Applying the Management System Model to a Federal Government Organization

by

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Thesis submitted to the Faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of Master of Science in Industrial Engineering and Operations Research

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(ABSTRACT)

This research develops and applies a set of measurements to assess organizational system balance. The Management System Model (MSM), consisting of "who manages," "what is managed," and "what is used to manage," supplies the basis for defining balance. Balance requires the system to regain stability at an equal or higher level when brought out-of-balance by change.

This is exploratory research, examining management systems for correlations among related characteristics. Discovery of correlations helps in the understanding of management system behavior, and can lead to hypotheses on cause-and-effect relationships.

Four U.S. Department of Energy subagencies were used as case studies for the management system analysis. The set of instruments used in this analysis provided a good first-cut at defining and describing balance for management systems. Two of the cases were found marginally balanced. The other two were marginally out-of-balance.

Failure to achieve balance is analyzed by looking at results for conditions of balance between components of the management system. These conditions represent matches of important criteria, such as information portrayal formats, organization-compatible decision styles, and data capture. Balance should be measured, over time, to see if the management system analysis led to improvement. Various instruments were used to assess these balance conditions, including the Myers-Briggs Type Indicator and the Driver Decision Style Exercise.
Acknowledgements

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Many thanks are in order for my advisor, Dr. Harold Kurstedt, who provided me the opportunity to conduct real-world research with MSL sponsors. He guided me through the halls of DOE Headquarters to meet with various managers and other DOE employees to find out how their management systems operate. I am indebted to those people at DOE who took time out of their busy days to talk about what they do and to take various instruments.

Dr. Scott Sink and Dr. Marv Agee supplied valuable input to my work. I especially thank Dr. Sink for the experience I gained in the summer I worked at the Virginia Productivity Center.

And my co-workers at MSL, they are too numerous to name, but too good to forget. They provided morale support, made sure I got my funding, prepared my graphics, opened avenues to help me finish my research, and provided an exciting place to learn.
Certainly I can’t forget two very good friends, Ed DeMeter and Radha Jayaraman, who made my life here at Tech a bit sillier and who offered support when times weren’t so good.

My parents deserve my deepest thanks. I never could have reached my potential if they hadn’t taught me the value of hard work and the meaning of responsibility. They started me down the right roads, and allowed me to discover paths that interested and challenged me.
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Chapter 1. Introduction

1.1 Prologue

This research develops a preliminary set of instruments for assessing management system balance. The instruments measure constructs important to the components of a management system — "who manages," "what is managed," and "what is used to manage." Conditions of balance (COBs) relate dependent pairs of component characteristics. The instruments give results of measurement, from this I can reach conclusions about balance for each condition. I aggregate these conditions to reach balance conclusions for the three interfaces. Finally, I conclude management system balance by looking at the COBs and interface balance conclusions.

The scope of this research is broad, exploring many aspects of organizational systems. Thus, it is exploratory research, examining management systems for correlations among characteristics. These correlations may suggest hypotheses on cause-and-effect relationships. Unlike confirmatory research, which formulates and tests specific hypotheses, exploratory research has more general research objectives. In exploratory research, we compare observations to expectations, and draw implications from this comparison.

I studied a government oversight agency (GOA) at the Office Director level within the U.S. Department of Energy. Managers in four subagencies of this GOA participated by allowing me to
measure several characteristics of their management systems. This real-world application in a complex domain defies specification of variables, and is a good subject for exploratory research.

I found the preliminary instrument set provided a good first-cut at characterizing management system balance. Balance should be measured, over time, for the same system. Measurement over time will show whether or not the management system has improved.

A review of the literature showed many studies on specific aspects of the management system model — information presentation, decision making performance, cognitive styles, and manager demographics. The literature cited the need for research that (1) considers the complexity of real-world organizations, (2) shows how government management tools work together, and (3) develops results generalizable to other settings.

I conducted a review of selected management and MIS literature and found no significant advance has been made with respect to conceptual frameworks in the past five years. There have been frameworks proposed since that time, but none bear new insights or perspectives. Recently, the focus of such work has been on managerial tasks, specifically, information technology as part of corporate strategy (H. C. Lucas, personal communication, April 11, 1985).

This transition from conceptual to managerial implies the conceptual side has been duly developed. Such an assumption is not necessarily true, and the need exists for more work on conceptual frameworks of information systems and their implications on management systems. Lucas, Clowes, and Kaplan (1974) state "frameworks serve an important function in organizing ideas and approaches to problem solving in the emerging information systems field... Frameworks also suggest new directions for research, a vital function in the emerging [information systems] field" (emphasis theirs). Frameworks serve an equally worthy purpose when generalized and applied to management. Managers need a structure on which to both plan and explain routes taken for goal attainment. Mintzberg (1975) said: "It is time to strip away the folklore about managerial work, and time
to study it realistically so that we can begin the difficult task of making significant improvements in its performance."

1.2 Need for Research in Government Management Tools

I selected federal government organizations at the office director level for analysis in this research. Government agencies, especially at the oversight level, encounter problems of different character than their industrial counterparts. We call these agencies GOAs, for government oversight agencies. GOAs are close to the legislative bodies they correspond with, while public works agencies are closer to the provision of services to the public. (See "Appendix B. Characteristics of Government Oversight Agencies" on page 174 for more detail on GOAs.) Government managers need help with their management tools.

I claim what government oversight agencies manage are not the physical things, but information about those physical things. Therefore, these organizations should adopt an information processing orientation. Salamon (1981) says current implementation research in government focuses on the wrong unit of analysis, and researchers should concentrate on the "generic tools of government action." He almost makes a direct request for my efforts:

What is needed ... is a usable body of knowledge about how different tools of government action work and how they can be adapted to different purposes. It is this body of knowledge that is the appropriate domain of implementation study. And it is this range of issues on which implementation research can finally cut its theoretical teeth.

The first theoretical tooth is a management framework, the Management System Model.
1.3 Preview of a New Model

I now introduce the Management System Model, the framework for this research (see Figure 1). Three components comprise the MSM: MIS/DSS tools, organizational structures and other management tools ("what is used to manage"), the physical operation being managed ("what is managed"), and the manager who uses information to make decisions that affect the physical operations ("who manages"). We must understand the importance, function, and interactive qualities of the MSM components to use the model effectively.

1.4 Importance of the Management System Model

Some may inquire, "Why another framework?" This point is best cleared early. The MSM is not so much a framework as it is an approach to management. The core of this approach is embodied in the MSM, which, along with the accompanying theories and methodologies operationalizes the notion that organizations exist as management systems. The nature of management systems can be understood by examining the three components and the interfaces among them. This model supplies a referent base for discussion of management and management tool issues; it allows us to put a structure on our domain of responsibility¹ (the essential components of our responsibilities) for better understanding of the system and also for better understanding of the management process itself. The MSM will facilitate the location of intervention targets for change efforts. Jenkins (1983, p. xi) expresses the need for solid theoretical underpinnings: "Theory building and testing are the fundamental foci for generating research questions and testable hypotheses." He says we need

¹ I use the terms "domain of responsibility," "domain," and "management system" interchangeably.
A SUCCESSFUL MANAGEMENT SYSTEM BALANCES THREE ESSENTIAL COMPONENTS.

Figure 1. The Management System Model: The three management system components link together through shared interfaces. (Source: Kurstedt et al., 1986a.)
programs of research based upon a framework that provides a useful structure and focuses on manageable subsets of the MIS discipline. I generalize his comments to apply to the management spectrum. The MSM provides a framework with which to study management systems.

1.5 Research Objectives

Management Systems Laboratories (MSL)\textsuperscript{2} finds the MSM useful for understanding management in federal government agencies and in industry. Most quantitative models have roots in a sound qualitative model. The progression to a quantitative model requires a solid conceptual foundation. Much of the current MIS research (and organizational research) is criticized for lack of a good theoretical research base. I am driving the MSM down to a level containing more certainty and structure. The immediate goal of this exercise is to develop, adapt, and choose instruments to characterize the components of the MSM. Specific results of these instruments to my chosen domain of responsibility are not particularly valuable outside the domain being studied. However, the process of application is generally important. The ultimate goal (post-research) is to identify a set of measuring instruments valuable for a manager or researcher to assess his or her domain. We can use information from these instruments to discover more about our domains. Outputs from these instruments should give us clues as to which portion of the MSM should be the target of intervention.

Succinctly stated, my research objectives are:

(Immediate)

\textsuperscript{2} MSL is a research arm of the Department of Industrial Engineering and Operations Research at Virginia Polytechnic Institute and State University.
• To arrive at a preliminary set of instruments to characterize domains of responsibility

• To define and describe management system balance in terms of measured characteristics

• To observe management system behavior, compare against a priori personal judgments, and to draw implications from these observations

(Ultimate)

• To give managers and researchers greater structure when analyzing their domains of responsibility

• To easier locate intervention targets for change efforts

1.6 My Contribution to the Industrial Engineer's Systems

Approach to Management

My research will give professionals a preliminary set of tools to analyze the components of their management systems. By developing, adapting, or choosing these tools for my purpose of improving and understanding management systems, professionals are closer to understanding management more as a science than as an art. There is a continuum between a model's conceptual being and its quantitative nature. The quantitative nature cannot come into being until the concepts are thoroughly understood. To thoroughly understand the MSM components, we must have ways to measure various aspects of those components.
Succinctly, my contribution is a step in the development of a structured approach to understanding management systems, so we can locate where effective interventions should take place, and describe systematic effects of changes to any of the three MSM components. This research is exploratory, examining why or why not a particular management system is balanced. I assume managers want to balance their management systems, which I claim is success. This MSM application to government agencies only gives a partial understanding of management systems. Later applications to other GOAs and private sector organizations should complement and complete the research.

1.7 Definitions

To facilitate discussion, I define several terms.

*What is met or accomplished (Source: Management Systems Laboratories, Virginia Tech)*

**Goal**
the end toward which effort is directed, especially for strategic level endeavors; goals specify general direction

**Objective**
the "object" of a pursuit, implying something more physical than a goal; objectives contain more of the tactical level details necessary for accomplishment of goals; objectives relate to tactical level endeavors

**Mission**
a specific task with which a person or a group is charged; missions relate to operational level endeavors

**Job**
a piece of work (the sum total of which constitutes a mission); jobs relate to clerical level endeavors
**Endeavors (Kurstedt et al., 1986a)**

**strategic**

of, relating to, or marked by a careful or planned method, tactics, or logistics; strategic usually refers to the highest level of management — the key decision makers

**tactical**

involving actions or means of less magnitude or at a shorter distance from a base of operations than those of strategy; Anthony: (management control) process by which managers assume resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives; Forrester: "moment-by-moment direction of the battle"

**operational**

relating to the performance of a practical work or of something involving the practical application of principles or processes; Anthony (1965): the process of assuming specific tasks are carried out effectively and efficiently

**clerical**

low judgment, given instructions get same result every time

**What is used (Source: Management Systems Laboratories, Virginia Tech)**

**pursuits**

defined in terms of perplexity, problem, program, project, and process; management activities as mapped against a scale of uncertainty

**tasks**

a usually assigned piece of work often to be finished within a certain time

**actions**

a thing accomplished usually over a period of time, in stages, or with the possibility of repetition
1.8 Chapter Summary

This research will place the Management System Model in context of existing frameworks. I then apply the model to several Department of Energy organizations to demonstrate how it may be used to describe management activities. Chapter 2 reviews the state of the art in management frameworks, and provides background for the MSM components and interfaces. This is accomplished through a review of the relevant literature. The scope of the research and methodology will be discussed in Chapter 3. In Chapter 4 I apply selected instruments to the domain of interest. Results of the application and conclusions are discussed in Chapter 5. Discussion of the research and suggested future research efforts are the focus of Chapter 6.
Chapter 2. Literature Review

2.1 Introduction

I partition the literature reviewed in this chapter into three sections: management frameworks, the three Management System Model components, and the three interfaces between those components. A search of selected journals (Management Science, Sloan Management Review, Data Base, and Harvard Business Review) from 1980 to mid-1985 revealed no frameworks relevant to this research.

