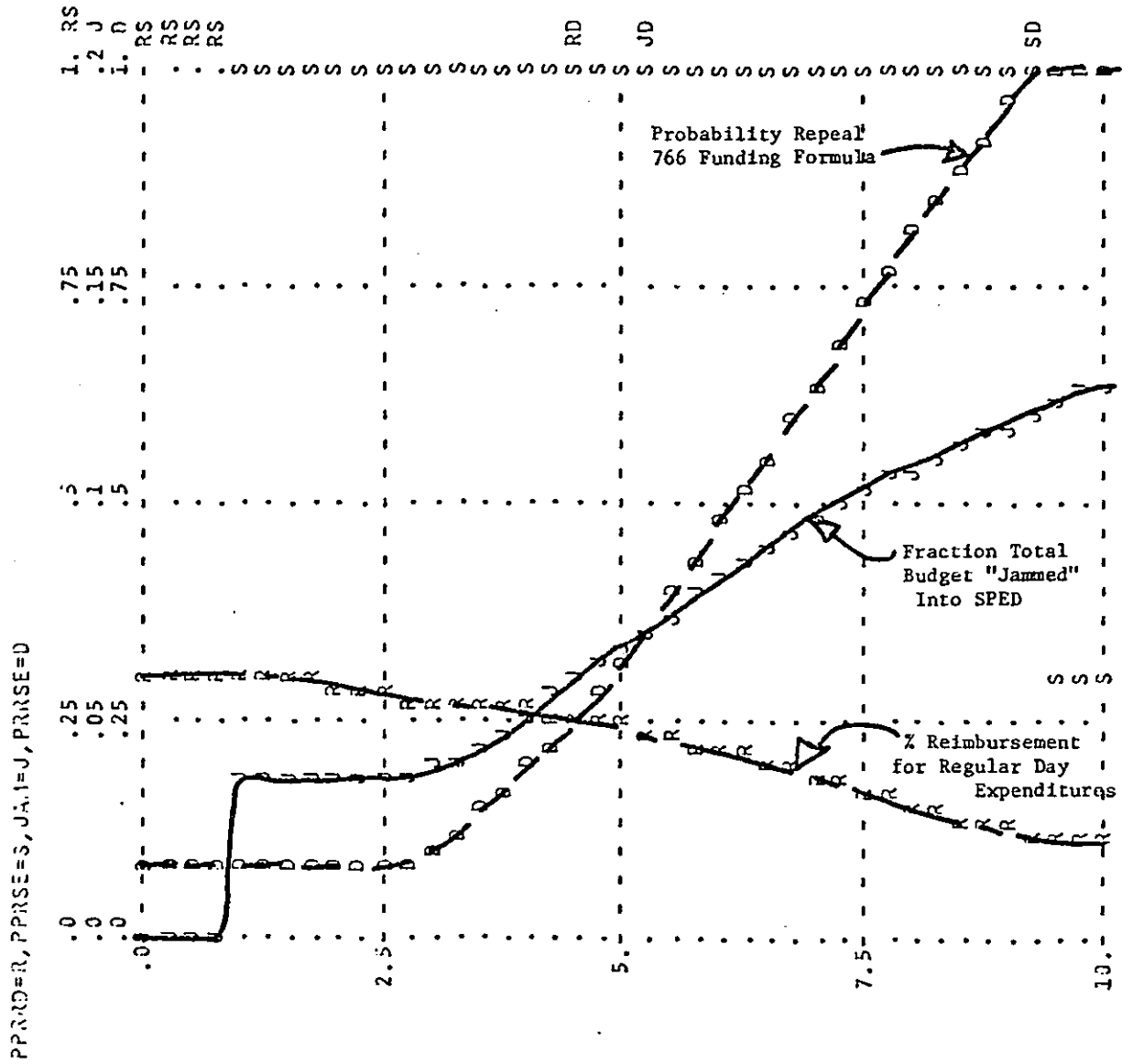


FIGURE A.5.B: Standard Run of SPED2—Key Indicators of System Performance

30% of all expenditures before the passage of 766. As special education budgets continue to grow, the amount of monies available for regular day reimbursements declines. As the total amount available declines, so does the percentage being reimbursed by the state. At year ten, the state is reimbursing less than 15% of the total regular day expenditures.

The final variable, Probability of Repeal of 766 Funding Formula, is an index devised for purposes of illustrating the type of fiscal crisis that an unchecked growth in special education budgets can produce. It is assumed that as a larger and larger fraction of the overall available state aid is spent on special education (leaving a lower and lower fraction of the aid being spent on regular day) pressures will mount within the State Legislature to revise the funding formula for 766. When 80% of the available state aid is being sunk into special education, the probability of repeal of the funding formula is assumed to equal one. Note that this situation actually occurs in the simulation at year nine.

The remaining runs will compare these same output variables for different assumed values of the different control parameters. For example, Figure A6 is exactly the same run as in Figure A5B except that at year three (two years after the implementation of the law) the Department's control of Budget Allocations rises sharply from 25% to 90%. Such a shift represents a vigorous and sustained effort on the part of the Division of Special Education to implement fiscal control policies such as those outlined in section II C. As shown in Figure A6, the results of such policy changes are dramatic. Within one year after the institution of improved fiscal controls, the fraction of the budget jammed turns around and actually begins to decline. From four to five years after the policy

changes, the fraction of the budget jammed reaches a low point reflecting leaner and more cost effective special education budgets. The decline in % Reimbursement for Regular Day expenditures still occurs, but it is much less severe in comparison to the decline shown in Figure A5B. Finally, the probability of Repeal of the 766 funding formula shows much less rapid growth and does not exceed .5 over the entire ten year run.

It should be emphasized that these drastic improvements in system behavior should not be totally surprising. The model has assumed that the Department can gain a full 90% control of budget allocations in a relatively short period (actually, the model assumes that there is a two year phasing in delay between the actual gain of fiscal control and the LEAs perception of that control as reflected in budget setting behavior). It is entirely possible that the Department will not be able to gain a full 90% control over LEA budget allocation decisions given that a limited amount of resources in the form of audit personnel can be applied to the monitoring of special education expenditures.

Figure A.7.A. explores what would happen if the Department were to gain less than a full 90% of budget allocation decisions. A single variable, Fraction Budget Jammed, is plotted for three different cases: The standard run as shown in Figure A5B, the 90% control run as shown in Figure A6, and a third run reflecting the attainment of 60% fiscal control. For the intermediate case, Figure A7A shows that 60% fiscal control can contain cost jamming, but it can not turn the trend around. On the other hand, the standard run shows a growing fraction of costs being jammed into special education and the 90% fiscal control case shows the trend toward cost jamming to turn around and to decline.

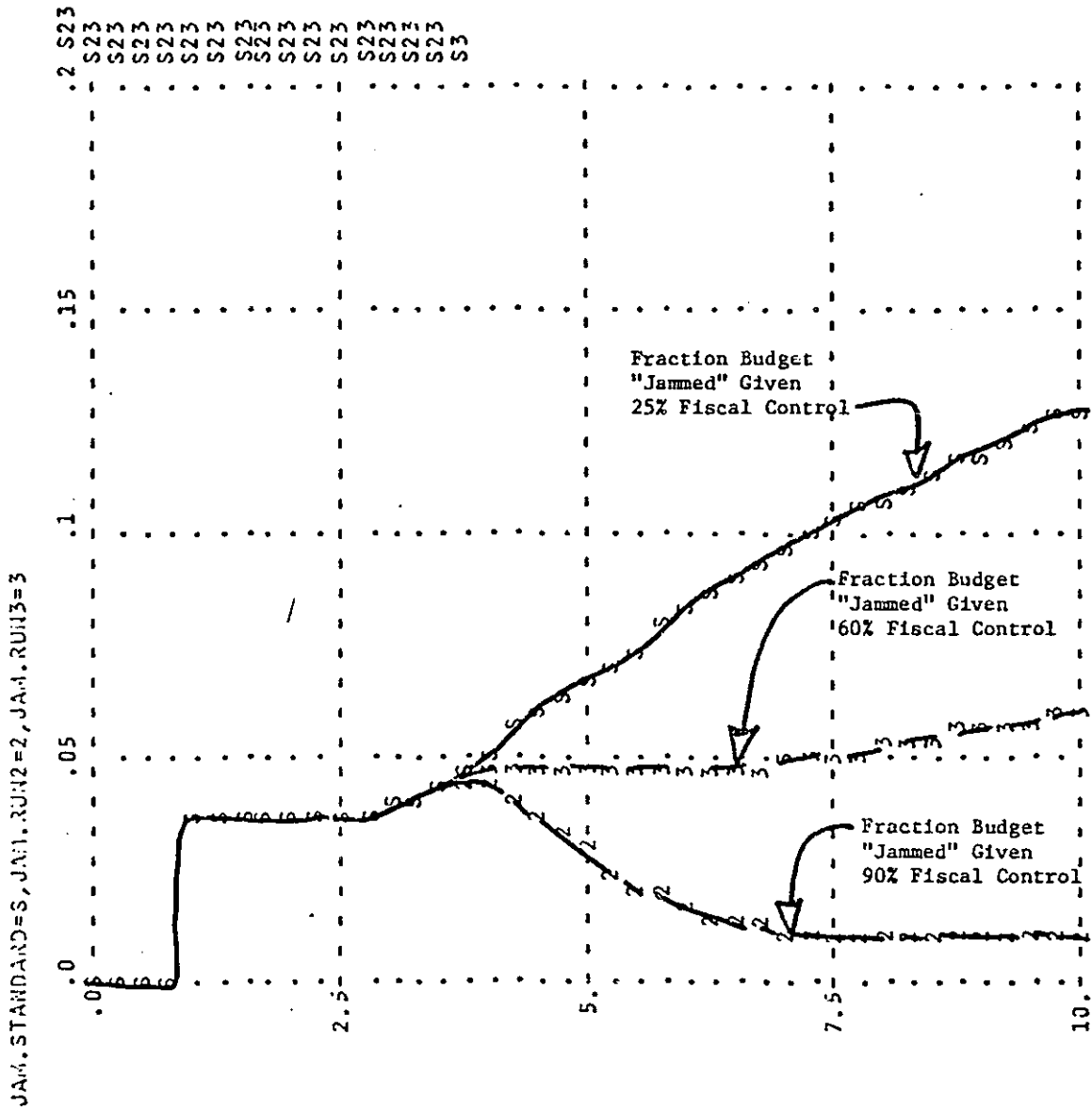


FIGURE A.7.A: Comparison of Fraction Cost "Jammed" for 25%, 60%, and 90% Fiscal Control Starting Year 3

Figure A.7.B gives a comparison run for another variable given the same three cases shown in Figure A7A. The staff adequacy index is a measure of the actual staff available within the special education system to the staff needed to adequately and fully service that population. An index of less than one implies that the special education system is under-staffed and conversely an index of greater than one implies an over-staffed system. As shown in Figure A7B, the staff adequacy index drops off sharply during the first year of implementation of 766. This does not imply that the actual staff available to special education declined. On the contrary, we know that for all of the runs examined, the absolute number of staff increased dramatically during the first year of the law. A decline in the staff adequacy index merely implies that students flowed into the special education system more rapidly than did staff, thereby diluting the available staff among more pupils needing service. For the first six to seven years of the implementation of 766, pupils continue to flow into the program at a rate more rapid than the inflow of staff. Hence the staff adequacy index continues to hover below one.

The curves in Figure A7B, tend to indicate that increasingly stringent fiscal controls will slightly worsen the performance of the staff adequacy index. However, the worsened performance of the staff adequacy index is not necessarily an all bad sign. For example, by year 8 in the standard run, special education programs are overstaffed (staff adequacy index greater than) indicating that the staff will tend to draw more pupils into special education in order to keep themselves busy. Such a situation clearly contradicts the philosophical and programmatic "mainstreaming" concepts behind the 766 special education law.

In summary, increasingly stringent fiscal controls help to stabilize the growth in 766 reimbursement claims primarily through the elimination of cost jamming. A second order effect occurs wherein leaner 766 budgets do not encourage spurious growth in special education staffs who in turn must recruit pupils in order to keep themselves busy. The stronger and the sooner the implementation of fiscal controls, the better for the overall system performance.

A.6 ANALYSIS OF PROGRAM CONTROL POLICIES

Several simulations were also completed that attempted to control the instability of growth in reimbursement by the enforcement of program controls alone. Given the preceding discussion of model structure and behavior, one should expect in advance that program controls in and of themselves would be incapable of totally stabilizing the fiscal system. The program sector of the SPED2 model is self-regulating and self-stabilizing. That is, the fraction of pupils in special education tends to adjust to the available staff, and to a lesser degree the staff available tends to respond to the pupils needing service. The strongest pressures toward unstable growth occur within the budget-setting and reimbursement sectors. The growth in budgets is transmitted into the program sector through the increased degrees of freedom and autonomy that SPED directors attain through larger and more consistently growing budgets. In general, attempts to contain a sprawling 766 program will be ineffective unless they get at the root causes of instability, namely lax fiscal controls on the part of the department and a reimbursement formula that encourages inflated budgets and cost jamming on the part of the rational, self-interested local administrator.

Not surprisingly, the simulations shown in Figures A8A and A8B indicate that program controls taken by themselves can not check the system's growth. Figure A8A compares the Fraction Budget Jammed curves for three different situations. The first situation is the standard run with 40% program control for the entire length of the run. In the second run, program control is suddenly stepped up to 80% at year 3 (two years after the implementation of 766). In the third run, program control is suddenly stepped up to a full 100% at year three. Increased program control can and will stop the spurious growth in staff due to "empire building" that results from growing.