I researched areas corresponding to the components and interfaces of the MSM. For the "who manages" component, literature on human characteristics, history, and cognitive style was reviewed. "What is used to manage" focuses on five groups of tools we use to manage. "What is managed" can be most anything (including activities and their levels a la Anthony), the general categories being resources, time, and performance. Research on the MSM interfaces is based on decisions and actions, the human factors aspects of information portrayal and perception, and the conversion of measurements to data.
2.2 Frameworks

A review of management frameworks follows, with emphasis on those of Simon, Anthony, and Kurstedt (Pursuits and Maturity). These four are the subjects of special interest because they frame distinctly different aspects of a domain of responsibility. Collectively, these four frameworks give a detailed view into a domain of responsibility. Upon concluding the discussion of the frameworks, I review literature pertaining to the MSM components and interfaces.

2.2.1 Framework # 1: Anthony

The framework proposed by Anthony (1965) has its roots in management accounting. It provides a scheme for classifying information on planning and control systems into three categories: strategic planning, management control, and operational control. Anthony provides definitions for these categories — they are given after the dictionary definitions above. Anthony points out strategy is not meant to be a response to a competitor's action or an anticipation of his probable action (p. 16).

I use the word "tactical" in place of "management control." Anthony himself stated management control is not a satisfactory term (Anthony, 1965, p. 28), but objects to the use of the word "tactics" (p. 56) arguing a military tactical maneuver has a definite beginning and end and a management control process refers to a continuing cycle. However, tactical maneuvers are a subset of tactics, the nature of which involves actions of a lesser magnitude than strategy, based on the dictionary definitions. Anthony's framework shall be considered to consist of strategic, tactical, and operational activity levels. Tactical maneuvers may have a definite beginning and end, but tactics are ongoing, as are management activities and thus Anthony should no longer have a problem with my interpretation of "tactical."
2.2.2 Framework #2: Simon

Simon's framework (1977)\(^3\) approaches management as primarily decision making activities and problem solving processes. He has three stages to problem solving: intelligence — the gathering of information that signals problem areas, design — the development of alternative solutions for the problem areas, and choice — the selection of the best solution generated in the design phase.

Simon (1977) said any problem consists of subproblems having their own intelligence, design, and choice phases. Cooper and Swanson (1979) expand this idea to claim the three phases are not necessarily sequential, but they can occur in any order and application is recursive as subproblems are encountered.

The framework of Herbert Simon (1977) places decisions into two polar types: programmed and nonprogrammed (see Figure 2 on page 14). Simon is quick to state a continuum exists for the two types of decisions and the categories are not discrete. Simon says (1977, p. 46) "decisions are programmed to the extent that they are repetitive and routine, to the extent a definite procedure has been worked out for handling them so they don't have to be treated de novo each time they occur."

Procedures arise for handling situations because of their frequency of occurrence; organizations develop day-to-day contingency plans in an effort to reduce nonprogrammed decisions to the level of programmed decisions. This shift reduces the resources required to deal with the situation and readies it for automation.

Simon explains (1977, p. 46) "decisions are nonprogrammed to the extent they are novel, unstructured and unusually consequential. There is no cut-and-dried method for handling the problem because it hasn't arisen before, or because its precise nature and structure are elusive or complex..."

---

SIMON SHOWS DIFFERENT TECHNIQUES FOR MAKING PROGRAMMED AND NONPROGRAMMED DECISIONS.

<table>
<thead>
<tr>
<th>Type of Decision</th>
<th>Traditional</th>
<th>Modern</th>
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<tbody>
<tr>
<td>Programmed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Routine, repetitive.</td>
<td>1. Habit.</td>
<td>1. Operations research:</td>
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<tr>
<td>Solvable by analytical procedures</td>
<td>2. Clerical routine:</td>
<td>a. Mathematical analysis;</td>
</tr>
<tr>
<td>Organization develops specific processes for handling them.</td>
<td>a. Standard operating procedures.</td>
<td>b. Models;</td>
</tr>
<tr>
<td></td>
<td>a. Common expectations;</td>
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<td></td>
<td>b. A system of subgoals;</td>
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<tr>
<td></td>
<td>c. Well-defined information</td>
<td></td>
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<tr>
<td></td>
<td>channels.</td>
<td></td>
</tr>
<tr>
<td>Nonprogrammed</td>
<td>1. Judgment, intuition, and</td>
<td>1. Heuristic problem-solving techniques for:</td>
</tr>
<tr>
<td>One-shot, ill-structured, novel, policy decisions.</td>
<td>creativity.</td>
<td>a. Training human decision makers;</td>
</tr>
<tr>
<td>Not solvable by analytical procedures.</td>
<td>2. Rules of thumb.</td>
<td>b. Constructing heuristic computer programs.</td>
</tr>
<tr>
<td>Handled by general problem-solving processes.</td>
<td>3. Selection and training of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>executives.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. Simon's framework: Management activities can be either programmed (structured) or nonprogrammed (unstructured). (Source: Simon 1977, p. 45.)
Programmed and nonprogrammed decisions are often referred to as structured and unstructured problems, which is how I will refer to the two types from now on. Unstructured problems require the use of a heuristic, a search activity, in order to narrow the realm of possible solutions. One of the goals of artificial intelligence is to accurately replicate this search activity. Artificial intelligence techniques tend toward the unstructured side of the continuum, as has been the direction of modern progress in computing expertise. Unstructured problems require the decision maker to use intuition, insight, and judgment (Simon, 1977, p. 64), while for structured problems the decision maker usually has procedures and routines.

Just as we hope to automate decisions at the unstructured side of the continuum, it is advantageous in terms of time, money, and frustration to try to put more structure on the problem. A new taxonomy will help to describe the range of "pursuits", and is the topic of the next section.

2.2.3 Framework #3: The Pursuits

The word pursuit is used to generically describe the nature of management activities as mapped onto a scale of uncertainty (see Figure 3 on page 16). There are five pursuits (Kurstedt et al., 1986b):

A *process* is a pursuit that routinely and repeatedly achieves the same known end through well-defined intermediate steps from start to finish. An example pursuit is a bottling plant for soft drinks.

A *project* is a pursuit for which you know the starting point and have full quantitative specifications for the end. Although it is the first of its kind (not a process) you have drawings and detailed specifications. An example pursuit is the first version of a plan or a prototype instrument for constructing a new production plant.
FIVE PURSUITS RANGE FROM UNCERTAIN TO CERTAIN.

UNCERTAINTY

PERPLEXITY — Can specify neither the start nor the end.

PROBLEM — Can specify the start but not the end.

PROGRAM — Know the start and have qualitative fix on the end.

PROJECT — Know the start and have specifications for the end.

PROCESS — Repeatedly achieve the same known end.

Figure 3. The Pursuits: The nature of a pursuit is characterized by its degree of uncertainty. (Source: Management Systems Laboratories, Virginia Tech.)
A *program* is a pursuit with a definite starting point but only a qualitative fix on the end. Example programs are research and development programs or pursuits where you evaluate alternatives, each of which provides a different solution to the given problem.

A *problem* is a pursuit with a definite starting point but a completely unspecifiable end. In emergency response you can define the beginning but you can’t define where the emergency might take you or what else it might impact.

At the highest level of uncertainty, a *perplexity* is a pursuit for which neither the start nor the end, and hence, nothing in between, can be specified. In emergency management you must be ready to manage whatever comes along without any (or much) forewarning.

Notice the last three pursuits have no specifications for the end. But we often apply techniques to pursuits assuming we know the end, and this is where trouble begins. Applying PERT and CPM to a perplexity will yield invalid results, since the assumption of a known end is not true. Thus, the pursuits framework is useful for diagnosing when techniques are appropriate.

If you can drive your pursuit down to one of greater certainty, it becomes more manageable and more analysis tools are likely to exist (Kurstedt et al., 1986b). Such is the goal of this research: to put more structure on the management process so more analysis tools are available to understand management. For the more certain pursuits, we can concentrate on productivity and efficiency, which Peter Drucker says is doing things right. For the more uncertain pursuits we must attend to performance or effectiveness, which Drucker says is doing the right things (Drucker, 1967, p. 2).

### 2.2.4 Framework #4: Maturity

The concept of maturity, in my context (see Figure 4 on page 18), embraces the stage at which an organization is operating. The manager matures with a successful management system by first
THE LEVELS OF INFORMATION SOPHISTICATION MATURE FROM VISIBILITY TO OPTIMIZATION.

Figure 4. The Maturity Spectrum: The levels of sophistication mature from visibility to optimization. (Source: Management Systems Laboratories, Virginia Tech.)
gaining visibility of the physical operation. Then he attempts to control his domain by reducing the amount of changes that occur and by holding operations constant. Optimization of the system’s operations is the next and final step.

Visibility is gained by effective presentation of key information based on complete, comprehensive, coordinated, accurate, and timely data. Key information varies throughout the life of an organization. Without effective visibility, management action is not completely informed.

Managerial control is the measurement and evaluation of operational performance for conformance to preset standards and expectations. Corrections are made for those areas where deviations are large enough to warrant intervention. We must have visibility of our present operations before we can have control of them.

Once we have achieved control of our operation, we should optimize it. Optimization is approached by varying plans and standards to improve performance. Our operation must be in control before we can optimize.

This is not the only occurrence of the maturity concept. Sink (1985) refers to measurement and evaluation, control, and improvement. Measurement and evaluation give visibility to one’s activities and help in finding the answer. Control is control. Improvement means advancing or making desirable progress, and if we optimize we indeed advance or make desirable progress.

### 2.2.5 The First Four

The frameworks of Anthony, Simon, and Kurstedt (Pursuits and Maturity) are presented collectively in Figure 5 on page 20. The connection between frameworks is loose and should not be depended on. For example, not all decisions in a perplexity are unstructured, but more there are
Figure 5. Four external frameworks: The frameworks of Anthony, Simon, the Pursuits, and Maturity help classify domains of responsibility. (Source: Kurstedt et al., 1986b.)
more unstructured decisions here than in a process. Activities at the strategic level generally surround visibility issues — those for which the answers can be found.

Tactical level activities usually encompass semi-structured problems and can be problematic, programmatic, or a project. This level tries to achieve control of the domain, to use existing conditions.

Operational levels deal mostly with structured problems, those for which there are standard operating procedures. Processes are usually the focus of operational levels, the same end repeatedly achieved. Since there is much structure at this level, we can optimize by making the best possible use of resources.

2.2.6 Framework #5: Gorry and Scott Morton

Gorry and Scott Morton (1971) bring together Anthony’s levels of managerial activities and Simon’s decision structure in their framework. See Figure 6 on page 22. “Anthony’s categorization is based on the purpose of the management activity, whereas Simon’s classification is based on the way in which the manager deals with the problems which confront him” (Gorry and Scott Morton, 1971).

The structure of the decision making phases — intelligence, design, and choice — defines the structure in this framework. Gorry and Scott Morton say a fully structured problem is one in which all three phases are programmed; semi-structured problems have only one or two phases programmed. Lucas et al. (1974) comment the Gorry and Scott Morton framework illuminates the goal of information systems for unstructured situations, that being the improvement of the organization and presentation of information outputs; the goal of information systems for structured situations is to improve information processing.
<table>
<thead>
<tr>
<th>Operational Control</th>
<th>Management Control</th>
<th>Strategic Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structured</td>
<td></td>
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<tr>
<td>Accounts receivable</td>
<td>Budget analysis</td>
<td>Tanker fleet mix</td>
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<tr>
<td>Order entry</td>
<td>Short-term forecasting</td>
<td>Warehouse location</td>
</tr>
<tr>
<td>Semi-structured</td>
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</tr>
<tr>
<td>Inventory control</td>
<td>Variance analysis</td>
<td>Mergers/acquisitions</td>
</tr>
<tr>
<td>Production scheduling</td>
<td></td>
<td>New product planning</td>
</tr>
<tr>
<td>Unstructured</td>
<td>Cash management</td>
<td>Sales and production</td>
</tr>
<tr>
<td></td>
<td>Pert/Cost systems</td>
<td>Personnel management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R&amp;D planning</td>
</tr>
</tbody>
</table>

Figure 6. The Gorry and Scott Morton framework: Simon’s decision types and Anthony’s activity levels are combined. (Source: Gorry and Scott Morton, 1971.)
We can generally realize the greatest potential benefit from unstructured situations. Designing for and understanding the decision process for unstructured problems is important, since technology is constantly progressing from operational, structured problems to strategic, unstructured problems (Simon, 1977).

2.2.7 Framework #6: Mason and Mitroff

Mason and Mitroff (1973) proposed a framework for information systems similar to the MSM, but theirs does not show components, interfaces, or relationships among them. Mason and Mitroff consider many of the same issues as does the MSM. Mason and Mitroff (1973) say an information system “consists of at least one person [‘who manages’] of a certain psychological type who faces a problem within some organizational context [‘what is managed’] for which he needs evidence [measurement-to-data interface] to arrive at a solution (i.e., to select some course of action) and that the evidence is made available to him through some mode of presentation [output of tools]” (emphasis theirs). This definition does not explicitly mention management tools. The authors present a taxonomy of states for each variable noted in their definition (see Figure 7 on page 24).

Psychological type draws from the works of Jung and more recently, from Isabel Briggs Myers, co-developer of the Myers-Briggs Type Indicator (MBTI) (Myers, 1980). Two modes of psychological functions provide four possible combinations of function pairs. Further discussion of the MBTI’s (and psychological types’) function in frameworks will be considered under the “who manages” component of the MSM.

Problem class uses Simon’s structured/unstructured classifications. Unstructured, or “wicked” problems are said to be those for which one or more of the actions, utility of the outcome, or “states of nature” (where you are and where you want to be) are unknown or not known with a high degree
Psychological Type
(a) Thinking—Sensation
(b) Thinking—Intuition
(c) Feeling—Sensation
(d) Feeling—Intuition

Class of Problems
(a) Structured
   (1) Decisions under certainty
   (2) Decisions under risk
   (3) Decisions under uncertainty
(b) Unstructural—"Wicked" Decision Problems

Method of Evidence Generation and Guarantor of Evidence—Inquiring Systems (IS)
(a) Lockean IS (Data Based)
(b) Leibnizian IS (Model Based)
(c) Kantian IS (Multiple Models)
(d) Hegelian IS (Deadly Enemy—Conflicting Models)
(e) Singerian-Churchmanian IS (Learning Systems)

Organizational Context or Organizational Class of Problem
(a) Strategic planning
(b) Management control
(c) Operational control

Modes of Presentation
(a) Personalistic
   (1) Drama—Role plays
   (2) Art—Graphics
   (3) One-to-One contact group interaction
(b) Impersonalistic
   (1) Company reports
   (2) Abstract models—computerized information systems

Figure 7. The Mason and Mitroff framework: Information portrayal, the MBTI, and Simon’s and Anthony’s frameworks are brought together. (Source: Mason and Mitroff, 1973.)

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24
of confidence. These "states of nature" are similar to the "pursuits" discussed earlier. Anthony's (1965) framework is used for organizational context (problem class).

Mason and Mitroff consider an item not found in many frameworks — mode of presentation. They introduce two types of presentation modes: personalistic (e.g., drama, art/graphics, one-to-one and group contact) and impersonalistic (company reports, abstract models, information systems). The linking of framework components together both through pictorial representation (graphics) and narrative is essential for full development of the contained ideas. If we take a systems approach, then we should consider all interactions. If we ignore the interactions, then we do not have an information system — we have information fragments.

2.2.8 Framework #7: Leavitt

Leavitt's framework (1965) considers four components of an organization: task, structure, technology, and people. Leavitt's use of the word "task" is not general enough to apply to actual organizational functions; often, we cannot specify the completion time of an organization's work, which is required for a "task." The "Pursuits" framework acknowledges the existence of more uncertain activities.

Leavitt considers structure and technology separately, although they are both management tools. If we group Leavitt's structure and technology, we would have a rudimentary version of the MSM. Distinct differences would be: (1) the MSM allows only one person to manage a given domain, Leavitt considers all involved people in one component; (2) Leavitt's task is too specific for managerial endeavors; and (3) structure and technology can be augmented by several other management tools, see Figure 13 on page 46.
Figure 8. Leavitt's framework: Task, structure, technology, and people make up this framework. (Source: Leavitt, 1965, p. 1145.)
2.2.9 Framework #8: Forrester

Forrester presents his framework in *Industrial Dynamics* (Forrester, 1961). His framework is rooted in information-feedback control theory. He claims the role of information is at the central core of the feedback system. The decision making process is viewed as a response to the gap between the organization's objectives and its progress toward those objectives (Lucas et al., 1974).

The role of information in Forrester's framework is in the feedback system's central core. His model treats the behavior of the firm as a whole and focuses entirely on the management decision process.

An information feedback system exists "whenever the environment leads to a decision that results in action which affects the environment and thereby influences future decisions" (Forrester, 1961, p. 14). The automobile driver is an example of such a system. When the speed limit on a road changes from 35 mph to 55 mph the driver reacts by accelerating; when the desired speed is reached, the driver ceases acceleration and assumes a somewhat steady state.

2.2.10 Framework #9: Blumenthal

The framework of Sherman Blumenthal (1969) consists of decision centers, activity centers, and management control centers (see Figure 10 on page 29). Singhal (1986) has unraveled Blumenthal's definition of management information systems as the means for capturing data about "what is managed" and generating information which is used in domains of responsibility throughout the organization for making decisions that lead to actions.

The underpinnings of this framework come from Forrester's information-decision-action model of management systems, from Simon's programmed and nonprogrammed decisions, and from Anthony's characterization of management planning and control levels as strategic, management
MANAGEMENT PROCESSES CONVERT INFORMATION INTO ACTION THROUGH DECISION-MAKING.

Figure 9. Forrester’s feedback loop framework: Managers use information to make decisions to control actions, generating new information in the process. (Source: Forrester, 1961, p. 94.)
THE BLUMENTHAL FRAMEWORK SHOWS THE LINKS BETWEEN ORGANIZATIONAL SUBSYSTEMS.

Figure 10. The Blumenthal framework: Activity centers, management control centers, and decision centers guide the management process. (Source: Blumenthal, 1969, p. 34.)

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control, and operational. "These concepts complement each other so naturally that this synthesis of them into a single, consistent view of enterprise is no great or original feat" (Blumenthal, 1969, p. 24).

2.2.11 Summary Discussion

These frameworks represent the most relevant work pertaining to the historical context of the Management System Model development. Although I have noticed some similarities between these frameworks and the MSM, I did not find a framework that covers all the aspects the MSM does. Bariff and Ginzberg (1982) have identified five criteria useful frameworks should meet. These criteria are: completeness, consistency, mutual exclusivity of framework categories, conciseness, and impact on research behavior. Some frameworks that cover most of the MSM's aspects do meet the completeness criterion, but invariably such frameworks do not meet the conciseness criterion. The MSM, as a model, is concise and can be represented pictorially and is therefore easy to remember. Easily remembered frameworks are more apt to be used, and for this reason I believe the MSM is a useful framework for understanding and improving management systems.

2.3 A Look at "Who Manages"

"Who manages" is anyone who uses information to make decisions that result in actions affecting "what is managed." This is adapted from Drucker's definition of the executive (Drucker, 1967; Kurstedt et al., 1986). "Who manages", as the human component of the Management System Model, is composed of a variety of dimensions and characteristics which I can categorize and attempt to measure. The definition of what is to be measured must precede its actual measurement; the formulation of a definition necessitates an understanding (Sink, 1985, p. 87). The "who man-
ages" component can be described by three terms: history, cognitive style, and human characteristics. I conducted research using the Wall Street Journal's "Job Mart." Details of this research are in "Appendix A. Research Methods for "Who Manages"" on page 169.

In management systems, "who manages" perceives information and makes decisions based on those perceptions. How he or she perceives information and makes decisions are then integral to our understanding of this component. Successful development and implementation of information systems should consider the psychological disposition of the user (Bariff and Lusk, 1977; Lusk and Kersnick, 1979). Huber (1983) disputes the use of cognitive styles as a basis for MIS and DSS design. He claims operational guidelines cannot be derived from the current literature, and further cognitive style research is unlikely to provide the body of knowledge to produce such guidelines. Cognitive styles may not necessarily be useful as a basis for MIS and DSS design, but how the decision maker perceives and uses information should be considered in management tool design. A battery of tests, theories, ideas, models, hypotheses, and myths about human perception and decision making exist. My task is to shake out the useful items and to use them.

2.3.1 History

The history of "who manages" lies in those events or experiences that have already occurred and that we could expect to have an impact upon the manager. Experience, education, and recognition constitute the manager's history.

Experience

Experience is knowledge, skill, or practice derived from direct observation of or participation in events, according to the dictionary. My research produced three types of experience companies are willing to pay for in their management recruits. Hands-on experience was sought by those organ-
izations wanting a person with a fuller understanding of the business operations. Supervisory experience was sought for positions for which the management of human resources is a perceived important part of the job. Companies that conduct business in the world market place look for people with multi-national experience.

Several studies have attempted to verify a link between experience and performance. Taylor (1975) investigated the effects of age and experience on information processing performance and found the more years of management experience one has leads to: (1) greater accuracy in judging information value, (2) quicker decisions, and (3) decreased chance the decision will be changed as a result of adverse consequences. Despite this last conclusion, Taylor found greater amounts of management experience lead to decreased confidence of those decisions by the decision makers.