SPED component of cost jamming--namely excess costs resulting from SPED "empire building"--can be eliminated by program controls, but the larger component resulting from blatant attempts to inflate budgets to get larger reimbursements can only be addressed through strong fiscal controls.

Figure A8B examines the impact of the same three policy sets upon the staff adequacy index. As might be expected, tighter program controls dampen the flow rate of both pupils and especially staff into special education (the accelerated flow of staff into the program due solely to budget availability is eliminated). Hence, the staff adequacy index is less under conditions of strong program controls because pupils tend to flow into the program before staff and at a faster rate rather than vice versa. Again, the worsening in the staff adequacy index is not necessarily a totally bad effect.

In summary, although program controls may have beneficial effects that can not be fully captured within the present model, they do not

JAM.STANDARD=5, JAM.RUN4=4, JAM.RUN5=5

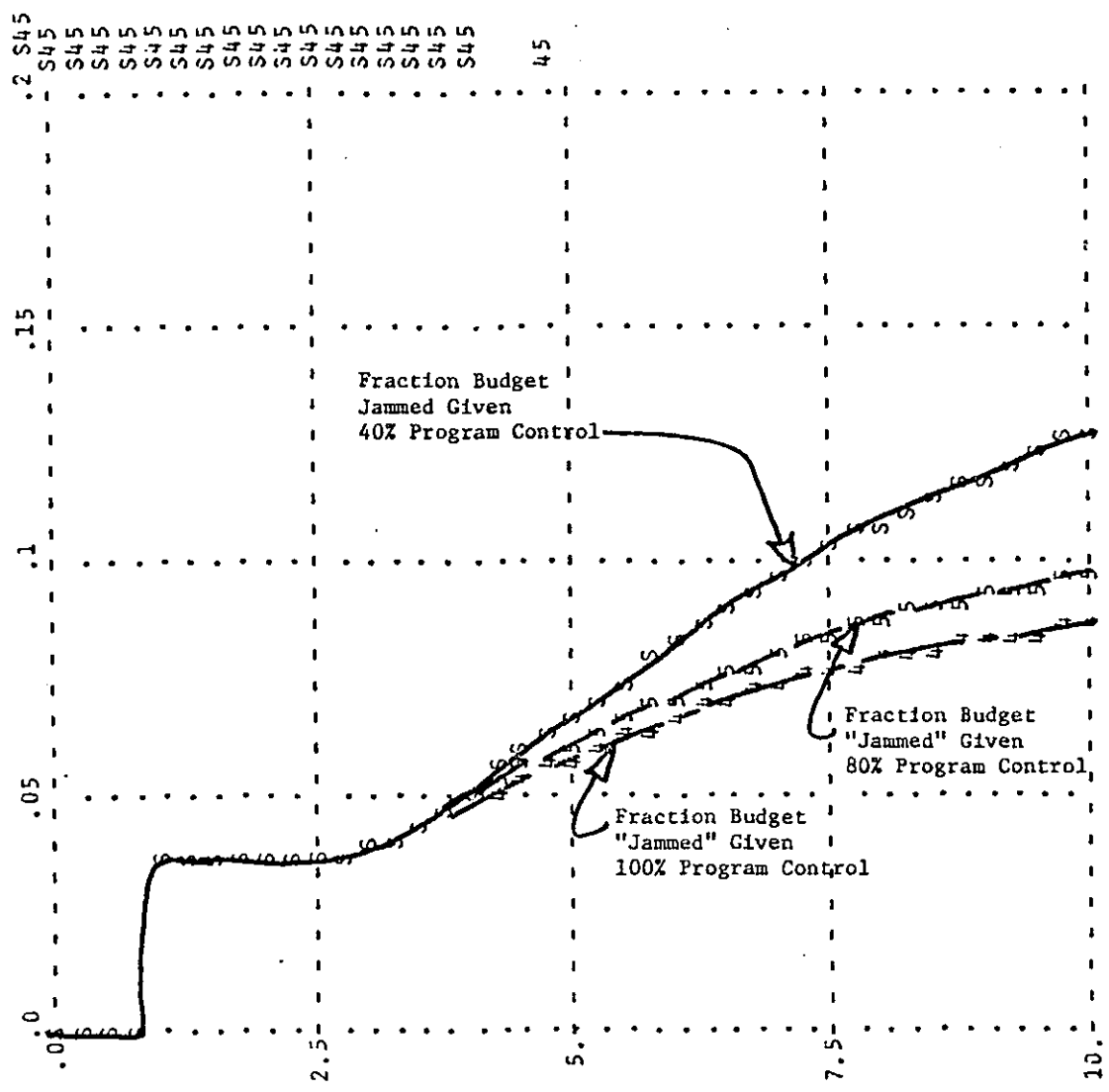


FIGURE A.8.A: Comparison of Fraction Cost "Jammed" for 40%, 80%, and 100% Program Control Starting Year 3

SAI . STANDARD=5, SAI . RUN4=4, SAI . RUN5=5

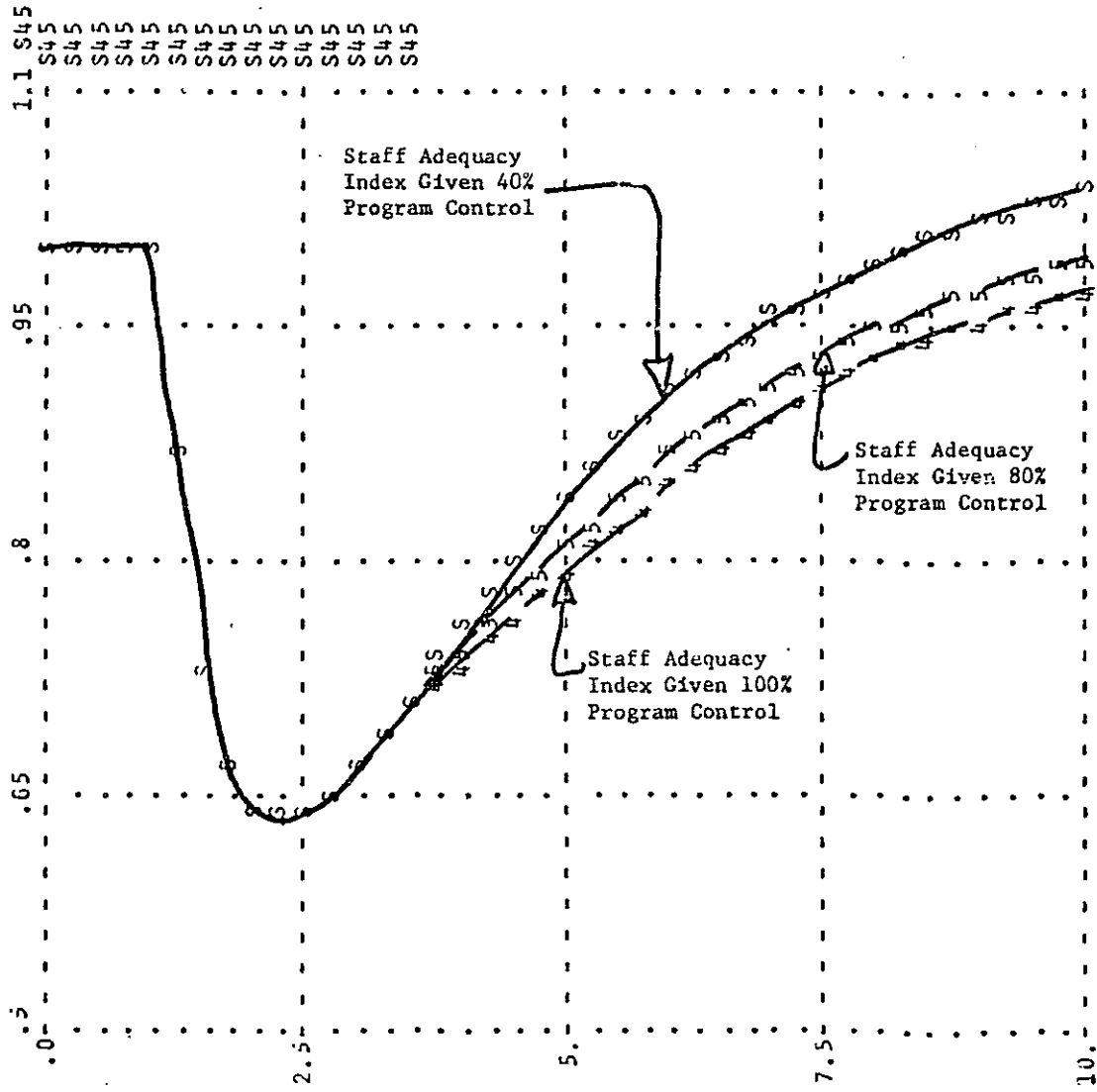


FIGURE A.8.B: Comparison of Staff Adequacy Index for 40%, 80%, and 100% Program Control Starting Year 3

appear to be able to contain the growth of 766 in and of themselves. Program controls do help the fiscal situation greatly by eliminating "empire building" by local SPED directors.

A.7 ANALYSIS OF PROGRAM STANDARDS

All of the runs examined thus far have assumed that the Department of Education has had strong control over program standards (80%) right from the beginning of 766. This section examines the interesting counterfactual question, "What would have happened to 766 if the Department (and the Division of Special Education in particular) had not asserted strong control of program standards right from the start?"

A program standards parameter of 100% implies that LEAs across the state screened students into the 766 program exactly according to the program definitions promulgated by the Division (it also assumes that the Division was 100% clear itself as to what it means by the 766 program guidelines). A program standards parameter of zero percent implies that LEAs continue to act according to a traditional average of their performance over the past few years. A program standards parameter somewhere between zero and 100 percent takes a weighted average of these two limiting cases.

Figure A.9.A shows what happens to the principal system levels when low program standards (20%) are maintained for the length of the ten year run. The most interesting variable is fraction pupils in special education. The response of pupils is sluggish indeed with less than two thirds of the total pupils needing service receiving service after ten years (the model assumes that 766 program standards call for some 12% of the total population to be receiving some services). The program never "gets off the ground" because LEAs continue to adhere to their traditional standards for

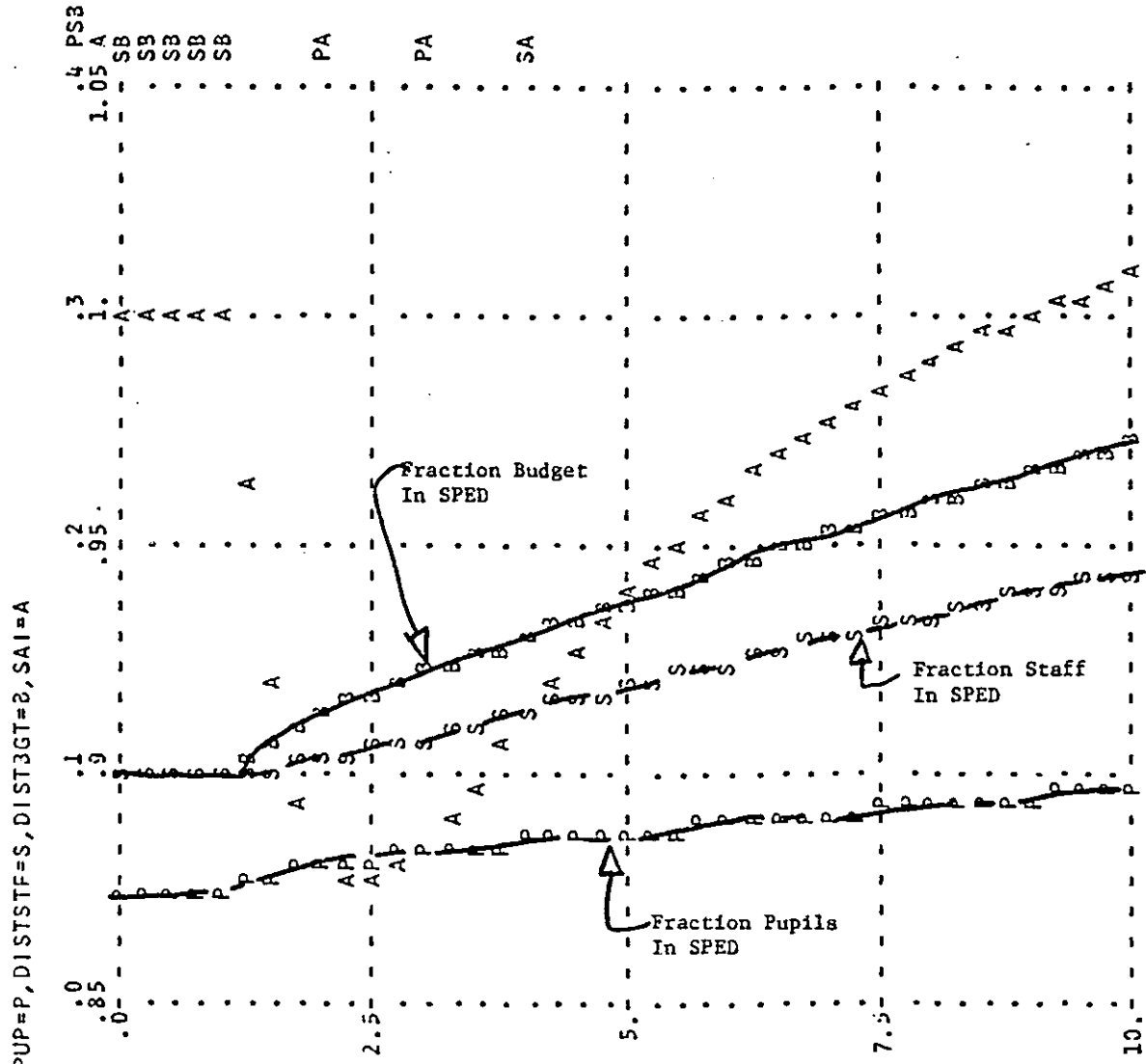


FIGURE A.9.A: Standard Run(Principal Levels) with Low Initial Program Standards

dealing with pupils. Even though the number of pupils being served does not respond rapidly, a substantial growth in 766 budget occurs anyway. Even though pupils are not being served, business agents continue to exploit the enriched reimbursements made available through the 766 legislation.

Figure A.9.B makes this same point even more graphically. The growth in Fraction Budget Jammed is slower than in the standard run, but still retains the same character of unstable and continuing growth. % Reimbursements for Regular Day Expenditures continue on a slow but steady decline.

In a simulation completed but not shown here, the system was run with low program standards and with high fiscal and program controls. Over the ten year run, the percent of pupils served strayed only a few percentage points from its equilibrium value. That is without the impetus of high program standards and in the face of tight fiscal and program controls little to no action occurred in the field of special education.

In summary, strong program standards seem to be a prerequisite to a successful and growing special education program in the Commonwealth. Fortunately, the Division of Special Education has already been highly effective in promoting such program standards. However, such strong program standards have the unfortunate side-effect of accelerating the growth of inflated special education budgets. Hence, the ultimate source of 766's programmatic strength is also a major source of its fiscal weakness.

A.8 APPENDIX

This appendix contains a complete DYNAMO flow chart that gives a more technical description of all of the feedback paths and relations contained within the SPED2 model. Each symbol in the flow diagram is keyed with an equation number that refers to an equation in the listing of DYNAMO equations that is also attached.

Finally, a documented version of the DYNAMO equations is given that gives an ordinary English explanation for the various variable names contained in each of the equations.

For a more complete description of DYNAMO flow charting and DYNAMO equations, see Jay Forrester, Principles of Systems, Wright Allen Press.


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SPED2.DYNAMO
00001 NOTE SIMPLE MODEL OF SPED REIMBURSEMENT
00002 NOTE
00003 NOTE PUPIL SECTOR
00004 NOTE
00010 L PUPRD.K=PUPRD.J+(DT)(-PUPAR.JK)
00011 H PUPRD=PUPRD.H
00012 C PUPRD.H=330
00020 L PUPSE.K=PUPSE.J+(DT)(PUPAR.JK)
00021 H PUPSE=PUPSE.H
00022 C PUPSE.H=50
00030 A PUPTOT.K=PUPSE.K+PUPRD.K
00040 A DISTPUP.K=PUPSE.K/PUPTOT.K
00050 R PUPAR.KL=((PUPDEFI.K-DISTPUP.K)+PUPTOT.K)/TAP
00051 C TAP=2
00060 A PUPDEFI.K=(PSDEFI.K)(IPR3A.K)(IP3A.K)(1-PDCPA.K)+(PSDEFN.K)(PDCPA.K)
00070 A IPR3A.K=TABLE(IPR3AT,DISTSTF.K/STFND.K,0,2,.5)
00071 T IPR3AT=0/.75/1/1.25/1.5
00080 A IP3A.K=TABLE(IP3AT,DISTSTF.K/STFND.K,0,2,.5)
00081 T IP3AT=0/.75/1/1.25/1.5
00090 A PDCPA.K=SMOOTH(DCPA.K,TPDCPA)
00091 C TPDCPA=1
00100 A DCPA.K=IDCPA+STEP(SIDCPA,DCST)
00101 C IDCPA=.4
00102 C SIDCPA=0
00110 A DPROGSTND.K=SMOOTH(PROGSTND.K,TPP)
00111 C TPP=2
00120 A TPROGSTND.K=SMOOTH(DISTPUP.K,TALS)
00121 C TALS=2
00130 A PSDEFN.K=DPROGSTND.K*DCPS+TPROGSTND.K*(1-DCPS)
00131 C DCPS=.8
00140 A PROGSTND.K=IS+STEP(PS.I,PST)+PULSE(PLS I/DT,FRST,500)
00141 C IS=.35
00142 C PS.I=.07
00143 C PST=1
00144 C PLS.I=.5
00145 C FRST=1
00146 NOTE
00147 NOTE STAFF SECTOR
00148 NOTE
00150 L STFRD.K=STFRD.J+(DT)(-STFAR.JK)
00151 H STFRD=STFRD.H
00152 C STFRD.H=45
00160 L STFSE.K=STFSE.J+(DT)(STFAR.JK)
00161 H STFSE=STFSE.H
00162 C STFSE.H=5
00170 A STFTOT.K=STFRD.K+STFSE.K
00180 A DISTSTF.K=STFSE.K/STFTOT.K
00190 R STFAR.KL=((NDHSTF.K-DISTSTF.K)*STFTOT.K)/TAS
00191 C TAS=.5
00200 A NDHSTF.K=RJDSTF.K*ISR3A.K*(1-PDCSA.K)+RJDSTF.K*PDCSA.K
00210 A PDCSA.K=SMOOTH(DCSA.K,TPDCSA)
00211 C TPDCSA=1
00220 A DCSA.K=IDCSA+STEP(SIDCSA,DCST)
00221 C IDCSA=.4
00222 C SIDCSA=0
00230 A ISR3A.K=TABLE(ISR3AT,DISTSTF.K/RJDSTF.K,0,2,.5)
00231 T ISR3AT=0/.75/1/1.25/1.5
00240 A RJDSTF.K=SMOOTH(STFRD.K,TASP)
00241 C TASP=2
00250 A STFND.K=TABLE(STFNDT,DISTPUP.K,0,1,.2)
00251 T STFNDT=0/.4/.6/.8/1
00260 S SAI.K=DISTSTF.K/STFRD.K
00261 NOTE
00262 NOTE BUDGET SETTING SECTOR

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DYNAMO Listing of SPED 2 Model

JJ265 NOTE
 JJ270 L $BSTRD.K = BSTRD.J + (DT) * (-BGTAR.JK)$
 JJ271 I $BSTRD.J = BSTRD.K$
 JJ272 C $BSTRD.I = 400000$
 JJ280 L $BGTSE.K = BGTSE.J + (DT) * (BGTAR.JK)$
 JJ281 I $BGTSE.J = BGTSE.K$
 JJ282 C $BGTSE.I = 500000$
 JJ290 A $BGTTOT.K = BSTRD.K + BGTSE.K$
 JJ300 A $DISTSTF.K = BGTSE.K / BGTTOT.K$
 JJ310 R $BGTAR.KL = ((CLM3GT.K - DIST3GT.K) * BGTTOT.K) / TAB$
 JJ311 C $TAB = 1$
 JJ320 A $CLM3GT.K = DISTSTF.K * PDC3A.K + IINF3GT.K * (1 - PDC3A.K)$
 JJ330 A $PDC3A.K = DLINF3(DC3A.K, TPDC3A)$
 JJ331 C $TPDC3A = 2$
 JJ340 A $DC3A.K = IDC3A + STEP(DC3AS.I, DCST)$
 JJ341 C $IDC3A = .25$
 JJ342 C $DC3AS.I = 0$
 JJ343 C $DCST = 3$
 JJ350 A $IINF3GT.K = DISTSTF.K * MARR.K$
 JJ360 A $MARR.K = TABIL(MARRT, PPRSE.K / PPRRD.K, 0, 3, .5)$
 JJ361 T $MARRT = 0 / .75 / 1 / 1.25 / 1.5 / 1.5 / 1.5$
 JJ370 S $JAM.K = CLM3GT.K - ROSTF.K$
 JJ371 NOTE
 JJ372 NOTE COMPUTATION OF REIMBURSEMENT
 JJ373 NOTE
 JJ380 A $PPCRD.K = BSTRD.K / (PUPRD.K * (1 - BIAS * DISTPUP.K))$
 JJ390 A $PPCSE.K = BGTSE.K / (PUPSE.K * (1 + BIAS))$
 JJ391 C $BIAS = 0$
 JJ400 A $SEECPP.K = PPCSE.K - PPCRD.K$
 JJ410 A $SEECTOT.K = SEECPP.K * PUPSE.K$
 JJ420 A $RORT.K = TOTAL - SEECTOT.K$
 JJ421 C $TOTAL = 150000$
 JJ430 A $RDTOTC.K = PPCRD.K * PUPTOT.K$
 JJ440 A $PRRD.K = CLIP(.5, (CLIP(RORT.K / RDTOTC.K, .3, TIME.K, RST))),$
 JJ441 X $PRRSE.K, 1)$
 JJ450 A $PPRD.K = DLINF3(PRRD.K, TPR)$
 JJ451 C $TPR = 1.5$
 JJ460 A $PRRSE.K = CLIP(.5, (CLIP(1, .3, TIME.K, RST))), PRRSE.K, 1)$
 JJ461 C $RST = 1$
 JJ470 A $PRRSE.K = TABLE(PRSET, SEECTOT.K / TOTAL, 0, 1, .2)$
 JJ471 T $PRSET = 0 / .1 / .3 / .6 / 1 / 1$
 JJ472 NOTE
 JJ473 NOTE CONTROL CARDS
 JJ474 NOTE
 JJ475 C $DT = .125$
 JJ476 C $PLTPER = .25$
 JJ477 C $LENGTI = 0$
 JJ478 C $SAVPER = 0$
 JJ479 PLOT $DISTPUP = P, DISTSTF = S, DIST3GT = 3(0, .4) / SAI = A$
 JJ481 PLOT $PPRRD = R, PRRSE = S(0, 1) / JAM = J(0, .2) / PRRSE = 0(0, 1)$
 READY

FILE SPED2 11/17/76

PUPIL SECTOR

$PUPRD.K = PUPRD.J + (DT)(-PUPAR.JK)$ 1, L
 $PUPRD = PUPRDN$ 1.1, N
 $PUPRDN = 950$ 1.2, C
 PUPRD - PUPILS REGULAR DAY (STUDENTS)
 DT - MODEL SOLUTION INTERVAL (YEARS)
 PUPAR - PUPIL ADJUSTMENT RATE (STUDENTS/YEAR)
 PUPRDN - PUPILS REGULAR DAY INITIAL CONDITION (STUDENTS)

$PUPSE.K = PUPSE.J + (DT)(PUPAR.JK)$ 2, L
 $PUPSE = PUPSEN$ 2.1, N
 $PUPSEN = 50$ 2.2, C
 PUPSE - PUPILS SPECIAL EDUCATION (STUDENTS)
 DT - MODEL SOLUTION INTERVAL (YEARS)
 PUPAR - PUPIL ADJUSTMENT RATE (STUDENTS/YEAR)
 PUPSEN - PUPILS IN SPECIAL EDUCATION INITIAL CONDITION (STUDENTS)

$PUPTOT.K = PUPSE.K + PUPRD.K$ 3, A
 PUPTOT - TOTAL PUPILS (STUDENTS)
 PUPSE - PUPILS SPECIAL EDUCATION (STUDENTS)
 PUPRD - PUPILS REGULAR DAY (STUDENTS)

$DISTPUP.K = PUPSE.K / PUPTOT.K$ 4, A
 DISTPUP - DISTRIBUTION OF PUPILS (FRACTION IN SPED)
 PUPSE - PUPILS SPECIAL EDUCATION (STUDENTS)
 PUPTOT - TOTAL PUPILS (STUDENTS)

$PUPAR.KL = ((PUPODFN.K - DISTPUP.K) * PUPTOT.K) / TAP$ 5, R
 $TAP = 2$ 5.1, C
 PUPAR - PUPIL ADJUSTMENT RATE (STUDENTS/YEAR)
 PUPODFN - PUPIL OPERATING DEFINITION (FRACTION IN SPED)
 DISTPUP - DISTRIBUTION OF PUPILS (FRACTION IN SPED)
 PUPTOT - TOTAL PUPILS (STUDENTS)
 TAP - TIME TO ADJUST PUPILS (YEARS)

$PUPODFN.K = (PSODFN.K)(MPRSA.K)(MPRBA.K)(1 - PDCPA.K) + (PSODFN.K)(PDCPA.K)$ 6, A
 $PUPODFN = PUPIL OPERATING DEFINITION (FRACTION IN SPED)$
 PSODFN - PUPIL STANDARD OPERATING DEFINITION (FRACTION IN SPED)
 MPRSA - MULTIPLIER ON PUPILS FROM RELATIVE STAFF AVAILABILITY (DIMLESS)
 MPRBA - MULTIPLIER ON PUPILS FROM RELATIVE BUDGET AVBLTY (DIMLESS)
 PDCPA - PERCEIVED DEPARTMENT CONTROL OF PUPIL ALLOCATION (DIMLESS)

FILE SPED2 11/17/76

MPRSA.K=TABLE(MPRSAT,DISTSTF.K/STFND.K,0,2,.5) 7, A
 MPRSAT=0/.75/1/1.25/1.5 7.1, T

MPRSA - MULTIPLIER ON PUPILS FROM RELATIVE STAFF
 AVAILABILITY (DIMLESS)
 MPRSAT - TABLE SPECIFYING FORM OF MPRSA
 DISTSTF- DISTRIBUTION OF STAFF (FRACTION STAFF IN
 SPED)
 STFND - STAFF ACTUALLY NEEDED (FRACTION STAFF IN
 SPED)

MPRBA.K=TABLE(MPRBAT,DISTRGT.K/STFND.K,0,2,.5) 8, A
 MPRBAT=0/.75/1/1.25/1.5 8.1, T

MPRBA - MULTIPLIER ON PUPILS FROM RELATIVE BUDGET
 AVBLTY (DIMLESS)
 MPRBAT - TABLE SPECIFYING FORM OF MPRBA
 DISTRGT- DISTRIBUTION OF BUDGET (FRACTION OF BUDGET
 IN SPED)
 STFND - STAFF ACTUALLY NEEDED (FRACTION STAFF IN
 SPED)