Experience can sometimes be a detriment to performance. Fozard and Carr (1972) cite a training program where air traffic controllers with extensive military experience had a failure rate three times their less-experienced younger counterparts. Not surprisingly, Taylor (1975) found age to be highly and significantly correlated with experience (0.69). Dulewicz and Fletcher (1982) also found a statistically significant correlation between age and experience. These studies discuss the effect of age on performance; the results will be discussed under "Human Characteristics."

**Education**

Education, while not as direct an indication of performance as experience, does bear implications for "who manages." Education is a function of which degrees have been earned, in what field the degrees were taken, at which school the degrees were earned, and of level of performance while in school (i.e., grades, class rank). Field of study, when combined with experience, leads to technical expertise, hence I include it in this category.

Few studies discuss the effect of education attainment on decision making. Perhaps its interdependent nature with other variables causes researchers to select those variables more easily attri-
buted to performance changes. Age and intelligence are correlated significantly (Dulewicz and Fletcher, 1982). The same study finds a significant correlation (0.31) of education with managerial performance. Dulewicz and Fletcher showed intelligence was linked to performance.

Recognition

This third part of history, recognition, provides measures for education and experience. My definition of recognition is limited to formal and universal recognition devices. A “proven, successful track record” provides an indication of use of education and gain of experience. Professional certifications, such as Professional Engineer, CPA, etc., recognize a prescribed level of professional competence. Although frequently requested in recruiting ads, the academic research to date has not addressed the implications of recognition (as I consider it here) on performance.

2.3.2 Cognitive Styles

Cognitive styles are relatively fixed patterns learned by decision makers for experiencing the world (Benbasat and Taylor, 1978). Witkin (1972, in Benbasat and Taylor, 1978) has done extensive research on cognitive styles and defines them as “characteristic modes of functioning we show throughout our perceptive and intellectual activities in a highly consistent and pervasive way.” The particular style adopted has implications for how the manager perceives the world, specifically, how he or she perceives information presented on which decisions are to be made.

Cognitive Style Dimensions

The literature mentions many cognitive style dimensions. I review cognitive complexity, field dependence-independence, analytical-heuristic ways of reasoning, left/right brain processes, and two of the Jungian archetypes used in the development of the Myers-Briggs Type Indicator (MBTI):
perception in terms of intuition and sensing, and judging in terms of thinking and feeling. A description of each dimension follows, with relevant measures being noted. I believe this discussion will illustrate the importance of considering cognitive style in management systems.

**Cognitive complexity** entails three processes (Benbasat and Taylor, 1978). First there is differentiation, or the number of dimensions extracted from the data. Second, the articulation, or fineness of discrimination is involved. Lastly, cognitive complexity includes integration, the complexity of the rules used to combine data. The Sentence Completion Test is a common measure of this cognitive dimension.

Decision Style Theory (Driver and Mock, 1975) puts cognitive complexity to work in its “minimal” and “maximal” users. A minimal user is one who “satisfices” in decision making; just enough information is gathered to make the decision. The maximal user seeks out all available information before making a decision.

**Field-dependence/field-independence** was first formally identified by Witkin (1978). Field-independence is the tendency to rely primarily on internal referents in a self-consistent way; field-dependence is the tendency to give greater credit to external referents (Witkin, 1978, p. 16). These dimensions define a continuum of dependence and are not two distinct types of people. Field-dependent types are more likely to use other people’s opinions when making decisions. Field-independent types are less likely to use information provided by others or may even disregard it (Witkin, 1978, p. 19). The Embedded Figures Test (EFT) is the most frequently used measure of this dimension. In the EFT, the subject is asked to perceive a simple figure within a larger complex figure.

**Analytic/heuristic** ways of reasoning are discussed by Huysmans (1970). The analytical person reduces problems to a core set of underlying causal relationships which often lead to the development of a quantifiable model. Heuristic persons emphasize workable solutions to total problem situations. The search is for analogies with previously solved problems, rather than for a set of causal

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relationships. Common sense, intuition, and unquantified feelings about the future come into play and are applied to the whole rather than built up from parts (Huysmans, 1970). Huysmans used mathematical puzzles, coin and pitcher tests, and decision making problems to test the ways of reasoning.

Left and right brain processes provide a base on which to discuss skills of analysis and those of synthesis. The concept of left and right brain processes occurs in the literature in a variety of guises: analytic/heuristic, structured/unstructured, planning/managing, and all refer to the same basic processes. The left hemisphere of the brain is the analytical side, preferring to compute, account, process speech, generally operating linearly in a sequential, bit-by-bit fashion. The right side operates in a more holistic manner, being better suited for ambiguities and complexities.

The claim that “effective managers seem to revel in ambiguity; in complex, mysterious systems with relatively little order” (Mintzberg, 1976) suggests the use of relational and holistic processes. I can conclude managers prefer right-brained processes. Robey and Taggart (1981) concur with this conclusion. Their research into information processing styles led to an indirect measurement of left/right brain activity. This was accomplished through an electroencephalogram (EEG) where brain waves are monitored for a gross indication of where information processing is occurring. Doktor and Bloom (1972) observed executives use more right-brain processing on both analytical and intuitive tasks than the other experimental group consisting of operations researchers.

The holistic viewpoint of managers is the basis for “Management Myth-Information Systems” (Mitroff, Nelson, and Mason, 1974). An MMIS presents information in anecdotal, mythic form, such that a story is woven around the relevant facts. A story contains a logical flow of events, which those with right-brain preference will comprehend and remember more easily. Mitroff et al. (1974) use MMIS to define information in terms of data tied to a story relevant to the user.

The MBTI (Myers, 1980) is based on two Jungian archetypes: perception and judging. The two ways we can perceive is through our senses and by intuition. This archetype affects the
information-perception side of the MSM's information-perception-to-information-portrayal interface. Judging can be either thinking or feeling our way to conclusions. Thinking is a logical process, based on impersonal findings, while feeling gives things subjective value, and has an appreciation for what is being considered. This archetype affects the decision side of the MSM's decision-to-action interface.

Validity of the MBTI is higher than most tests of its type (Keen and Bronsema, 1981). Various empirical studies relate behaviors and managerial characteristics to dimensions of the MBTI. The power of the MBTI in assessing personality types as well as its validity and consistency with other measures provides an explanation for its popularity in management research today.

Henderson and Nutt (1980) found sensation-thinkers (ST) saw the greatest risk in decision making and were reluctant to adopt proposals. Sensation-feeling types were more risk tolerant and more likely to adopt the same proposals. The power of the MBTI in assessing personality types as well as its validity and consistency with other measures provides an explanation for its popularity. The idea of high analytic and low analytic is used by Lusk and Kersnick (1979) and corresponds to analytic and heuristic, respectively, as discussed above. Zmud (1979a) associates field-dependence with low analytic and field-independence with high analytic. Therefore, the cognitive style dimensions above are not mutually exclusive.

McKenney and Keen's model of cognitive style has two axes: information gathering and information evaluating (see Figure 11 on page 37). These correspond to the MBTI's sensing and judging dimensions. Information gathering refers to how the verbal and visual stimuli are organized by the mind. Information is the result of coding based on mental set, memory capacity, and strategies that tend to ease cognitive strain (McKenney and Keen, 1974). McKenney and Keen's preceptive thinker holds concepts to filter data and focus on relationships between items and to look for deviations and/or conformities with their expectations. Receptive individuals, however, are sensitive to the stimulus itself. Their focus is on detail rather than on relationships. Attributes of informa-
## INFORMATION EVALUATING

<table>
<thead>
<tr>
<th>PRECEPTIVE</th>
<th>SYSTEMATIC</th>
<th>INTUITIVE</th>
</tr>
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<tbody>
<tr>
<td>Production &amp; Logistics Manager Statistician Financial Analyst</td>
<td>Marketing Manager Psychologist Historian</td>
<td></td>
</tr>
<tr>
<td>RECEPTIVE</td>
<td>Auditor Clinical Diagnostician</td>
<td>Architect Bond Salesman</td>
</tr>
</tbody>
</table>

Figure 11. McKenney and Keen's cognitive style framework: Cognitive style theory suggests compatible tasks and roles. (Source: McKenney and Keen, 1974.)

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tion are derived by direct examination instead of fitting it to a set of precepts. Receptive and preceptive thinking processes constitute the extremes of the information gathering axis.

McKenney and Keen's information evaluation means the same thing as problem solving. Systematic and intuitive thinking make up the information evaluation axis. A relationship was also found between systematic and MBTI "thinking" types, and also between McKenney and Keen's (1974) "intuitive" and the MBTI "feeling" (F) individual. Mason and Mitroff (1973) agree with this relationship noting "thinking" individuals think in terms of abstract true/false judgments and they have formal systems of reasoning; feeling types were found to rely on affective processes, e.g., like/dislike, good/bad, pleasant/unpleasant. Zmud (1979a) provides an extensive review of the literature on these individual differences concerning MIS design.

**Combining the Dimensions**

Several of the discussed dimensions suggest interrelationships and tempt me to combine these separate schools of thought into an integral framework. However, Zmud (1978) found attempts to combine such frameworks have not been successful. Henderson and Nutt (1980) advise the researcher to choose one tool for decision style research. Hence, I will not combine the cognitive style dimensions.

**2.3.3 Human Characteristics**

Human characteristics are traits and qualities of humans and I divide them into two categories: personal and interpersonal. Personal qualities are those which do not involve interaction with others. On the other hand, interpersonal qualities do involve interaction with others and I call them "human relations skills."
Personal Qualities

My research ("Appendix A. Research Methods for "Who Manages"" on page 169) was rich in adjectives for this category. Ads for managerial positions included only the subjective of these personal qualities; objective, demographic data were not found in the ads. Researchers, especially in psychology, have tested performance as a function of several demographics, notably age, sex, and socioeconomic status. Subjective qualities are those defying rigid classification, such as risk-taking propensity, dogmatism, maturity, innovation, leadership, resourcefulness, and more.

Earlier, I cited two studies significantly correlating age with experience. Fozard and Carr (1972) say the experience of the older worker makes his training needs more specific than those of younger ones, implying a link between age and experience.

Decision makers use information differently and these differences can be partially explained by their ages. Taylor (1975) found older decision makers do not necessarily process information more slowly than their younger colleagues. The same study showed age to have a greater influence on performance than prior decision making experience. Taylor also discovered an increase in age was associated with (1) a tendency to seek more information, (2) to take longer to make a decision, and (3) to diagnose more accurately the value of information.

However, age apparently has the effect of reducing the ability to integrate the large information base into a basis for effective decisions. Baugher (1978) supports several of Taylor's conclusions, finding age-related declines in performance are slight, except in physically demanding jobs. Correspondingly, age-related losses of intellectual ability are minimal and not found to affect job performance. Arenberg (1974) found reasoning abilities do not significantly decrease until subjects are 70 years of age or older. Dulewicz and Fletcher (1982) show a negative correlation of age with performance, as measured in an assessment center. As the manager's age increases and experience widens, we can expect the person to exhibit more mature critical thinking processes (Adisesiah, 1977).
Interpersonal Qualities

Interpersonal qualities describe how the manager relates to others around him or her. I classify these qualities into three distinct categories: communication skills, skills of manipulation, and social characteristics.