PDCPA.K=SMOOTH(DCPA.K,TPDCPA) 9, A
 TPDCPA=1 9.1, C

PDCPA - PERCEIVED DEPARTMENT CONTROL OF PUPIL
 ALLOCATION (DIMLESS)
 SMOOTH - EXPONENTIAL AVERAGING FUNCTION
 TPDCPA - TIME TO PERCEIVE DEPARTMENT CONTROL OF
 PUPIL ALLOC. (YEARS)

DCPA.K=IDCPA+STEP(SHDCPA,DCST) 10, A
 IDCPA=.4 10.1, C
 SHDCPA=0 10.2, C

IDCPA - INITIAL DEPARTMENT CONTROL OF PUPIL
 ALLOCATION (DIMLESS)
 SHDCPA - STEP HEIGHT IN DEPARTMENT CONTROL OF PUPIL
 ALLCATION
 DCST - TIME AT WHICH DEPARTMENT GAINS STEP
 INCREASE IN CONTROL

DPROGSTND.K=SMOOTH(PROGSTND.K,TPP) 11, A
 TPP=2 11.1, C

* - DEPARTMENT'S PROGRAM STANDARDS (FRACTION IN
 SPED)
 SMOOTH - EXPONENTIAL AVERAGING FUNCTION
 * - PROGRAM STANDARDS (FRACTION IN SPED)
 TPP - TIME TO PERCEIVE PROGRAM STANDARDS

TPROGSTND.K=SMOOTH(DISTPUP.K,TALS) 12, A
 TALS=2 12.1, C

* - TRADITIONAL PROGRAM STANDARDS (FRACTION IN
 SPED)
 SMOOTH - EXPONENTIAL AVERAGING FUNCTION
 DISTPUP- DISTRIBUTION OF PUPILS (FRACTION IN SPED)
 TALS - TIME TO ADJUST LOCAL STANDARDS (YEARS)

FILE SPED2 11/17/76

$PSODFN.K = DPROGSTND.K * DCPS + TPROGSTND.K * (1 - DCPS)$ 13, A
 $DCPS = .8$ 13.1, C
 PSODFN - PUPIL STANDARD OPERATING DEFINITION
 (FRACTION IN SPED)
 - DEPARTMENT'S PROGRAM STANDARDS (FRACTION IN
 SPED)
 *
 DCPS - DEPARTMENTAL CONTROL OF PROGRAM STANDARDS
 - TRADITIONAL PROGRAM STANDARDS (FRACTION IN
 SPED)
 *

$PROGSTND.K = IS + STEP(PSH, PST) + PULSE(PLSH/DT, FRST, 500)$ 14, A
 $IS = .05$ 14.1, C
 $PSH = .07$ 14.2, C
 $PST = 1$ 14.3, C
 $PLSH = .3$ 14.4, C
 $FRST = 1$ 14.5, C
 - PROGRAM STANDARDS (FRACTION IN SPED)
 *
 IS - INITIAL STANDARDS (FRACTION IN SPED)
 PSH - PROGRAM STEP HEIGHT (FRACTION IN SPED)
 PST - TIME AT WHICH STEP INCREASE IN STANDARDS
 INSTITUTED
 PLSH - HEIGHT OF INITIAL PROGRAM STANDARDS
 (FRACTION IN SPED)
 DT - MODEL SOLUTION INTERVAL (YEARS)

STAFF SECTOR

$STFRD.K = STFRD.J + (DT) * (-STFAR.JK)$ 15, L
 $STFRD = STFRDN$ 15.1, N
 $STFRDN = 45$ 15.2, C
 STFRD - STAFF IN REGULAR DAY (PERSONS)
 DT - MODEL SOLUTION INTERVAL (YEARS)
 STFAR - STAFF ADJUSTMENT RATE (PERSONS/YEAR)
 STFRDN - INITIAL STAFF IN REGULAR DAY (PERSONS)

$STFSE.K = STFSE.J + (DT) * (STFAR.JK)$ 16, L
 $STFSE = STFSEN$ 16.1, N
 $STFSEN = 5$ 16.2, C
 STFSE - STAFF IN SPECIAL EDUCATION (PERSONS)
 DT - MODEL SOLUTION INTERVAL (YEARS)
 STFAR - STAFF ADJUSTMENT RATE (PERSONS/YEAR)
 STFSEN - INITIAL STAFF IN REGULAR DAY (PERSONS)

$STFTOT.K = STFRD.K + STFSE.K$ 17, A
 STFTOT - TOTAL STAFF (PERSONS)
 STFRD - STAFF IN REGULAR DAY (PERSONS)
 STFSE - STAFF IN SPECIAL EDUCATION (PERSONS)

$DISTSTF.K = STFSE.K / STFTOT.K$ 18, A
 DISTSTF - DISTRIBUTION OF STAFF (FRACTION STAFF IN
 SPED)
 STFSE - STAFF IN SPECIAL EDUCATION (PERSONS)
 STFTOT - TOTAL STAFF (PERSONS)

FILE SPED2 11/17/76

$STFAR.KL = ((NOMSTF.K - DISTSTF.K) * STFTOT.K) / TAS$ 19, R
 $TAS = .5$ 19.1, C
 STFAR - STAFF ADJUSTMENT RATE (PERSONS/YEAR)
 NOMSTF - NOMINALLY NEEDED STAFF AS REPORTED
 (FRACTION STAFF IN SPED)
 DISTSTF - DISTRIBUTION OF STAFF (FRACTION STAFF IN
 SPED)
 STFTOT - TOTAL STAFF (PERSONS)
 TAS - TIME TO ADJUST STAFFING (YEARS)

$NOMSTF.K = RQDSTF.K * MSRBA.K * (1 - PDCSA.K) + RQDSTF.K * PDCSA.K$ 20, A
 NOMSTF - NOMINALLY NEEDED STAFF AS REPORTED
 (FRACTION STAFF IN SPED)
 RQDSTF - REQUIRED STAFF (FRACTION STAFF IN SPED)
 MSRBA - MULTIPLIER ON STAFF FROM BUDGET
 AVAILABILITY (DIMLESS)
 PDCSA - PERCEIVED DEPARTMENT CONTROL OF STAFF
 ALLOCATION (DIMLESS)

$PDCSA.K = SMOOTH(DCSA.K, TPDCSA)$ 21, A
 $TPDCSA = 1$ 21.1, C
 PDCSA - PERCEIVED DEPARTMENT CONTROL OF STAFF
 ALLOCATION (DIMLESS)
 SMOOTH - EXPONENTIAL AVERAGING FUNCTION
 DCSA - DEPARTMENT CONTROL OF STAFF ALLOCATION
 (DIMLESS)
 TPDCSA - TIME TO PERCEIVE DEPARTMENT CONTROL OF
 STAFF ALLOCATION (YEARS)

$DCSA.K = IDCSA + STEP(SHDCSA, DCST)$ 22, A
 $IDCSA = .4$ 22.1, C
 $SHDCSA = 0$ 22.2, C
 DCSA - DEPARTMENT CONTROL OF STAFF ALLOCATION
 (DIMLESS)
 IDCSA - INITIAL DEPARTMENT CONTROL OF STAFF
 ALLOCATION (DIMLESS)
 SHDCSA - STEP HEIGHT IN DEPARTMENT CONTROL OF STAFF
 ALLOCATION
 DCST - TIME AT WHICH DEPARTMENT GAINS STEP
 INCREASE IN CONTROL

$MSRBA.K = TABHL(MSRBAT, DISTBGT.K / RQDSTF.K, 0, 2, .5)$ 23, A
 $MSRBAT = 0 / .75 / 1 / 1.25 / 1.5$ 23.1, T
 MSRBA - MULTIPLIER ON STAFF FROM BUDGET
 AVAILABILITY (DIMLESS)
 MSRBAT - TABLE SPECIFYING FORM OF MSRBA
 DISTBGT - DISTRIBUTION OF BUDGET (FRACTION OF BUDGET
 IN SPED)
 RQDSTF - REQUIRED STAFF (FRACTION STAFF IN SPED)

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RQDSTF.K=SMOOTH(STFND.K,TASP) 24, A
 TASP=2 24.1, C
 RQDSTF - REQUIRED STAFF (FRACTION STAFF IN SPED)
 SMOOTH - EXPONENTIAL AVERAGING FUNCTION
 STFND - STAFF ACTUALLY NEEDED (FRACTION STAFF IN SPED)
 TASP - TIME TO ADJUST STAFFING PATTERNS (YEARS)

STFND.K=TABLE(STFNDDT,DISTPUP.K,0,1,.2) 25, A
 STFNDDT=0/.4/.6/.8/.9/1 25.1, T
 STFND - STAFF ACTUALLY NEEDED (FRACTION STAFF IN SPED)
 STFNDDT - TABLE SPECIFYING FORM OF STFND
 DISTPUP - DISTRIBUTION OF PUPILS (FRACTION IN SPED)

SAI.K=DISTSTF.K/STFND.K 26, S
 SAI - STAFF ADEQUACY INDEX (DIMLESS)
 DISTSTF - DISTRIBUTION OF STAFF (FRACTION STAFF IN SPED)
 STFND - STAFF ACTUALLY NEEDED (FRACTION STAFF IN SPED)

BUDGET SETTING SECTOR

BGTRD.K=BGTRD.J+(DT)(-BGTAR.JK) 27, L
 BGTRD=BGTRDN 27.1, N
 BGTRDN=450000 27.2, C
 BGTRD - BUDGET IN REGULAR DAY (DOLLARS/YEAR)
 DT - MODEL SOLUTION INTERVAL (YEARS)
 BGTAR - BUDGET ANNUAL ADJUSTMENT RATE (DOLLARS/YEAR/YEAR)
 BGTRDN - INITIAL BUDGET IN REGULAR DAY (DOLLARS/YEAR)

BGTSE.K=BGTSE.J+(DT)(BGTAR.JK) 28, L
 BGTSE=BGTSEN 28.1, N
 BGTSEN=50000 28.2, C
 BGTSE - BUDGET IN SPECIAL EDUCATION (DOLLARS/YEAR)
 DT - MODEL SOLUTION INTERVAL (YEARS)
 BGTAR - BUDGET ANNUAL ADJUSTMENT RATE (DOLLARS/YEAR/YEAR)
 BGTSEN - INITIAL BUDGET IN SPECIAL EDUCATION (DOLLARS/YEAR)

BGTTOT.K=BGTRD.K+BGTSE.K 29, A
 BGTTOT - TOTAL BUDGET (DOLLARS/YEAR)
 BGTRD - BUDGET IN REGULAR DAY (DOLLARS/YEAR)
 BGTSE - BUDGET IN SPECIAL EDUCATION (DOLLARS/YEAR)

DISTRGT.K=BGTSE.K/BGTTOT.K 30, A
 DISTRGT - DISTRIBUTION OF BUDGET (FRACTION OF BUDGET IN SPED)
 BGTSE - BUDGET IN SPECIAL EDUCATION (DOLLARS/YEAR)
 BGTTOT - TOTAL BUDGET (DOLLARS/YEAR)

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$BGTAR.KL = ((CLMBGT.K - DISTBGT.K) * BGTTOT.K) / TAB$ 31, R
 TAB=1 31.1, C
 BGTAR - BUDGET ANNUAL ADJUSTMENT RATE (DOLLARS/
 YEAR/YEAR)
 CLMBGT - CLAIMED BUDGET IN SPECIAL EDUCATION
 (FRACTION OF BUDGET IN SPED)
 DISTBGT - DISTRIBUTION OF BUDGET (FRACTION OF BUDGET
 IN SPED)
 BGTTOT - TOTAL BUDGET (DOLLARS/YEAR)
 TAB - TIME TO ADJUST THE BUDGET (YEARS)

$CLMBGT.K = DISTSTF.K * PDCBA.K + INFBGT.K * (1 - PDCBA.K)$ 32, A
 CLMBGT - CLAIMED BUDGET IN SPECIAL EDUCATION
 (FRACTION OF BUDGET IN SPED)
 DISTSTF - DISTRIBUTION OF STAFF (FRACTION STAFF IN
 SPED)
 PDCBA - PERCEIVED DEPARTMENT CONTROL OF BUDGET
 ALLOCATION (DIMLESS)
 INFBGT - INFLATED BUDGET (FRACTION OF BUDGET IN
 SPED)

$PDCBA.K = DLINF3(DCBA.K, TPCBA)$ 33, A
 TPCBA=2 33.1, C
 PDCBA - PERCEIVED DEPARTMENT CONTROL OF BUDGET
 ALLOCATION (DIMLESS)
 DCBA - DEPARTMENT CONTROL OF BUDGET ALLOCATION
 (DIMLESS)
 TPCBA - TIME TO PERCEIVE DEPARTMENT CONTROL OF
 BUDGET ALLOCATION (YEARS)

$DCBA.K = IDCBA + STEP(DCBASH, DCST)$ 34, A
 IDCBA=.25 34.1, C
 DCBASH=0 34.2, C
 DCST=3 34.3, C
 DCBA - DEPARTMENT CONTROL OF BUDGET ALLOCATION
 (DIMLESS)
 IDCBA - INITIAL DEPARTMENT CONTROL OF BUDGET
 ALLOCATION (DIMLESS)
 DCBASH - DEPARTMENT CONTROL OF BUDGET ALLOCATION
 STEP HEIGHT (DIMLESS)
 DCST - TIME AT WHICH DEPARTMENT GAINS STEP
 INCREASE IN CONTROL

$INFBGT.K = DISTSTF.K * MARR.K$ 35, A
 INFBGT - INFLATED BUDGET (FRACTION OF BUDGET IN
 SPED)
 DISTSTF - DISTRIBUTION OF STAFF (FRACTION STAFF IN
 SPED)
 MARR - MULTIPLIER FROM ATTRACTIVENESS OF RELATIVE
 REIMBURSEMENTS (DIMLESS)

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MARR.K=TABHL(MARRT,PPRSE.K/PPRRD.K,0,3,.5) 36, A
 MARRT=0/.75/1/1.25/1.5/1.5/1.5 36.1, T

MARR - MULTIPLIER FROM ATTRACTIVENESS OF RELATIVE
 REIMBURSEMENTS (DIMLESS)
 PPRSE - PERCEIVED PERCENT REIMBURSEMENT SPECIAL
 EDUCATION
 PPRRD - PERCEIVED PERCENT REIMBURSEMENT REGULAR DAY

JAM.K=CLMBGT.K-RQDSTF.K 37, S
 JAM - FRACTION OF BUDGET 'JAMMED' INTO SPECIAL
 EDUCATION
 CLMBGT - CLAIMED BUDGET IN SPECIAL EDUCATION
 (FRACTION OF BUDGET IN SPED)
 RQDSTF - REQUIRED STAFF (FRACTION STAFF IN SPED)

COMPUTATION OF REIMBURSEMENT

PPCRD.K=BGTRD.K/(PUPRD.K*(1-BIAS*DISTPUP.K). 38, A
 PPCRD - PER PUPIL COST REGULAR DAY (DOLLARS/YEAR/
 STUDENT)
 BGTRD - BUDGET IN REGULAR DAY (DOLLARS/YEAR)
 PUPRD - PUPILS REGULAR DAY (STUDENTS)
 BIAS - BIAS IN REPORTING OF SPECIAL EDUCATION
 PUPILS
 DISTPUP- DISTRIBUTION OF PUPILS (FRACTION IN SPED)

PPCSE.K=BGTSSE.K/(PUPSE.K*(1+BIAS)) 39, A
 BIAS=0 39.1, C
 PPCSE - PER PUPIL COST SPECIAL EDUCATION (DOLLARS/
 YEAR/STUDENT)
 BGTSSE - BUDGET IN SPECIAL EDUCATION (DOLLARS/YEAR)
 PUPSE - PUPILS SPECIAL EDUCATION (STUDENTS)
 BIAS - BIAS IN REPORTING OF SPECIAL EDUCATION
 PUPILS

SEECPP.K=PPCSE.K-PPCRD.K 40, A
 SEECPP - SPECIAL EDUCATION EXCESS COST PER PUPIL
 (DOLLARS/YEAR/STUDENT)
 PPCSE - PER PUPIL COST SPECIAL EDUCATION (DOLLARS/
 YEAR/STUDENT)
 PPCRD - PER PUPIL COST REGULAR DAY (DOLLARS/YEAR/
 STUDENT)

SEECTOT.K=SEECPP.K*PUPSE.K 41, A
 SEECTOT- SPECIAL EDUCATION EXCESS COST TOTALS
 (DOLLARS/YEAR)
 SEECPP - SPECIAL EDUCATION EXCESS COST PER PUPIL
 (DOLLARS/YEAR/STUDENT)
 PUPSE - PUPILS SPECIAL EDUCATION (STUDENTS)

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RDRT.K=TOTAL-SEECTOT.K 42, A
TOTAL=150000 42.1, C
RDRT - REGULAR DAY REMAINING TOTAL TO BE
REIMBURSED (DOLLARS/YEAR)
TOTAL - TOTAL REIMBURSEMENTS MADE AVAILABLE BY THE
STATE (DOLLARS/YEAR)
SEECTOT- SPECIAL EDUCATION EXCESS COST TOTALS
(DOLLARS/YEAR)

RDTOTC.K=PPCRD.K*PUPTOT.K 43, A
PPCRD - PER PUPIL COST REGULAR DAY (DOLLARS/YEAR/
STUDENT)
PUPTOT - TOTAL PUPILS (STUDENTS)

PRRD.K=CLIP(.3,(CLIP(RDRT.K/RDTOTC.K,.3,TIME.K,
RST)),PRRSE.K,1) 44, A
PRRD - PERCENT REIMBURSEMENT FOR MARGINAL DOLLARS
SPENT IN REGULAR DAY
CLIP - LOGICAL FUNCTION THAT CHOOSES BETWEEN FIRST
TWO QUANTITIES
RDRT - REGULAR DAY REMAINING TOTAL TO BE
REIMBURSED (DOLLARS/YEAR)
RST - TIME AT WHICH "ENRICHED" REIMBURSEMENT
FORMULA BEGINS
PRRSE - PROBABILITY OF REPEAL OF SPECIAL EDUCATION

PPRRD.K=DLINF3(PRRD.K,TPR) 45, A
TPR=1.5 45.1, C
PPRRD - PERCEIVED PERCENT REIMBURSEMENT REGULAR DAY
PRRD - PERCENT REIMBURSEMENT FOR MARGINAL DOLLARS
SPENT IN REGULAR DAY
TPR - TIME TO PERCEIVE REIMBURSEMENTS (YEARS)

PPRSE.K=CLIP(.3,(CLIP(1,.3,TIME.K,RST)),PRRSE.K,1) 46, A
RST=1 46.1, C
PPRSE - PERCEIVED PERCENT REIMBURSEMENT SPECIAL
EDUCATION
CLIP - LOGICAL FUNCTION THAT CHOOSES BETWEEN FIRST
TWO QUANTITIES
RST - TIME AT WHICH "ENRICHED" REIMBURSEMENT
FORMULA BEGINS
PRRSE - PROBABILITY OF REPEAL OF SPECIAL EDUCATION

PRRSE.K=TABLE(PRSET,SEECTOT.K/TOTAL,0,1,.2) 47, A
PRSET=0/.1/.3/.6/1/1 47.1, T
PRRSE - PROBABILITY OF REPEAL OF SPECIAL EDUCATION
SEECTOT- SPECIAL EDUCATION EXCESS COST TOTALS
(DOLLARS/YEAR)
TOTAL - TOTAL REIMBURSEMENTS MADE AVAILABLE BY THE
STATE (DOLLARS/YEAR)

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CONTROL CARDS

DT=.125	47.5, C
PLTPER=.25	47.6, C
LENGTH=0	47.7, C
SAVPER=0	47.8, C

DT - MODEL SOLUTION INTERVAL (YEARS)
 PLTPER - CONSTANT SPECIFYING HOW OFTEN COMPUTER SHOULD PLOT RESULTS
 LENGTH - CONSTANT SPECIFYING THE LENGTH OF THE SIMULATION RUN.

PLOT DISTPUP=P, DISTSTF=S, DISTBGT=B(0,.4)/SAI=A 47.9
 DISTPUP- DISTRIBUTION OF PUPILS (FRACTION IN SPED)
 DISTSTF- DISTRIBUTION OF STAFF (FRACTION STAFF IN SPED)
 DISTBGT- DISTRIBUTION OF BUDGET (FRACTION OF BUDGET IN SPED)
 SAI - STAFF ADEQUACY INDEX (DIMLESS)

PLOT PPRRD=R, PPRSE=S(0,1)/JAM=J(0,.2)/PRRSE=D(0,1) 48.1
 PPRRD - PERCEIVED PERCENT REIMBURSEMENT REGULAR DAY
 PPRSE - PERCEIVED PERCENT REIMBURSEMENT SPECIAL EDUCATION
 JAM - FRACTION OF BUDGET "JAMMED" INTO SPECIAL EDUCATION
 PRRSE - PROBABILITY OF REPEAL OF SPECIAL EDUCATION

APPENDIX B

METHODS AND EVIDENCE

The research reported here is based upon a modified participant-observer research methodology. The basic research strategy involved the formulation of theoretical priors (naive theory), conducting the empirical work, revising the original theory, and finally deriving conclusions. This basic research design is more fully described in Chapter 1, section 1.3.

Nine types of evidence were collected: unstructured interviews, structured interviews, minutes and agendas from meetings, notes taken by the author summarizing his impressions, informal documents such as memos and first drafts of position papers, formal documents such as guidelines and policy statements, printed matter representing published articles on the implementation of Chapter 766, questionnaires administered to key managers in the Division of Special Education detailing how they spent their time on various fiscally-related tasks, and statistical summaries of these questionnaires. Appendix C.1 describes each of these types of evidence in more detail and Appendix C.2 presents a catalogue of approximately 20 percent of the evidence used in the case.

This appendix discusses several of these nine streams of evidence in more detail. Specifically, Appendix B.1 discusses the questionnaires circulated among key managers to assess how much time and attention each of them was allocating to fiscally-related projects. B.2 discusses various types of interviews conducted in the course of the study. B.3 describes the daily log of events and the author's study of his own time allocation.

B.1 TIME STUDY QUESTIONNAIRES

Between October 1 and December 30, 1976, a record was kept of the fiscal activities of five key managers within the Division of Special Education. This record of activity (a time study of sorts) was accomplished through a self-administering, bi-weekly questionnaire. Every two weeks, selected managers were asked to assess how much time they had spent in the past two weeks on fiscally-related activities. Also, they were asked to estimate how much time they would be spending in the upcoming two weeks on the same tasks. Two weeks later, a blank list similar to the one they had turned in earlier was returned to the managers. At this time managers were asked to add any new tasks that had come up in the past few weeks and delete any that would need no further attention. Then, managers were asked to reassess how much time they had spent on each of the activities on the updated list as well as how much time they projected they would be spending on this list of activities in the upcoming two weeks.

Several interesting pieces of information were gathered through these questionnaires: 1) what fiscal tasks were being completed by whom, 2) how much time was being allocated to each task, and 3) were managers spending more or less time on certain tasks than they had originally estimated.

A summary of the data collected in these questionnaires is presented in Tables B.1.A through B.1.E.

BOB AUDETTE ASSOCIATE COMMISSIONER OF SPECIAL EDUCATION

FROM: 10-19-76 TO: 12-21-76

TASK	Actual # of hours spent	# of hours projected
Governor's Task Force	6.0	4.0
Mtg. Frohman and BIS personnel re. transfer of fiscal responsibility to LEAs	5.0	4.0
Mtgs. with Hamden County Teachers Assoc. and New York Times stressing fiscal issues.	6.0	0
Third Party payment meetings.	12.5	9.0
Meetings with Dave Andersen	2.0	11.0
Governor's office on BIS	4.0	5.0
Mtsg. with Steve Kagan on BIS, Reimbursement and school finance reform	7.0	5.0
Speech emphasizing importance of school finance reform legislation.	4.0	2.0
Work with Fred and Auditors (on federal audits).	7.5	14.0
EPSDT (Lawrence)	4.0	7.0
Meeting with Board of Education.	2.0	4.0
Westfield State College Symposium.	0	6.0
Planning for legislative Committee.	12.0	10.0

ANALYSIS OF TIME SPENT ON FISCALLY RELATED TASKS

TABLE B.1.C 563

ED GOTCART DIRECTOR, BUREAU OF MANAGEMENT DIVISION OF SPECIAL EDUCATION

FROM: 10-19-76

TO: 1-4-77

TASK	Actual # of hours spent	# of hours projected
Moving Grandfathered Transportation to L.E.A.s. (a meeting with Dave Andersep)	3.0	7.0
Transportation Crisis Management	69.0	62.0
Venfor Audits	23.0	22.0
Recreation Reimbursement Problems (Involves changes in SPED 5 and Dick Pedro)	3.0	4.0
School Bus Contractor Conference	6.0	6.0
Federal Funds Administration (working out some of the kinks--involves working with Rod and Dale) Later Hal.	101.0	117.0
Assuring exhaustion of State Funds	15.0	25.0
Personnel Issues	56.0	81.0
Attend Meetings (F.P.G., etc.)	69.0	85.0
Straightening out audits	54.0	70.0
Private School Deficiency Problems	26.0	13.0
Coordinating the Move to Park Square	10.0	26.0
Private School/HEW Suit	12.0	11.0
BIS/External Audit--"03" contracts	8.0	16.0
"Bob's Plan"	18.0	6.0

ANALYSIS OF TIME SPENT ON FISCALLY RELATED TASKS TABLE B.1.E 565
 BILL DONALDSON ED. SPECIALIST, DIVISION OF SPECIAL EDUCATION

FROM: 10-19-76 TO: 12-21-76

TASK	Actual # of hours spent	# of hours projected
Title I ADA	95.0	108.0
P.L. 94-142	72.0	95.0
Community Profile System Maintenance	27.0	36.0
Community Profile Reports	27.0	31.0
Bureau Planning	6.0	14.0
Information Requests	11.0	18.0
Child Search Project	8.0	5.0
M.I.S. Development	5.0	5.0
State Plan	3.0	13.0
Daily Document Time	33.0	33.0
Dissertation Proposal	170.0	144.0
Fiscal Policy Work Group	3.0	8.0

B.2 TYPES OF INTERVIEWS

All formal interviews conducted in the study were transcribed from notes or tapes and returned to the interviewee for comments. Other informal conversations between the author and managers are not listed as "interviews" per se. Instead, these conversations are reported as journal entries or informal discussions. Three types of formal interviews were conducted:

1) Structured Time Assessments. Periodically, key managers would be asked to describe how they were spending all of their time. By allocating 100 percent of a manager's time across various categories of activity, it was possible to more accurately assess what was the total mix of problems receiving attention and concern from that manager at that point in time. These formal interviews allowed the author to assess better how the fiscal policy project was fitting into the greater range of problems being actively considered by key managers.

2) Unstructured "Real Time" Interviews. A second set of interviews were more open-ended, asking managers to comment on what they were thinking at the time about key problems and issues or what they thought would be happening in the near future. These interviews captured managers' current images of what was important without the "filtering" that often happens when managers reflect on what has happened in the past.