Communication skills include both oral and written proficiency, as well as presentation skills. Presentations require more specific communication skills, notably the ability to communicate complex information clearly and the ability to communicate concisely. Foreign language fluency is certainly a communication skill and is valued by multi-national companies in particular. The ability to interface with upper and lower levels of management is placed in this category since its success rests largely with the quality of communication skills.

Skills of manipulation include such things as persuasion, negotiation, and diplomacy. While incorporating communication skills, manipulation is more. It requires a more critical reading and understanding of the audience.

Social skills is the third type of interpersonal skill. Being a "team player" is important for some managers to be successful. Appearance and personality project images from which others form impressions. Possessing desirable personality traits and good appearance pave the way for the success of communication and manipulation skills.

The empirical literature cites several studies where subjective human characteristics have been observed for their effect on performance. Close and Bergmann (1979) administered the Rokeach Dogmatism Scale to 445 managers to assess differences due to educational level. Their results suggest those at higher educational levels are less dogmatic. Taylor and Dunnette (1974) studied the effects of dogmatism and risk-taking on decision making strategies of a group of industrial managers. By definition, dogmatic decision makers are marked by strong, positive assertion of opinion. By observation, dogmatic decision makers make rapid decisions with limited information.
and hold tightly to the resulting decisions (Long and Ziller, 1965). Tests were conducted using the Personnel Decision Simulation, developed by Taylor (1975). Dogmatic decision makers required less time to make a decision, were more confident in their decisions, and made more accurate decisions (Taylor and Dunnette, 1974). The same studies showed risk-takers use less information, take less time to make decisions, but process information at a slower rate. Although risk-takers use less information the study suggests they pore over this information slowly.

2.4 Examining "What is Managed"

I divide "what is managed" into three categories: resources, time, and performance. A printing shop encountered by one of my colleagues on a business trip had a sign proclaiming "Price, Speed, Quality. Pick Two." In other words, we can't always get what we want. There are sacrifices to be made, and our resources, time, and performance compete against each other. These categories are interdependent. The competition between the categories of "what is managed" is best likened to a three-way tug-of-war. For example, if we want better performance, we need to be willing to commit more resources or more time.

2.4.1 Resources

I subcategorize resources as people (labor), machines, materials, money, energy, and information. We can apply traditional industrial engineering techniques to all these subcategories. We use finance and engineering economic analysis to solve money problems and plan capital investments. We manage energy with engineering techniques that maximize efficiency. We manage information with data flow diagrams, communication theory, and other tools of computer and information science.
The nature of management activities in GOAs is markedly different than those of industrial organizations. Most notably, these government managers manage information rather than the physical things themselves. Correspondingly, their tools reflect an information processing orientation.

2.4.2 Time

The concept of time requires we know which of its three segments we are examining. We react to the past; we act on the present; and we are proactive about the future. When we look into the future the mind’s creativity and planning skills are best utilized. This is where we are proactive.

For future activities, we have the luxury of having time to plan. This is the time frame which often gets slighted because of the problems of the present. However, by effective planning, we can avoid or reduce some of the problems we will face when the future becomes the present.

Time can also be classified as discretionary and nondiscretionary. At operational levels, the managers’ time is mostly nondiscretionary, while at strategic levels, managers’ time is mostly discretionary. The goal in a good management system is not only to increase the amount of discretionary time managers have, but to ensure the discretionary time is used productively (Drucker, 1967).

2.4.3 Performance

First, we must resolve we do indeed manage performance. I claim we manage performance by manipulating those variables significantly correlated to performance. If we can favorably influence performance through our control of these variables, then we are managing performance.
EFFECTIVENESS = Doing the "right" things on time.
EFFICIENCY = Using the "right" amount of resources to produce the "right" things.
QUALITY = Conformance to specifications; fitness for use.
PRODUCTIVITY = Ratio of outputs to inputs.
QUALITY OF WORK LIFE = How people feel about working in and living in the organization.
INNOVATION = Introduction of new or better products and processes.
PROFITABILITY AND BUDGETABILITY = The relationship between revenues and costs or between budgets/standards and actual costs.

Figure 12. Seven performance criteria: Performance is a function of seven criteria. Source: Sink, 1983.
For this discussion, I will draw upon Sink (1983). I have shown the work of several other experts in the area of performance measurements to collapse into Sink's seven performance criteria (Mallak, 1985). These criteria and their definitions are presented in Figure 12 on page 43.

The seven criteria operationalize the concept of performance, but to develop measures we need subcriteria. For example, if we wish to measure innovation, we might measure how many new products are introduced in a year. One technique for using a set of criteria to assess our domain of responsibility is first to prioritize the criteria we are using. Next, for each criterion, develop operational subcriteria that will be good indicators of what we are attempting to measure. These measures can be evaluated against historical standards, industry standards, or expectations of what should be happening.

Once we know what we manage, we can look in the right places for the proper management tools. When we use the right tool to help us manage our operations, we are working at balancing our management system. In summary, the division of "what is managed" into resources, time, and performance is a start. I could classify time as a resource and say we really only have two major divisions of what we manage. The difference: time is intangible and our resources (as defined) are tangible. Therefore, I maintain my division of "what is managed" and realize further research may refine this division.

2.5 What is Used to Manage

2.5.1 Introduction

We use many different tools to manage. Take the game of golf, for example. A simple golf score card is an information system, since it presents information in a systematic manner. We could keep
score in our heads, but we don’t, because it would distract us from concentrating on our swing. We don’t computerize this scoring process because carrying a computer around a golf course is a waste of effort. A management information system presents information in a systematic manner so managers can make better decisions or the same decisions in less time (De Greene, 1981, p. 64).

The "what is used to manage” component is where the management tools are housed. I have identified five groups of management tools, and they are shown in Figure 13 on page 46. Notice computers do not show up in a category, since I consider them operational tools and not management tools themselves.

Management tools must be distinguished from operational tools. For now I consider management tools to be those that can be contained in your head, even though a device such as a filing cabinet or a computer may actually be housing the tools because of cognitive crowding. Operational tools, such as hammers, pens, and rulers, cannot be kept in your head, because they are physical things (Kurstedt et al., 1986b).

2.5.2 The Five Groups of Management Tools (Kurstedt et al., 1986b)

Relationships and Structures

The organizational structure is a tool used to manage. We do not manage an organizational structure. Management tools tie together “what is managed” to “who manages” within a domain and between domains. Relationships provide for stability in a domain mostly through structure because, to be successful, all tools, people, materials, and facilities together must be greater than the sum of the parts.
DECISION SUPPORT TOOLS, THROUGH THEIR INTERRELATEDNESS, CONSTITUTE A DSS.

- Relationships and Structures — organizational, work breakdown, formulation and execution (B & R), communication, and coordination
- Methods — expert systems, quantitative models, heuristics, paperwork, and participative management
- Guides and Rules — policies, plans, procedures, and instructions; and directives, constraints, specifications, conditions, and laws
- Precedence — history and culture
- Data-to-Information Chain — MIS (EDP, IS, etc.)

Figure 13. Five groups of management tools: Management tools are a lot more than MIS. (Source: Kurstedt et al., 1986b.)
Methods

Methods help us manage. Quantitative models, expert systems, heuristics, and rules of thumb lead to solutions, provided all assumptions are reasonably met. We may question the solution and test it for known situations to examine deviations, and then may have a clearer notion of solution validity for the problem of interest.

Precedence

How an organization has acted in the past sets precedents for future actions. Although basing present actions on past ones is not always a good idea, it is generally a safe idea. Organizations that are not risk-takers will likely let precedence play a large role in managing. On the other hand, company culture leads to a cohesive management team that works together and thinks along similar lines. A good culture nurtures managers who can function independently, but their actions and decisions fit into the company mold and produce results better than those organizations with little or no culture.

Data-to-Information Chain

The data-to-information chain operates routinely to acquire, store, retrieve, and manipulate data to generate and portray information. The other groups of tools involve data and information; but by focusing on the word "chain," the data-to-information chain links our routine, repeated steps. This is the group where MIS and EDP are located.

When analyzing "what is used to manage," we can use the data-to-information chain to get an alternate view of the MSM. The chain is shown in Figure 14 on page 48. The links in the chain represent the process by which data is transformed from its raw state, as received from the operation, to its representation as information to an intelligent decision maker.
THE DATA-INFORMATION CHAIN BIASES DATA TO PROVIDE INFORMATION.

Figure 14. The data-to-information chain has several vital links: (Source: Kurstedt et al., 1986b.)
The links of the data-to-information chain correspond to retrieval, manipulation, information generation, information portrayal, and management intelligence. The illusory link between the information media and decision made is “who manages.” Each of the other links in the chain represent technical specialties, and the manager must coordinate these specialists so the chain is connected and working smoothly.

EDP and MIS can be defined and related to each other using the data-to-information chain since the purpose of a majority of those systems is to convert data to information.

Electronic data processing (EDP) deals only with data — access, storage, retrieval, and manipulation — functions characteristic of clerical- and operational-level endeavors. Before the advent of computers into data processing, errors and tedium limited the amount of data that could be processed. Now, with computers, more data can and is being processed, but we need to step back and analyze our needs lest we suffer the demise of information overload. As Ackoff (1967) said, what we need is not more relevant information, but less irrelevant information. Since I consider text to be data, word processors are one example of computer-based EDP devices.

An understanding of the definition of EDP is important when discussing information systems, because many of the systems that purport to be MIS or DSS are actually EDP’s with the wrong name attached. MIS and DSS should be systems that provide management with relevant information and support management decision.

Many management information systems (MIS) have failed, that is they have not supplied meaningful information to managers so better decisions can be made. Instead, MIS has become a prefix to managerial activities: MISguiding, MISdirecting, and MISinforming the decision maker.

MIS is the entire data-to-information chain and includes information portrayal as well as EDP functions (Kurstedt et al., 1986b). As discovered in my research on management frameworks, information system frameworks rarely included presentation of information. MIS, as mapped on the
DECISION SUPPORT JARGON IS PLACED ON THE MANAGEMENT SYSTEM MODEL.

Figure 15. MIS, DSS, and MSS are defined based on the Management System Model. (Source: Kurstedt et al., 1986b.)
MSM (in Figure 15 on page 50) includes "what is used to manage" from the measurement-to-data interface to the information portrayal-to-information perception interface. Other definitions (Murdick, 1980; Mason and Mitroff, 1973) include information portrayal but in practice the interface with "who manages" has not been properly developed in MIS activities.

Decision support systems (DSS) evolved from Scott Morton's "management decision systems" (1971). DSS was to support semi-structured and unstructured decisions in the Gorry and Scott Morton framework presented earlier.

DSS is defined in terms of the MSM as including all of the tools of the "what is used to manage" component and both the measurement-to-data and the information-portrayal-to-information-perception interfaces. A DSS addresses the interrelatedness of the tools and synergy results from the tools working well together.