3) Unstructured Retrospective Interviews. A problem with "real time" interviews is that often both the interviewer and managers do not accurately perceive which of the threads of activity taking place are the most important. Hence real time interviews often lack a good perspective on what was and was not important. The real time interviews have been supplemented by

retrospective discussions that "fill in the holes" in the earlier interviews. A remaining task is to have managers comment on the accuracy of the three stories reported in this research in a reflexive manner. Thus far, this task of having managers comment on the text presented here has only been completed for Chapter 6 (the cognitive story).

Evidence items I.1 through I.33 presented in Appendix C.2 give the titles of all of the formal interviews conducted to date.

B.3 THE DAILY LOG

The heart of the systematic collection and analysis of evidence was the keeping of a daily log. On a daily basis, the author recalled how his own time had been spent, recalled his impressions, and collected any documents relating to fiscal policy that he had come across that day. Hence, the daily logs containing several thousand pages of memos and notation provide a detailed record of fiscal policy activities throughout the course of the study. The three major components of the daily log are described in more detail below:

Author's Self-time Study. By far and away, the majority of the time spent in the study was spent in meetings. Time spent in meetings was logged according to with whom the meeting was held. If more than one person attended the meeting (besides the author), the author's time for that meeting would be split evenly among all those persons present. For example, in a one hour meeting with four persons, the author would allocate fifteen minutes time as "in meeting" with each of four different persons. Using this scheme, the number of hours shown in meetings actually reflect the total hours in meetings, although they are not accurate records of "contact time" with key managers. In addition, time spent directly working on a model or drafting position papers was also logged in. These final time estimates do not include time puzzling about a model or position paper-- there appeared to be no way to accurately measure such time. A summary of how the author spent his direct time between September, 1976 and March, 1977 is presented in Table B.3.

Subjective Impressions. An important source of ideas and basic concepts

MEETINGS OR ACTIVITIES	SEPT. 76	OCT.	NOV.	DEC.	JAN.	FEB.	MAR. 77	TOTAL
R. Audette Associate Commissioner of Spec. Ed.	2.75	4.50	8.00	3.75	3.25	1.50	6.25	30.00
H. Gibber, Director Program Coordination	4.25	4.75	7.00	6.00	11.75	5.50	7.50	46.75
E. Gotcart, Director Bureau of Management	1.00	5.75	5.25	1.00	2.00	2.00	2.25	19.25
D. Keeler, Education Specialist in School Management Services		1.75	6.00	1.50	1.75	3.00	1.25	15.25
G. Thayer, Planner and Former Superintendent		2.50	2.00	1.25	3.25	3.50	3.25	15.75
J. Yannacci, Chief Accountant Division of Special Education		2.75	1.00	.75	.50	.75	.25	6.00
B. Levine, Administrative Asst. Assoc. Commissioner of Spec. Ed.	1.25	4.25	3.75	2.75	2.50	.50	5.25	20.25
G. Mercandante, Ed. Specialist in Local Aid Task Force		.50	3.50	.75	3.50	4.50	1.25	14.00
Bill Donaldson, Education Spec. Division of Special Education	.50	3.25	2.25	1.00	1.50	2.00	.25	10.75
Other Activities	3.50	2.25			4.50	3.75	3.00	17.00
Meetings with Others	4.25	8.25	13.50	13.25	5.25	14.25	11.25	70.00
Drafting Non-Model Position Papers		5.0	10.00	5.00	7.75	12.25	15.00	55.00
Formal Modeling		13.50	42.50					56.00
TOTAL	17.50	59.0	104.75	37.00	47.45	53.50	56.75	376.00

TABLE B.3: Analyst's Total Hour Allocation by Month

used to modify the original body of theory was the daily subjective impressions recorded by the author in the daily log. In these daily notations, small kernels of ideas were worked out, later to be spun together in writing the chapters presented in this research. Also recorded were notes on the progress of the fiscal policy project. These were invaluable in reconstructing the overall progress of the project. Finally, the author took some notes at every meeting that he attended so that the basic events transpiring during that meeting could be reconstructed.

Collecting Decision-Making Residue. Finally, all fiscally related documents falling within the author's reach were systematically collected, dated, and filed, creating a valuable and detailed file of decision processes. All of these notes were combed on a monthly basis, sifting out the most important events, memos, and meetings. These important events were listed on a monthly calendar. Based upon these monthly calendars, the flow charts summarizing important events presented in Chapter 5 were drawn up.

APPENDIX C

SUBJECTIVE CODING OF EVIDENCE

A sample of the total evidence collected in the case study has been catalogued and coded in this appendix. The point of this subjective coding of the evidence is to determine how well each perspective "covers" various pieces of evidence. That is, how well do the vocabulary and concepts used within a given theoretical perspective explain the activity represented by the piece of evidence in question?

The summary results of this subjective coding procedure are presented in Chapter 7.

C.1: PROCEDURE AND CRITERIA FOR SUBJECTIVE CODING OF EVIDENCE

Overview of the Coding Procedure

Each piece of evidence will be coded with six subjective measures. These measures will assess the type of evidence items, the degree to which the model was involved with the piece of evidence, a subjective assessment of the overall effectiveness of the evidence item in impacting on fiscal decision making, and finally three assessments of how well the piece of evidence was "covered" by each of the three theoretical perspectives. The data matrix will look like the following:

	Type of Evidence I	Degree Model Involved II	Impact of Evidence III	Covered by Rational Perspective IV	Covered by Organizational Perspective V	Covered by Cognitive Perspective VI
Item #1						
Item #2						
Item #3						
.						
.						
.						

FIGURE C.1: Format of Matrix for Subjective Coding of Evidence

The coding schemes to be used for each of the six columns is presented in more detail below.

The coded evidence consists primarily of the formal interviews and the complete log of daily evidence collected between March and August of 1976 (Phase II). This sample of evidence was deemed typical of the total body of evidence collected throughout the study.

Column I: Type of Evidence

Nine types of evidence are coded. The nine types are unstructured interviews (IU), structured interviews (IS), meetings (M), hand-written

notes (DN), informal documents (DI), formal documents (DF), printed materials (PM), raw questionnaires (QR), summaries of questionnaires (QS), and other types of evidence (O). Each of these nine categories is defined in more detail below:

Unstructured Interviews. (IU) Interviews refer only to these meetings between the author and one of the organizational participants that were formally written up and returned to the interviewee for comment. In each of these interviews, the interviewee was asked if he would consider himself "on the record" in this interview. If an interviewee would not go "on the record" for all or part of an interview, it was not listed as an interview per se. Unstructured interviews refer to those interviews where the author was broadly exploring an area of inquiry. Some of these unstructured interviews were taped and transcribed verbatim; all of these contain extensive quotation from the interview itself.

Structured Interviews. (IS) As with the unstructured interviews, these were formally written up and returned to the interviewee for comment. However, in the structured interview, the author was probing a much more narrow point, often asking the interviewee to subjectively assess his time allocation with numerical approximations.

Meetings. (M) An immense amount of time was spent in formal and informal meetings. At each meeting, the author listed all of the participants, the date, and such notes as seemed relevant to summarize the activities within the meeting. Unfortunately, many of these notes have since lost their meaning, or, due to active participation in the meeting, incomplete notes were taken. Sometimes in retrospect, the meeting did not turn out to be

particularly important. Consequently, only those meetings that were attended by three or more persons besides the author or were particularly memorable or had interesting notes attached to them were listed as meetings. When the agenda for a meeting contained merely a list of topics to be discussed, that agenda was listed as a "meeting" piece of evidence. When the agenda contained a more lengthy statement of a paper to be considered within a meeting, the agenda was listed as a document.

Notes. (DN) A general criteria for identifying a note is that it is a hand written document by the author commenting on some aspect of a meeting or the day's activities. Such notes are invariably contained in the log of daily events. However, a note may occasionally be authored by someone other than the author of this work (say a manager within the division). The author of such notes is marked in the evidence item description. If and when a note becomes typed and circulated, it is then listed as a document.

Informal Documents. (DI) Informal documents are those many short working memos, agendas of meetings, preliminary statements of problem, delineation of tasks, etc. that characteristically lose meaning once the task at hand is accomplished and will soon be discarded. For this project most all of the informal documentation representing intermediate stages of activity has been preserved.

Formal Documents. (DF) Formal documents are all of the final versions of working documents, regulations, assignments of responsibility, etc. that are kept for the record. In this study these formal documents have been kept and are contrasted with many of the informal documents that were earlier versions of the final working document. As a general rule of thumb,

formal documents represent that degree of documentation that would be available to a diligent researcher who was searching an organization's files after-the-fact of a policy decision. Some formal documents emanating from within the Department of Education have the power of full policy statements. Sometimes these have been printed and disseminated to the local school districts. These are still listed as formal documents.

Printed Matter. (PM) Printed matter represents formal reports and articles originating outside of the Department of Education. Examples of printed matter include copies of federal regulations and articles in local newspapers.

Questionnaires. (OR) As part of this study, questionnaires were circulated to key managers within the Division of Special Education on a bi-weekly basis to assess how they were allocating their time and what fiscal policy tasks were receiving their attention. These are listed as questionnaire data.

Questionnaire Summaries. (QS) For ease of interpretation, the many questionnaire documents were often accumulated into summary form. In addition, the time allocations inherent in the daily log was also summarized. All of these summaries of formally collected data have been coded "QS."

Column II: Degree Model Involved

Each piece of evidence will be coded as to whether it refers to activities or documents that are related to the formal system dynamics model per se (1), the direct model building activities (2), a broader view of modeling as policy making (3), or non-model building (4). Each category

is defined in more detail below:

Model Per Se. (1) A piece of evidence that related to the model itself or to some conclusions drawn directly from the model will be regarded as related to the model per se.

Direct Model Building. (2) If the activity or document was directly necessary to build the model, this evidence will be coded as model building. The defining question for this category is "could a model (not necessarily a good one) have been built without this activity?" If the answer to this question is "yes," then that activity must be classified as a broader modeling activity (3).

Broader Modeling Activity. (3) The third ring out in this classification of activities are those that can still be seen as related to the modeling effort but not necessarily to build the model per se. Such activities include educating others about the model's conclusions, conducting scouting interviews with non-members of the model-building team, and translating the activities represented within the model into agenda items for operating units. When an activity represents a critical piece of learning for the model builders, it may also be included as a broader modeling activity.

Non-modeling Activities. (4) Much of the fiscal policy activity recorded in the evidence had little at all to do with the formal model-building project. For example, many meetings were held with the external consultants to settle issues never mentioned within the modeling effort or time was spent discussing how to best allocate federal funds across communities. Activities and documents such as these are coded as "non-modeling related" (4).

Column III: Impact of Evidence

The coding scheme described thus far makes the implicit assumption that each piece of evidence is as important as any other one. That is, a small memo outlining several alternatives may fit the rational story very well as would a major position meeting that evaluates several alternatives that have been under study for a month. Some measure is needed to show that one piece of evidence should somehow be weighted more heavily than another.

However, coming up with some such single measure will be a rather difficult and highly subjective task (more so than any of the other codings). This is because there are so many possible criteria along which importance could be measured. What is a critically important even from an organizational point of view may not be all that important from a rational point of view. In general, it will not be possible to erect an impartial and absolute set of criteria for defining an important piece of evidence that has had significant impact.

The strategy used here shall be to use a relative measure of importance that will force a subjective choice between events. For each batch of data processed, 15% of the evidence points are rated as "having significant impact" (2). 20% of the points of evidence are rated as "having least significant impact." By default, the middle 65% are rated as having moderate impact (1). Once all of the batches of data have been processed, the twenty pieces of evidence representing those activities that were subjectively assessed as having the greatest impact of all are rated with a (3) "event having most significant impact."

Although such a forced choice procedure will do little for providing

a metric for deciding what was really important in the study, it clearly and explicitly exposes the criteria that the author used in determining his own measure of what was and was not important in improving divisional decision making.

There is further reason for not being overly concerned with the highly subjective nature of this assessment. It is anticipated that this measure will only be used when comparing the relative coverage of the three perspectives. Since each of these three theories shall be covering identical bodies of evidence, we shall be comparing one piece of evidence (when viewed from one point of view) against itself (when viewed from another point of view). Since each piece of evidence will be compared against itself, the dilemma of comparing all pieces of evidence against each other will not be as important.

General Criteria for Coding "Coverage" Data

Every attempt has been made to make the rules for coding the relative coverage of each piece of evidence by the three perspectives as explicit as possible and hopefully replicable by an informed and trained third party. To this end the following general criteria and procedures have been established for coding the coverage data. More detailed examples follow that should allow more exact "calibration" of the scoring for specific subcategories.

A piece of evidence shall be coded as "directly relevant" (2) to a given perspective if the direct and principle purpose of the activity represented by that evidence could be explained in terms of the theoretical terms of the given perspective. A major test will be the extent to which the

vocabulary employed by the theory seems to describe the activities summarized by the evidence. Hence a document would be considered directly relevant to the rational frame if it outlined outcomes of alternatives, to the organizational theory if it discussed membership in a newly forming group, and to the cognitive theory if it dealt with the training of key managers. If a coder hesitates and is in doubt, a (2) rating should not be assigned.

A piece of evidence shall be coded as "indirectly relevant" (1) if by inference it could be construed as supporting propositions and assertions made in the theory under consideration. In this case, the coder shall give considerable latitude of interpretation in assigning a rating of (1).

A piece of evidence will be coded as "not relevant" (0) if it seems awkward to explain the activities implied by the evidence within the theoretical framework under consideration. That is, the vocabulary of the theory does not seem to fit the activities under consideration.

The procedure for coding the data shall be to first scan the entire catalogue for the batch being processed and to assign a "directly relevant" score where appropriate. Then scan the data a second time to assign "not relevant scores" where appropriate. Review the scoring to assure that there is consistency within the scorings thus given. Finally, return to each piece of data not yet marked and assure that it can be appropriately coded as "indirectly relevant." Only in rare cases will a piece of evidence be moved up or down to a 0 or 2 at this stage.

Column IV: Covered by Rational Theory

The general rule for coding evidence as "directly relevant" (2) within

the rational frame is: Assign a "2" if the direct and principal purpose of the activity or document was related to delineating alternatives, outlining the consequences of alternatives, evaluating each of the alternatives, or choosing between them. If it is awkward to explain the activity in the vocabulary of the rational framework, assign a "0". If by inference the activity can be described in terms of the rational vocabulary, assign a "1". Some examples to help calibrate the scoring procedures follow:

Directly Relevant. The following are examples of directly relevant pieces of data:

- An interview whose principal purpose is to delineate alternatives open over the next several months or weeks, (but not an interview that retrospectively assessed what actually happened).
- A meeting whose purpose was to finally decide among several well formed alternatives.
- A memo that outlines a list of possible alternatives open for consideration.
- A meeting whose purpose is to evaluate the implications of several alternatives.

Not Relevant. The following are examples of pieces of evidence considered not relevant:

- An interview that discusses how a manager allocates his time.
- A meeting that discusses membership within a group.
- A document whose principle purpose is to serve as a training document.
- A meeting that discusses training of personnel.

Column V: Evidence Covered by Organizational Theory

The general rule for coding evidence as "directly relevant" (2) within the organizational frame is: Assign a "2" if the direct and principal purpose of the activity or document was related to the modification, manipulation, or improvement of organizational capabilities. That is, the activity could be described in terms of vocabulary involving the terms, goals, membership, standard operating procedures, and constraints. If it is awkward to explain the activity using the concepts and vocabulary of the organizational framework, assign a "0". If by inference the activity can be described in terms of the organizational vocabulary, assign a "1". Some examples to help calibrate the scoring procedures follow:

Directly Relevant. (2) The following are examples of directly relevant evidence:

- A meeting that discusses routines and procedures.
- A scouting meeting to assess activities in other units.
- A meeting to strategize over how to balance off different organizational interests.
- An interview that discusses organizational routines and pressures.
- A document that discusses organizational capabilities.

Not Relevant. (2) The following are examples of evidence considered not relevant:

- A discussion between two actors clarifying a technical point.
- A document that is a training package.

Indirectly Relevant. (1) In many meetings a unit will be routinely exercising its capabilities. For example, completing problem-directed search,

carrying out a procedure, etc. Since these activities only involve the exercise of organizational activity and not changing it, they are rated (1) and not (2). Examples include:

- A memo laying out options (problem directed search).
- A meeting to discuss several options.
- An interview discussing time allocation.
- An interview that discusses options, alternatives and next steps.

Column VI: Covered by Cognitive Theory

The general rule for coding evidence as "directly relevant" (2) within the cognitive framework is: Assign a "2" if the direct and principal purpose of the activity or document was related to modifying management's thinking, creating a training document, or helping to create new concepts and understandings on the part of managers or analysts. If it is awkward to explain the activity in the vocabulary of the cognitive framework, assign a "0". If by inference the activity can be described in terms of the cognitive vocabulary, assign a "1". Some examples to help clarify the scoring procedures follow:

Directly Relevant. The following are examples of directly relevant evidence:

- An interview where the interviewer discusses his view of some significant substantive issues in a non-retrospective fashion.
- A meeting explicitly involved with training.
- A document explicitly involved with training.
- A meeting designed to create new ideas, "brainstorm."
- A document that creates a new concept or insight.

- A document designed to persuade key management.

Not Relevant. The following are examples of evidence considered not directly relevant:

- A meeting focusing on procedures.
- A meeting focusing on personalities.

Indirectly Relevant. Managers are continually acting based upon their mental models. In a meeting or document where actions are taken or options outlined based upon management's existing mental models, a "1" is assigned. This is because in these cases no active learning or changing of mental models is taking place. For example:

- A group meeting to discuss an issue.
- A scouting meeting with another manager.
- A memo classifying an option not designed to persuade or teach another manager.

C.2 CATLOGUE OF EVIDENCE AND SUBJECTIVE CODING

Table C.2 (sheets 1 through 3) presents all of the evidence catalogued and analyzed in Chapter 7. The evidence with a prefix "I" represents formal interview documents. The evidence items with a prefix "B" represent items of evidence collected in the daily log of events between March and September, 1976 (Phase II of the overall project).

The rules and nomenclature used in coding all of the columns of evidence have been fully explained in section C.1 of this appendix.

TABLE C.2.A: A Subjective Coding of Sample of Evidence (Sheet 1)

ITEM #		Type of Evidence I	Degree Model Involved II	Impact of Evidence III	Covered by Rational Perspective IV	Covered by Organizational Perspective V	Covered by Cognitive Perspective VI
I.18	E. Gorgart, 9/7/76. Allocation of effort between all issues for September and projection of same for October.	IS	4	0	0	1	1
I.19	E. Gorgart, 10/27/76. Priorities for the bureau of management and discussion of why Dale (former director of bureau) left.	IU	4	1	1	2	1
I.20	B. Donaldson, 10/27/76. Allocation of all effort for October 76 and projections through November as well as some more general questions on fiscal policy.	IS	4	0	0	1	1
I.21	G. Mercadante, 11/2/76. Overview of fiscal policy development effort from her point of view (Bureau of Research and Evaluation)	IU	4	1	1	2	2
I.22	D. Keeler, 11/1/76. Discussion of some of the policy implications of David Andersen's memo outlining policy options for the fiscal policy group. Discussion of last meeting of fiscal policy work group.	IU	3	1	1	1	1
I.23	D. Keeler, 11/3/76. Total allocation of effort for the month of October with projections for the month of November.	IS	4	0	0	1	1
I.24	J. Yannacci, 10/27/76. A general discussion of fiscal policy within the division.	IU	3	1	1	1	2
I.25	J. Yannacci, 10/27/76. Allocation of time for the month of October projected into November.	IS	4	0	0	1	1
I.26	G. Thayer, 1/12/77. Projections of how Gene Thayer will be spending his time through the winter.	IS	4	1	0	1	1
I.27	G. Thayer, 3/10/77. Listing of activities currently on Gene Thayer's "active agenda".	IS	4	0	0	1	0
I.28	J. Flahive, 5/3/76. Broad questions concerning the "context of fiscal policy group and detailed delineation of "next steps".	IU	4	1	2	1	2
I.29	T. Bradford, 5/10/76. Broad questions concerning "context" of fiscal policy group and detailed delineation of "next steps".	IU	3	0	2	1	2

TABLE C.2.B: A Subjective Coding of Sample of Evidence (Sheet 2)

ITEM #		Type of Evidence I	Degree Model Involved II	Impact of Evidence III	Covered by Rational Perspective IV	Covered by Organizational Perspective V	Covered by Cognitive Perspective VI
B.32	4/7/76. Log Entry. Meeting with B. Blustein to discuss how intake of issues from SMS should happen.	M	3	1	1	2	0
B.33	4/8/76. Log Entry. First meeting of fiscal policy work group. Settled how J. Yannacchi should log issues. Dove into problem of FTEs.	M	3	2	1	2	1
B.34	4/8/76. "Full Time Equivalency" memo by Joe Flahive outlining how he thinks FTE should be computed.	DI	4	1	2	1	1
B.35	4/9/76. "Fiscal Training Sessions Scheduled" memo from B. Blustein to FPG noting when regional training sessions will occur.	DI	4	0	0	0	2
B.36	4/15/76. Log Entry. Meeting of Fiscal Policy group to discuss FTEs.	M	3	1	1	1	1
B.37	"Methodology and Cost Allocation Sheets", memo from D. Keeler to H. Gibber outlining how FTE issue ties into broader issue of cost allocation. 4/12/76.	DI	4	1	1	1	2
B.38	4/15/76. "Reimbursable Special Education Services" memo from J. Flahive to R. Audette outlining how FTEs should be computed.	DI	4	1	2	1	2
B.39	4/22/76. Log Entry. Meeting that was planning session for training for SMS.	M	4	1	0	1	1
B.40	4/22/76. Log Entry. Meeting with D. Keeler and L. Turo about FTE issue. I finally got it.	M	3	2	1	0	2
B.41	4/22/76. "Financial Reporting System: Supplemental Exhibits, Schedules and Cost Analyses" memo by L. Turo, R. Oakes, and N. Keeler showing how to allocate costs including special education.	DF	4	1	1	1	1
B.42	4/22/76. "Methodology" memo to supplement B.41 (above) outlining "pupil-staff accounting".	DF	4	1	1	1	1
B.43	4/24/76. "Proposed steps for constructing a formal training package", memo by D. Andersen outlining how SMS training should proceed.	DN	4	1	1	0	2
B.44	4/26/76. Log Entry. Meeting with Williams, Keeler and Flahive to discuss training package.	M	4	1	0	1	2
B.45	4/26/76 Log Entry. Meeting with extended fiscal policy group to discuss FTE issue.	M	3	1	1	1	1
B.46	4/29/76. Log Entry. Meeting of fiscal policy group that articulated five options for FTE.	M	3	1	2	1	1
B.47	4/29/76. Log Entry. Scouting meeting with Bruce Perlestein.	M	3	1	1	2	1
B.48	4/29/76. Log Entry. Scouting meeting with S. Kaagen.	M	3	2	1	2	1
B.49	4/29/76 Memo from J. Flahive to R. Audette outlining consequences of two options of computing FTE.	DI	3	1	2	1	1
B.50	4/30/76. Log Entry. Meeting with H. Fox to discuss coordination between FPG and Touche Rosse	M	3	1	0	2	0
B.51	4/30/76. Log Entry. Meeting of FPG to finalize options to be used in cost allocation.	M	3	2	2	1	1
B.52	4/30/76, Log entry. Meeting with Gibber and Audette to plan for final decision meeting over F	M	3	2	2	2	1
B.53	4/30/76. "Criteria", note dictated in meeting with Audette and Gibber outlining criteria for evaluation of alternative proposals.	DN	3	1	2	1	1
B.54	5/3/76, log entry. Meeting with Keeler, Flahive, Gibber, and lawyer to discuss options to be presented that afternoon.	M	3	1	1	1	1
B.55	5/3/76, log entry. Meeting extended FPG plus Williams and Kaagen to decide on how to allocate Special Education dollars.	M	3	2	2	1	1
B.56	5/3/76. Agenda for Fiscal policy meeting. Outline purpose of meeting, summary of two proposals being discussed and analysis of impacts along 9 different dimensions.	DF	3	1	2	1	2
B.57	5/3/76. Memo from B. Donaldson to R. Audette outlining the FTE concept.	DI	4	0	1	1	1
B.58	5/3/76. Memo by D. Keeler outlining and defending option #2 for computing FTE.	DF	4	1	2	1	2
B.59	5/3/76. Memo by J. Flahive outlining and defending option #1 for computing FTE.	DF	4	1	2	1	2

C.3 INTER-RATER RELIABILITY OF SUBJECTIVE CODING

The Reliability Problem

The results reported in Chapter 7 concerning the coverage of the evidence subjectively coded in this appendix might be sensitive to different interpretive rules that different observers might use for determining "direct", "indirect", and "non coverage" of various pieces of evidence. To test for this possibility, an experiment was devised to test the sensitivity of results presented in Chapter 7 to subjective scoring by two independent scorers.

In general, the pattern of results presented in Chapter 7 was replicated by the two independent scorers. Furthermore, the two independent scorers replicated exactly the original coverage score obtained by the author in 67 percent of the pieces of evidence scored. In 31 percent of the pieces of evidence scored, the author's score and those of the independent raters varied by one. That is, the author scored 1 (indirect coverage) and the independent rater scored 0 (not covered) or 2 (directly covered or vice versa). In only 2 percent of the cases did the author's ratings and those of the independent scorers diverge entirely.

The Replication Experiment

Two scorers were found who were familiar with the research and the three theoretical perspectives being used. The independent scorers were told that the purpose of the experiment was to test the reliability of the coding rules reported in section C.1 of this appendix. Thirty-three pieces of evidence were chosen to be recoded by the two raters (they had already been scored by the author several months previously). The thirty-

three items were items I.18 through I.29 and B.32 through B.52 presented in section C.2 of this appendix. These thirty-three items were chosen on the grounds that they were the first two pages of evidence coded by the author. The coders then read the general rules for coding the coverage of evidence as presented in section C.1. Next, the author spent about one and a half hours explaining all thirty three pieces of evidence to the raters. The raters were given an opportunity to peruse each piece of evidence and to ask questions about its content and the context within which it was gathered. The coders then read and discussed the specific rules for coding the evidence within the rational framework. The author answered any questions that they may have had concerning the coding rules. Specific items of evidence were not discussed. The raters coded the evidence according to the criteria. In sequence, the organizational rules were read and the organizational coding completed followed by the same procedure for the cognitive coding. The entire coding of thirty-three items three times took about one and a half hours.

Finally, the author and the two coders discussed the coding experiment, attempting to assess what the coders found most difficult, easiest, and most puzzling about the exercise.