Management support systems (MSS) is a term used by Katzan (1984) to describe a concept that nearly corresponds to my DSS. He defines MSS as "a computer-based information system that supports executive, management, and administrative activity through informational and computational resources" (Katzan, 1984, p. 2). My definition of MSS is a system that combines the "who manages" and "what is used to manage" components of the MSM, thereby including everything from the measurement-to-data interface to the decision-to-action interface.

The function of MSS is to support "what is managed," while a DSS supports "who manages." Since an MSS contains "who manages," it is not easily automated. An MSS does not replace "who manages," for until we can automate human thought processes to the extent needed (if ever) we will have to consider the cognitive style, history, and human characteristics of "who manages" in MSS.
Guides and Rules

Guides and rules help to control one's domain. Guides provide guidance for formulation efforts. Rules provide guidance for execution efforts. Organized by level of endeavor, appropriate guides and rules are prescribed to achieve the desired end. See Figure 16 on page 53. At the highest level, strategic, we accomplish goals and use policies for guidance. The pursuits describe the type of effort (see Figure 3 on page 16). We can evaluate our formulation tool, in this case policies, by the relationship to plans.

Note managerial level and endeavor level are not on a one-to-one correspondence. Strategic-level managers do engage in tactical-, operational-, and clerical-level endeavors as well as those at the strategic-level.

2.6 Information-Portrayal-to-Information-Perception

The portrayal of information — whether in tabular, graphic, checklist, or narrative format — influences how information is perceived by "who manages" and hence it affects the decisions made. (Mason and Mitroff, 1973; Kurstedt et al., 1986a). Operating from the premise information is merely data that bears a bias (i.e., through the chosen presentation format and/or caption), the level of bias can be adjusted to suit "who manages." Thus I distinguish between information and data, which are often used to refer to the same things. Blumenthal (1969, p. 30) defines data as "an uninterpreted raw statement of fact" and information as "data recorded, classified, organized, related or interpreted within context to convey measuring." This interpretation within context is bias and makes information less pure and more useful and powerful than data.
<table>
<thead>
<tr>
<th>Level of Endeavor</th>
<th>What Is Met or Accomplished</th>
<th>Type of Effort</th>
<th>Formulation Tool or Guidance</th>
<th>Evaluation of Formulation Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>Goals</td>
<td>Pursuits</td>
<td>Policies</td>
<td>Relationships of Plans</td>
</tr>
<tr>
<td>Tactical</td>
<td>Objectives</td>
<td>Activities</td>
<td>Plans</td>
<td>Framework for Procedures</td>
</tr>
<tr>
<td>Operational</td>
<td>Missions</td>
<td>Tasks</td>
<td>Procedures</td>
<td>Value of Instructions</td>
</tr>
<tr>
<td>Clerical</td>
<td>Jobs</td>
<td>Actions</td>
<td>Instructions</td>
<td>Yes-No on Steps</td>
</tr>
</tbody>
</table>

Figure 16. The right formulation tool supports effective execution: (Source: Kurstedt et al., 1986b.)
Some managers prefer tables, some graphics, some checklists, and others prefer narrative. This preference must be balanced against the inherent bias present in forms of information portrayal. Four forms of portrayal increase in bias from table, graphic, checklist, to narrative (Kurstedt et al., 1986c). Thus at this interface we achieve balance between “who manages” and “what is used to manage” by matching the characteristics of “who manages” to the portrayal formats afforded by the management tools. An adaptable information system adjusts itself for the particulars of the user. We cannot evaluate the utility of the information type separately from the users of that information (Dermer, 1973).

Although I discussed cognitive styles under “who manages,” I will need to consider it again in this section for the effect on how information is perceived. Literature cited in this section will be more empirical, drawing implications from specific tests.

2.6.1 Studies of Information-Portrayal-to-Information-Perception

The effect of information portrayal in terms of decision frames was studied by Tversky and Kahneman (1981). A decision frame refers to “the decision maker’s conception of the acts, outcomes, and contingencies associated with a particular choice.” Hence, the decision frame is a function of the decision maker’s characteristics and of how the problem is formulated.

Tversky and Kahneman (1981) found how a problem is formulated affects “the decision maker’s conception of the acts, outcomes, and contingencies associated with a particular choice. . . . A difference between options will loom larger when it is framed as a disadvantage of one option rather than as an advantage of the other option.” A good example of what they call “decision frames” in our everyday lives is at your local gas station. When buying gasoline, you may pay a higher price per gallon if you use your credit card. This is a surcharge. However, the gas station across the street may sell gasoline at the exact same cash price, but advertise a “cash discount.” You end up paying the same price at either station, but your decision on where you buy gasoline is influenced by the
stations' pricing strategies, which I generalize as the problem formulation being presented for decision. Another example occurs in economic analysis. The choice between several projects is apt to be affected by ones shown to reduce costs versus ones shown to increase profits.

A common problem in information portrayal is too much information portrayed. Miller (1956) in his classic work proclaimed a human’s short-term memory can hold $7 \pm 2$ "chunks" of information. Irrelevant information distracts the decision maker and shifts attention from key variables (Lucas and Neilsen, 1980). Schroder, Driver, and Streufert (1967) established a specific level of information input exists for information processing to be optimal.

Gaylin and Casali (1985) studied four types of graphs (line, point-plot, bar, and three-dimensional bar) and two types of coding (color, black-and-white) under two levels of task complexity. They found color coding to significantly improve performance, adding credence to the personal computer firms' claims that color graphics are more effective decision aids for managers. A secondary finding was three-dimensional bar charts proved inferior to the other three forms, particularly in terms of task speed.

Lucas and Neilsen (1980) studied the effects of the mode of information presentation. Besides finding more information is not necessarily better, they found only marginal support for the hypothesis that graphical presentation results in greater learning and performance. Another study by Lucas (1981) found limited support for the use of graphics for information presentation, but did conclude heuristic persons (field-dependent, low analytic) performed better when they could see a picture of the data (i.e., by using graphics). Dickson, Senn, and Chervany (1977) suggest the use of graphics may lead to better decision making.

One of the Minnesota experimental studies⁴ (Chervany and Dickson, 1974) reports on information aggregation versus raw data presentation. Chervany and Dickson concluded decision makers sup-

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⁴ These studies were conducted to "examine the significance of various information system characteristics on decision activity." The experiments were performed by the University of Minnesota.
plied with aggregated data (1) made better decisions, (2) were less confident in their decisions, and
(3) took longer to make those decisions, when compared to those using raw data. The reader will
note these conclusions are similar to those reached by Taylor when testing the performance of older
decision makers (see "Personal Qualities" on page 39).

DeSanctis' (1984) comprehensive review of information portrayal formats concluded choice of re-
port format depends on the individual and this choice is situation-dependent. DeSanctis disagrees
with both major findings of Gaylin and Casali, saying color does not enhance comprehension of
graphical information nor do graphs better communicate information than tabular data.

No studies confirm the hypothesis that older decision makers make more use of raw data rather
than basing decisions on aggregations of data. The decision process underlying the use of raw data
is more sensing; we cannot easily digest the the gestalt by mere perusal of the data, but we can note
specific instances instead of averaging them out. Often, the average is acceptable, but some of the
data making up that average are unacceptable.

The use of intuition in decision making has been linked to skill level as well. Dreyfus (1983) in-
troduced a set of five "skill acquisition stages": novice, advanced beginner, competent, proficient,
and expert decision makers. The first four types employ rational decision processes while the last
type, expert, uses intuition. The expert's use of intuition reflects his or her ability to place problems
into the context of a repertoire of patterns, from which an appropriate action can be prescribed
(Dreyfus, 1983). Sink, Mallak, and Luxhoj (in review) present a Situational Decision Making
Model which considers the role of intuitive managerial decision making. They claim "when a de-
cision maker uses a particular decision tool, regardless of its appropriateness, he or she feels control
over the outcome of the decision that results from that tool." Langer (1975) calls this phenomenon
"illusion of control."
2.6.2 Influence of Personality Type on Perception and Evaluation

The application of psychological archetypes gives researchers an instrument (MBTI) to assess how we perceive and evaluate our world. We can use MBTI results to try to explain why some modes of presentation are effective and why others are not. A brief review of the Myers-Briggs Type Indicator can be found under “Cognitive Styles” on page 33.

Mode of presentation must conform to the user: “What is information for one type will definitely not be information for another. Thus, as designers of MIS, our job is not to get (or force) all types to conform to one, but to give each type the kind of information he is psychologically attuned to and will use most effectively” (Mason and Mitroff, 1973). One of their conclusions is system designers have based information system design on their own personality types, which are generally sensation-thinking (ST). ST’s prefer analytical models (Alavi and Henderson, 1981), and the systems they design will likely incorporate analytical models even though the user will not even use them. Hence, system designers should consider their users’ psychological types in their design for the system to be successful.

2.6.3 Conclusions

This review of information-portrayal-to-information-perception studies reveals many contradicting conclusions. The conclusion I make is information portrayal decisions must be based on the characteristics of “who manages,” and I say only one person can be “who manages” in a management system. Therefore, information portrayal must suit the information perception and evaluation characteristics of the manager and must be designed on an individual basis for maximum success. When designing portrayal formats for groups of people, I can draw no consistent conclusion from the current research.
2.7 The Decision-to-Action Interface

This interface represents the implementation phase of the MSM. Here, the tools used to manage and the characteristics of the manager coalesce into a decision. For a decision to be meaningful, you have to act on it. This action causes a change in what is being managed with the result of that action being measured and compared with a standard or reference point.

Many decisions are heavily based on information gathered and provided by subordinates. Subordinates, therefore, advise their bosses by presenting information that reflects their own biases, and this influences the boss's decision.

2.7.1 Drucker's Decision Elements

Peter Drucker (1967, pp. 122-123) lists five elements of the decision making process. I am concerned with his fourth element: the building into the decision of the action to carry it out. Says Drucker, "converting the decision into effective action is usually the most time-consuming [step in the decision making process]" (1967, p. 136). Drucker further claims a manager has not made a decision until accountability has been established; before that time, only good intentions exist.

We must answer several questions to convert decisions into actions (Drucker, 1967, p. 136):

Who has to know of this decision?

What action has to be taken?

What is to take it?

Can the assigned person actually perform the action?
2.7.2 Simon’s Decision Making Process

Earlier, I named intelligence, design, and choice as Simon’s (1977) three decision phases. See “Framework #2: Simon” on page 12 for this discussion. He has a fourth step, review, which serves as a monitoring element for the decision making process. Managers have to satisfice (Simon’s term, from satisfy and suffice), that is, make decisions that are not optimal but are timely and workable.

2.7.3 Kepner and Tregoe

Kepner and Tregoe (1965) put decision making in context of the larger problem solving process. The spectrum of items presented for resolution range from issues, problems, designs, decisions, to implementation. This spectrum parallels the “Pursuits” classification. Ill-defined items are issues or perplexities. The parallelism falls off as we move toward implementation items. Kepner and Tregoe’s “decision” chooses among alternatives for a problem, and is “yes-no” on designed solutions.

2.7.4 Forrester

Forrester (1961, p. 93) calls management the process of converting information into action. The conversion process is called decision making. With this definition, “then it is clear that management success depends primarily on what information is chosen and how the conversion is executed. The difference between a good manager and a poor manager lies at this point” (Forrester, 1961, p. 93). Managers select only a fraction of the available information sources for use in decision making. The manager also selects which information sources to ignore. The manager’s success depends on how he or she uses the information. “How quickly or slowly is it converted to action? What is the relative weight given to different information sources in the light of the desired objectives? How
are these desired objectives created from the information available?” Forrester (1961, p. 96) uses the word “policy” to describe the decision process conversion of information into action.

### 2.8 The Measurement-to-Data Interface

When we take measurements of our operations, we need to know what to measure so we have good data which can be converted into information so the manager can make informed decisions. Figuring out what to measure is, therefore, a critical activity if we are to balance our management system. Managers must reward the right behavior; otherwise, they will get the wrong behavior (Drucker, 1967, p. 139).

Before we decide on what to measure, we need to have a clear and complete description of “what is managed.” We cannot manage what we cannot measure; we cannot measure what we cannot define (Sink, 1985, p. 49).

So, we need to first perform a situational analysis. Once completed, we can proceed with one of several techniques available for deciding on measurements. One such methodology, the Normative Productivity Measurement Methodology (NPMM) (Sink, 1985), although designed for producing a ranked list of productivity measures can be modified to include any measures prompted by the task statement.

Performance measures are more difficult in government organizations due to intangibles. Profitability doesn’t work. Even budgetability is weak. If the government manager can justify increasing the budget to meet more needs, that is good. The goal is to manage well the programs you have. If you manage well you get more programs. Whereas this looks like empire building or just performance based on spending more money, it is not. To satisfy the public and the legislative body,
meet the objectives and to do so efficiently and effectively is good management at its best. Good management in government begets more management.

2.8.1 Criteria for Measurements

In order to assess the quality of measurements, we need a set of criteria. These criteria will help in the formulation of conditions of balance between MSM components, and therefore help in the selection and development of instruments to assess those conditions. The following list of criteria is adapted from Kantrowitz et al. (1979, pp. 2-9) and Sink (1985, pp. 68-69).

- **accuracy** the degree of agreement of the results of a measurement to its true value of the unknown
- **precision** how well identically performed experiments agree with each other
- **sensitivity** the ratio of the response of the instrument to the cause or parameter being measured. Also, the largest the measured parameter can change without causing a detectable change in the instrument measuring that parameter
- **loading effect** the change on the system being measured caused by the instrument used
- **standards** the norms against which instrument results are compared
- **validity** the extent to which the instrument measures what it purports to measure
- **reliability** the extent to which repeated measurements consistently provide valid results
- **intelligibility** degree of simplicity and understandability of a particular measure, given the necessary measurements are still taken
controllability the extent to which we have control over parameters being measured

cost effectiveness the value of the measurements taken should be greater than the cost of obtaining those measurements

response time the frequency with which an instrument takes measurements

2.8.2 Using NPMM to generate meaningful measures.

NPMM relies on the Nominal Group Technique (NGT) to generate and rank consensus measures. (See Delbecq et al. (1975) for a good practical guide to executing the NGT.) There are five steps to the NPMM (Sink, 1985). The first step is to use the NGT (Delphi Technique can be used instead) to generate a prioritized list of measures for each specified unit of analysis. Since NGT is a small group process (6-12 persons), more than one session may be necessary to include everyone. The second step is to determine how and where to collect the necessary data for measurements, to interpret the results of that data collection, and to integrate the consensus measures from the NGT into existing control systems. Use of a consultant or other expert is recommended for this step.

Once we know what we want to measure and have an idea of how we will do the actual measuring, we need to brief all interested parties. This is step three. The briefing should be a springboard to discussion and revision of the proposed measures before they are brought up for approval. Step four is the integration and implementation phase, and requires the proposed measures be approved. This methodology is not complete without the fifth step which is monitoring the new system of measures and collecting feedback on the system. This last step will let us know if we have chosen the correct measures to generate data for our management tools.
2.9 Chapter Summary

Management frameworks help us classify domains of responsibility. In particular, Anthony’s activity levels, Simon’s decision structure, and Kurstedt’s pursuits and maturity concepts provide a comprehensive group for looking at domains. Literature pertaining to the MSM’s three components and three interfaces was reviewed to show the current thinking. We can study “who manages” by looking at cognitive style, the manager’s history, and human characteristics. “What is managed” contains resources, time, and performance. Five groups of management tools make up “what is used to manage.” Research on the interfaces between the components brought results of studies on information display formats, decision making styles, and measurement. Most of the papers on cognitive style suggest or reach conclusions supporting the use of cognitive style as a basis for information system design.

In the next chapter, I tell how I will apply the MSM. I present the logic behind my approach and formulate conditions of balance between MSM components.
Chapter 3. Methodology for Applying the Management System Model

3.1 Introduction

I first discuss how I apply the MSM to a specific domain of responsibility. Relevant instruments and techniques linked to the MSM's components and interfaces will operationalize the theory behind the management system approach, and help me in applying the model. I will define MSM component balance in terms of interdependent component measures.

This will be the first use of the MSM as a tool for measuring component characteristics of the organization and using the measurement results to suggest actions to improve management systems. Given the MSM is rooted in a range of applications, I felt I could influence the definition and construction of the initial measurement instruments with a real-world situation and not lose generality. Using a hypothetical situation would hurt my chances to make the instruments useful when first measuring characteristics of a management system.

The next stage of this research, confirmatory studies on specific pieces of this work, will be more quantitative in nature and is outside my scope. Later, with the theoretical and qualitative underpinnings supplied by research such as this, researchers can explore the quantitative aspects. Once
I develop the qualitative instruments, GOAs will be measured to obtain more quantitative results. Later research should apply the instruments to other organizations and adjust the instruments based on the applications. The objective is to develop instruments for measuring any organization, government or industry, product- or service-oriented. I believe the value of this discussion is in the process of instrument development and in the resulting suggestions for subsequent uses of the MSM rather than in the results of the instruments to the chosen organization.

3.2 Application Methodology Logic

My application methodology will require these steps (chapter references follow in parentheses):

1. Identify important component characteristics. (3)

2. Assemble these characteristics into conditions of balance. (3)

3. Identify instruments to measure conditions of balance. (3)

4. Use instruments to assess the chosen domain’s conditions of balance. (4)

5. Analyze instrument responses. (5)

6. Interpret instrument results individually. (5)

7. Synthesize results of instruments via MSM. (5)

8. Reach conclusions about balance conditions for the management system. (5,6)
My first step in applying the MSM is to identify the characteristics of the domain of responsibility that are important to the understanding and balancing of management system components. Next, I will locate instruments or methods to measure the desired constructs. The set of instruments will then be applied to the selected domains, and results recorded. Results from the application will be synthesized through the MSM to conclude balance for the interfaces and for the management system.

Detailed logic behind my methodology follows. It's based on the steps listed at the beginning of this section. The logic should help in the definition and description of balance and help explain how what I'm doing accomplishes my research objectives.

1. Identify component characteristics.
   a. List characteristics for each component.
   b. Arrange characteristics hierarchically through own heuristic or by Glaser's (1965) method. Add or throw out characteristics as appropriate throughout this organization process. (See "Appendix A. Research Methods for "Who Manages"" on page 169 for a description and illustration of a modified version of Glaser's constant comparative method applied to this research.)

2. Assemble component characteristics into conditions of balance.
   a. Look at component characteristics for each pair of components. Examine these characteristics for dependence — which characteristics from one component seem to be dependent on (or vice versa) other characteristics from the other component?
   b. Pair together seemingly dependent characteristics from neighboring components. These pairs of dependent characteristics I call "conditions of balance" (COBs), since I claim these
characteristics must match for the interfaces (and possibly the management system) to be in balance.

c. Examine these COBs for redundancy or for holes. Adjust as necessary. Toss out any trivial COBs, i.e., ones that have little or no impact on management system balance.

3. Identify instruments to assess those COBs.

a. Examine list of COBs for those most important.

b. Use various sources to locate relevant instruments to assess these important COBs — Mental Measurements Yearbook, Tests, Directory of Unpublished Experimental Mental Measures, journal articles, colleagues, promotional materials, instrument publishers and distributors, etc.

c. Evaluate relevant instruments.

1) Quality — base on published research validity and reliability

2) Constructs — which ones does the instrument measure?

3) Efficiency

   a) How much irrelevant data is collected?

   b) Is the data captured through minimal effort?

4) Time required (to administrate and to score)

5) Cost
6) Obtainability

a) How easy were the selected instruments to obtain?

b) Is any professional certification required to administer the test?

d. Select instruments to assess COBs.

e. Adjust COBs as needed to reflect instrument selection. (Some new COBs may come to mind when researching new instruments. Others may need to be modified for proper measurement by selected instruments.)

f. Iterate through steps 3a-3e until satisfied with COBs and instruments to assess them.

4. Use instruments to assess COBs.

a. Obtain necessary materials for instrument administration.

1) Forms

2) Examiner

3) Scoring protocol

4) Instructions for subjects

b. Arrange time to administer instruments.

c. Administer instruments.

1) Explain why giving this instrument.
2) Go over instructions.

d. Follow up on those to whom instruments were distributed.

e. Collect instrument materials once completed.

f. Check materials to be sure they’re filled out properly.

5. Analyze instrument responses. (Use supplied instructions or send to scoring service.)

6. Interpret instrument results individually.

a. Using materials supplied with instruments, determine what each instrument result means.

b. Compare this meaning with understanding of the subjects and constructs being measured.

1) Does the interpretation of results make sense? (i.e., conform to preconceived notions)

2) Is the interpretation justifiable? (theoretically and through knowledge of the actual system)

7. Synthesize instrument results and interpretations via the MSM.

a. Examine results for each interface separately.

1) Review instrument results collectively for each COB at the interface.

2) Considering the two interfacing components, are the instrument results for the conditions of balance desirable?

   Note which COBs are out-of-balance.
a) What caused the COB to be out-of-balance?

b) Assess the criticality of each out-of-balance COB — will this COB throw the interface out-of-balance?

3) Reach conclusions about balance for each interface based on each set of COBs. (If an interface is out-of-balance, refer to previous step for cause.)

b. Examine conclusions made in previous step.

1) Do any of the out-of-balance conditions lead to an out-of-balance management system? (i.e., Is the management system not successful because of a particular out-of-balance COB or interface?)

2) Do these conclusions make sense, considering what is known about the management system?

8. Reach conclusions about balance for the management system.

a. Reviewing conclusions about interface balance, do there exist desirable matches of important criteria among the components of the system, resulting in the overall success of that system?

    If yes, the management system is balanced.

    If no, the management system is out-of-balance. Make sure to identify these out-of-balance conditions, which, when balanced, should balance the system.

Go to step 4 to restart the MSM application once corrective action has been taken, if the same instruments will be used. Allow sufficient time for the organizational system to assimilate the change before restarting.
3.3 Definitions of Balance

I present balance definitions for paired characteristics, interfaces, and the entire management system. My presumption is a balanced management system is successful. By balance, I refer to the system's ability to regain stability at an equal or higher level after accommodating change. I base my balance conclusions on results of measuring management system characteristics.