Replicability of the Results

Figure C.3 displays the results obtained by the three scorere (the author's prior scoring of the same sample used in the replication experiment is also presented in C.3). With one minor exception, the broad pattern of results reported in Chapter 7 are replicated by the three scorers. Specifically, the following three general conclusions have been reaffirmed:

	RAT	ORG	COG
DIR	8	8	10
IND	15	22	20
NON	10	3	3

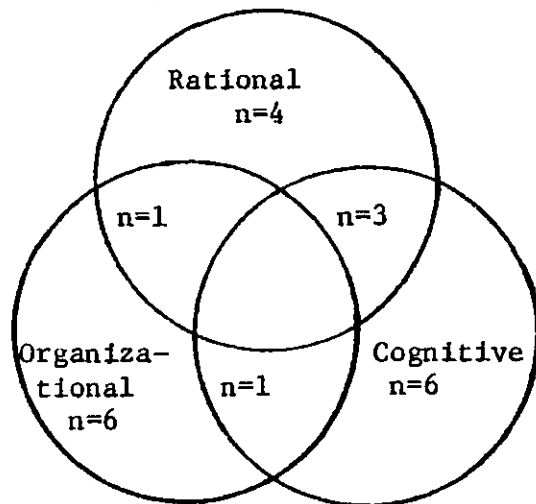
C.3.A Author's direct, indirect & non-coverage for three perspectives

	RAT	ORG	COG
DIR	9	10	13
IND	7	22	18
NON	17	1	2

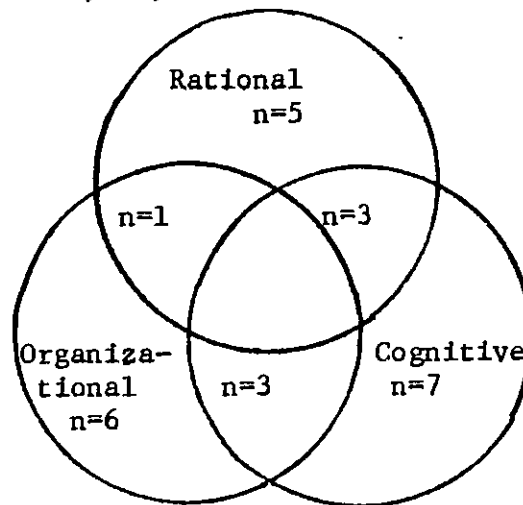
C.3.C Coder #1's direct, indirect & non-coverage for three perspectives

	RAT	ORG	COG
DIR	6	7	14
IND	9	15	12
NON	18	11	7

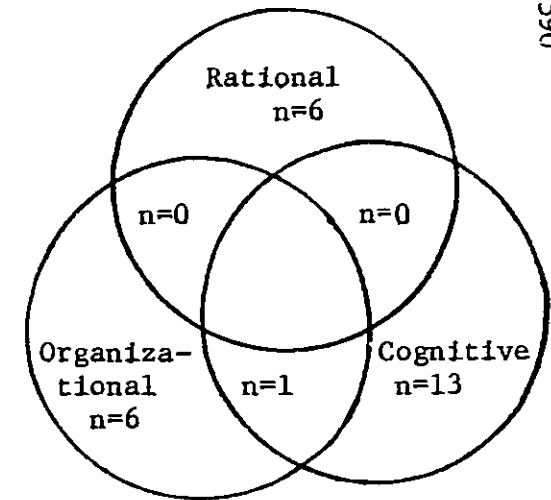
C.3.E Coder #2's direct, indirect & non-coverage for three perspectives



C.3.B Author's overlap in direct coverage (21 out of 33 items)



C.3.D Coder #1's overlap in direct coverage (25 out of 33 items)



C.3.F Coder #2's overlap in direct coverage (26 in 33)

FIGURE C.3: Comparison of Subjective Coding Between Author & Two Independent Coders

1) Single perspective coverage of the data. The finding that each perspective covered either directly or indirectly most of the evidence was not precisely replicated. Raters one and two found that the rational perspective did not cover more than fifty percent of the evidence considered. However, the broad pattern that each perspective did cover a large portion of the evidence was reaffirmed.

2) Direct coverage increases with multiple perspectives. On the average, a single perspective covered approximately 28 percent of the evidence directly. However, when all three perspectives were considered together, approximately 72 percent of all of the evidence was directly covered by one or more of the perspectives. That is, the use of a multiple perspective approach dramatically increased the direct coverage of the evidence for all of the scorers. We repeat here the word of caution mentioned in Chapter 7. All pieces of evidence coded were not equally important. Hence the current analysis gives no clue of which perspective covered the most important events. An analysis of the importance of the various events covered by each perspective would be an interesting task for future research.

3) Broad lack of overlap in direct coverage. For all three coders, no piece of evidence was directly covered by three bodies of theory. Only 18 percent of the pieces of evidence covered directly by any of the three bodies of theory were covered directly by two of the perspectives. Fully 82 percent of the evidence receiving direct coverage was covered by only one perspective. That is, in general each body of theory directly covers substantially different bodies of evidence.

The fact that two independent coders replicated the same overall

pattern of results reported in Chapter 7 lends slightly more credence to that analysis. However, the possibility still remains that each coder is coding according to entirely different rules of subjective interpretation. We would feel more confident of the results presented in Chapter 7 if it turned out that there was some reasonable correlation between the responses of the three coders on an item-by-item basis. If such a correlation existed, we would have some additional assurance that the coding rules presented in section C.1 are logical, learnable, and have some basis for existence independent of the subjective opinions of individual coders.

Inter-Rater Correlation of Results.

To test for the relative congruence of the subjective rules for coding the evidence used by each of the raters, the raw scores of the raters, taken two at a time, were plotted on scattergrams to test for patterns of correlation. Summaries of these nine scattergrams are presented in Figure C.4 (there are nine scattergrams because each scorer rated three perspectives and there are three pairings of raters taken two at a time producing a three-by-three array of scattergrams for a total of nine in all). Each of the nine summary scattergrams presents the pattern of correlation between two of the scorers for one of the three theoretical perspectives. Scores on the diagonal running from the lower left to the upper right represent items of evidence where both raters scored the piece of evidence exactly the same. Scores one box off the diagonal represent near misses, that is one scorer rated the evidence 1 and the other scorer rated the evidence as a 2 or 0 and vice versa.

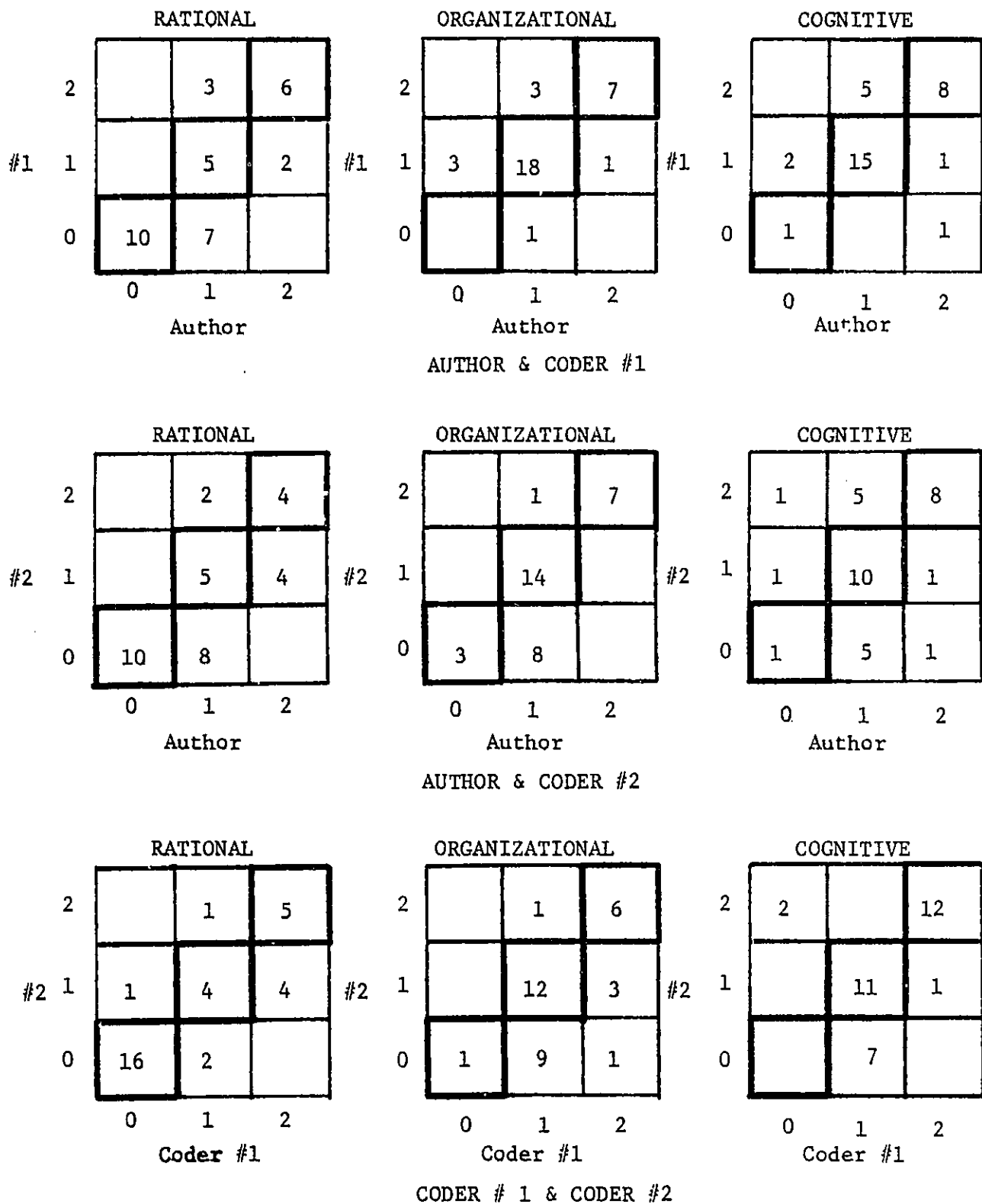


FIGURE C.4: Correlation Between Scoring Patterns of Author and Two Independent Coders

Responses in the upper left or lower right boxes represent times when the two raters scored a piece of evidence in exactly the opposite fashion (one rater giving it a 2 and the other giving it a 0).

In total, 67 percent of the pieces of evidence were reported on the diagonals in Figure C.4 (representing identical scorings by two of the raters). 31 percent of the pieces of evidence were scored with a difference of one point between the two scorers and only 2 percent of the evidence was in the upper left and lower right boxes representing mismatches.

Although no statistical tests of significance were completed (that would seem to be adding a pretense of precision that does not appear warranted by the approximateness of the whole coding procedure) the scattergrams presented in Figure C.4 would seem to indicate that the three coders were using rather similar subjective rules for interpreting the evidence.

As a final check, an item analysis was completed on the correlation in ratings of "direct coverage" reported in the Venn diagrams in Figure C.3. For 71 percent of the evidence rated as directly covered by at least one coder, all three coders listed that evidence as directly covered by the same theory. For 23.5 percent of the evidence rated as directly covered by at least one coder, two of the three coders listed the evidence in the same fashion (under the same theory). Only 5.5 percent of the evidence listed as directly covered was directly covered by only one rater. Again, the correlation between the three coders indicates that they were using somewhat similar subjective coding rules.

Raters' Reflections on the Experiment

Although the rating experiments indicated that the two independent coders were using subjective rules that were somewhat alike, both coders reported that the rating process was a difficult and often ambiguous one.

Comments by Rater #1. Rater #1 commented that the whole subjective coding process was "quite difficult". It "forced (him) to think about what each of the theories really means." To rater #1, rating the organizational evidence was the most difficult. The cognitive perspective was the second most difficult to rate. He found it relatively easy to rate the evidence using the rational frame of reference. Two types of evidence were most difficult for Rater #1. Documents dealing with the training sessions were most puzzling--is it a cognitive or organizational phenomena when an organization is training its members? Also, Rater #1 found it difficult to rate position papers where one member of an organization was advocating his point of view--is this a rational or organizational event? Finally, Rater #1 commented that his scores might be different if he were to go back over the sheet and look at the three scores he had given a single piece of evidence. The coding procedure, as conducted, forced him to score a piece of evidence independently of how it had been scored for other perspectives. He did not explore how his scorings might have been different.

Comments By Rater #2. Rater #2 reported that she felt "like a fish out of water" completing many of the scores. She referred back to the coding rules much more often than Rater #1 and seemed more concerned with following the coding rules to the letter than did Rater #1 (in fact

Rater #1 reported breaking the coding rules about how to code training sessions because the rule as stated in section C.1 of this appendix "didn't make any sense to him".) Rater #2 focused on the vocabulary used in the documents and their description. For example if a document was titled "training" or "options", she would file it away immediately as either "cognitive" or "rational" respectively. Rater #2 found the cognitive ratings to be the most difficult. Of next greatest difficulty was the organizational ratings. As with Rater #1, #2 found the rational coding easiest to perform (it somehow always seems easier to know what one should do with dealing with a rational perspective.)

A Final Note on the Experiment.

Discussing "Rater #1", "the experiment", "replication of results", "~~correlation between raters~~", and "inter-rater reliability" makes the whole affair reported in this appendix sound much more scientific than it perhaps actually was. An ethnomethodologist would note that the so-called experiment transpired at the author's home after dinner on a Friday night. Rater #1 was a good friend who had been following the research over the course of the past two years. Rater #2 was the author's wife who similarly knew the details of the whole project inside out.

We were all quite pleased when later on in the evening we tallied up the results and they came out actually saying something. We all spent quite a lot of time ~~examining~~ the outliers and trying to understand why we disagreed on the points that we did. We all chastised Rater #1 for disobeying the rule about training sessions (for it produced over half of the outliers) but he maintained staunchly that the rule didn't make any

sense anyway and deserved to be disobeyed.

In the end we all came away believing what the tabulated statistics reported here had shown--that independent observers familiar with the case and the bodies of theory under discussion would agree about 70 percent of the time on how to classify evidence, disagree about one or two percent of the time in some very basic ways, and have some sort of muddled half-way disagreement the other 28 percent of the time.