While it's true a management system in transition (recent major change in one or more of the three components) will likely be out-of-balance, the MSM application should be couched with a short explanation of the recent change. The issue of transitory management systems is not yet resolved. I discuss this issue in more detail in Chapter 6. By invoking a management system analysis we can help shake the "If it ain't broke, don't fix it" mentality that allows management systems to slip out-of-balance.

A continuum exists between the extremes of balance and being out-of-balance. I therefore use the terms "marginally balanced" and "marginally out-of-balance" to describe two possible states between balanced and out-of-balance.

3.3.1 Balance at each COB.

A COB is balanced when characteristics from the two neighboring components match according to criteria specified in "Formulating Conditions of Balance for the MSM Components" on page 74.
3.3.2 Balance at each interface.

An interface is balanced when all COBs at that interface is balanced. We need to consider some COBs have greater bearing on interface balance. An interface can therefore be balanced when some COBs are not completely balanced.

3.3.3 Balance for the management system.

A management system is balanced when there exist desirable matches of important criteria (conditions of balance) among components of a management system, resulting in the overall success of that system. Approaching balance from the mechanical analogy of blocks and dashpots, I define balance as the state when the management system can handle perturbations by stabilizing at an equal or higher state. See Figure 17 on page 73 for the mechanical system analogy of the MSM. Balance is not necessarily steady state. If the management system goes out-of-control or stabilizes at a lower state when perturbed, it is out-of-balance.

Management system balance can be likened to frogs and lily pads. When the frog is on a lily pad, life is stable, in balance. When he is jumping from one lily pad to another, he lacks stability, but regains it if he lands on another lily pad. The successful jump is similar to "good out-of-balance" for a management system. "Bad out-of-balance" happens when the frog misses the lily pad or lands on a bad lily pad, putting him in a worse position. I discuss good and bad out-of-balance in Chapter 6.
Figure 17. Block and dashpots are analogous to the MSM.
3.4 Formulating Conditions of Balance for the MSM Components

To provide more structure in assessing the balance of a management system, I developed conditions of balance between the three pairs of MSM components. These balance conditions allow me to synthesize the results of various instruments via the MSM. These synthesized results help me reach conclusions about management system balance.

Management system analogs exist in the physical sciences. COBs are analogous to electrostatic coupling using potential and induction coefficients (see Spitzer and Howarth, 1972, pp. 498-499 for a discussion on a system of three charged conducting bodies). In mechanics, the management system analogy is a lumped parameter system of three blocks connected to each other by dashpots or springs (Thomson, 1972, pp. 196-247). This is illustrated in Figure 17 on page 73. Equations exist for these analogous cases. Later research can use these analogies and their equations to help derive equations of balance for management systems.

Conditions of balance between components exist in place of steps to balance the components at the interfaces. They are like coupling coefficients in mechanical systems, leading to conclusions about balance through analyzing the degree of balance at each condition. I use this approach since I cannot assess balance directly. Quantitative research often relies on empirical coefficients to couple or relate components of a system. These empirical coefficients and conditions of balance may be analyzed using nonparametric statistical tests. Nonparametrics should be useful in hypothesis testing once this research reaches the confirmatory phase.

As I said earlier, the value of this research is in the process of application, not entirely in the results of the application. Therefore, once the application methodology is refined with subsequent works
like this one, the methodology can be applied to many firms to analyze results, having confidence in the process being used. Here are the conditions of balance.

3.4.1 Conditions of Balance between "What Is Used to Manage" and "Who Manages"

The information-portrayal-to-information-perception interface comes between "what is used to manage" and "who manages." Identifying characteristics of these two components gives rise to conditions of balance. I selected the following conditions of balance as a preliminary step in defining balance at the information-portrayal-to-information-perception interface.

1. Test samples of reports for their "reading ease" (Flesch, 1960) and their "fog index" (Gunning, 1952) and match to the user's reading level. Estimate this reading level from the user's education level. The fog index's scale parallels years of education. For example, a fog index of 16 means the reader should have a four-year college degree to best understand and read the material. This corresponds to a reading ease score of 28, reading ease being correlated to the fog index at -0.591, based on a sample of 15 documents. Data on managers' education levels was obtained in the demographic sections of the MBTI and DDSE. Flesch and Gunning provide heuristics for testing samples of writing. See "Appendix C. Reading Ease and Fog Index Heuristics" on page 179 for the details on these heuristics.

Another approach to analyzing the reading ease of written materials is to look at "low-probability words" (L. I. Middleman, personal communication). Readers constantly predict what comes next in the text. Low-probability words pleasantly violate this expectation of the reader. If the reader's expectations are always true, he or she will be bored with the reading. If the reader's expectations are never met, the reader will be frustrated. Good writing will use
low-probability words as small surprises, sprinkled throughout to keep the reader's interest, preventing boredom or frustration.

By comparing the reading level of the user to the reading ease and fog index of the reports he or she receives, I can reach a conclusion for this COB's balance. I found the average report supplied to the managers in my study to have a reading ease score of 23.28, and a fog index of 16.52. Considering these managers all have four-year college degrees, they should be able to understand materials with fog indexes up to 16; experience should provide additional room along this scale, making 16.52 a score that balances with the managers' capabilities. Converting 16.52 to a reading ease score gives 28, a little higher than the average of 23.28. Again, this should not produce a problem in understanding reports. This COB is balanced unless the reading ease of the manager's written materials is below 20 or fog index is above 18. Difficult writing on the manager's part reduces the reading ease of DWTM materials and makes this COB marginally balanced.

In my discussion of the results, I comment how each manager's writing contributes to or detracts from the reading ease of information supplied to DWTM employees.

2. Portrayal format should match portrayal preference, as based on MBTI and graph survey results. (See "Appendix E. Study of Report Format Preferences" on page 187 for the details of the graph survey.) The N-S dimension of the MBTI gives clues as to preference for information portrayal. Intuitives (N) like to see trends, the "bottom-line," and do not like to be bothered with details. Sensing types (S) prefer details, facts and tabular data. If the manager receives information in his or her preferred format, as determined by the MBTI and graph survey, this COB is balanced. If the manager is supplied information in one or more, but not all, preferred formats, this COB is marginally balanced. This COB is out-of-balance when the manager does not receive any information in his or her preferred formats.
3. The amount of information supplied should match Driver and Mock's satisficer and minimizer classifications. Data for the amount of information supplied comes from a graph survey response. This tells whether the manager feels he or she receives too much, too little, or just the right amount of information. Compare this response to the amount of information use dimension of the DDSE. Satisficers who receive too much information will have this COB out-of-balance. Maximizers who say they receive too much information may suddenly complain when their information supply is reduced; not likely with satisficers. Maximizers receiving too much or just enough information have this COB in balance. See "Driver Decision Style Exercise (DDSE)" on page 92 for more details.

4. Managers' decision styles and the structure of their organization should match, based on Driver's (1983) matrix which suggests desired organization structures for each of the five decision styles resulting from the DDSE. Using Mintzberg's (1975) organizational taxonomy, all the divisions in my study are machine bureaucracies. In Mintzberg's taxonomy, machine bureaucracies have simple and stable environments. The environments of the organizations I'm studying are complex and dynamic, and I base this COB on the match of decision styles to the environment they work in, and realize this environment is not be characteristic of machine bureaucracies.

Managers with integrative or systemic decision styles will best fit in organizational structures with complex, unstable environments such as those in my study (Driver, 1983). Integratives are information maximizers and focus on many alternatives arising out of a set of data. The systemic style is a combination of integrative and hierarchic. Decisives, with their minimal use of information and focus on a single alternative, will likely have the worst fit of all decision styles. These "best" decision styles for various types of organization are based on Driver's field research with organizations ranging from sole proprietors to Fortune 500 firms.
3.4.2 Conditions of Balance between "Who Manages" and "What Is Managed"

The decision-to-action interface comes between "who manages" and "what is managed." Identifying characteristics of these two components gives rise to conditions of balance. I selected the following conditions of balance as a preliminary step in defining balance at the decision-to-action interface.

1. Match the MBTI of "who manages" to those suggested or implied by Myers and/or against types emerging from research statistics compiled by Myers and McCaulley (1985). Using the sample of 7,463 managers and administrators, compare the manager's MBTI to the frequency of its occurrence in the large sample. If the manager's MBTI matches one of the frequently occurring types (ISTJ, ESTJ, ESFJ, or ENTJ), then I conclude the COB is balanced. Types not matching one of these four frequent ones should be looked at to see if they would typically possess desirable characteristics. Here, conclude balance on a case-by-case basis, considering how the four constructs individually and collectively create a fit with "what is managed."

2. Compare the manager's amount of information use to the response time needed by "what is managed." Driver (1972, in Driver and Mock, 1975) found a negative correlation exists between amount of information used and decision time. If "what is managed" requires quick response time, the satisficer would create balance at this condition because he or she would use less information in making a decision. This leads to a quicker decision time and better suits the needs of "what is managed." If "what is managed" experiences a slower response time, the maximizer would create the best balance here, but the satisficer would marginally balance this condition. In the organizations I studied, complex and dynamic environments require quick decision making abilities. Managers with dominant decisive or flexible styles backup will create balance at this COB. Managers not having dominant decisive or flexible styles, but have one of these as backup, will marginally balance this COB. This COB is out-of-balance for managers not having decisive or flexible as either dominant or backup.
3. Match the leadership style of "who manages" to the maturity of his or her followers, as defined by Blanchard and Hersey (1982). See Figure 21 on page 97 for the situational leadership model. Using the Maturity Style Match instrument between leader and followers, determine whether the manager overleads, underleads, or has a high probability of matching leadership style to follower maturity.

I used the following procedure to reach conclusions on this COB. When comparing actual leadership styles to those prescribed by the instrument, count one point for each objective where the manager uses the adjacent leadership style. For example, if the manager should be using a participative style, but actually uses a delegative or selling style, count one point. Count two points when the manager uses a style that is two categories away from the prescribed one. Count three points when the manager uses a delegative style when telling is prescribed, or when he or she uses a telling style when a delegative style is prescribed.

When counting points, take the lower of the score obtained for primary or secondary styles. If the manager should be using a participative style, and has a delegative primary style but a participative secondary style, then count no points because the secondary style matches.

Add up points for all objectives for all followers. Divide this sum by the total number of objectives rated for all followers. This dividend is now in units of points/objective. I use P to represent this variable. The range of this statistic is [0,3]. I used the following rules to reach my balance conclusions:

\[
P > 1.0 \quad \text{out-of-balance}
\]
\[
0.5 < P \leq 1.0 \quad \text{marginally out-of-balance}
\]
\[
0.2 < P \leq 0.5 \quad \text{marginally balanced}
\]
\[
P \leq 0.2 \quad \text{balanced}
\]
3.4.3 Conditions of Balance between "What Is Managed" and "What Is Used to Manage"

The measurement-to-data interface comes between "what is managed" and "what is used to manage." Identifying characteristics of these two components gives rise to conditions of balance. I selected the following conditions of balance as a preliminary step in defining balance at the measurement-to-data interface.

1. The organizational structure should match "what is managed." Combining the guidelines of Perrow's (1970) environmental complexity and dynamism with Mintzberg's (1980) five organizational forms, classify the current organizational structure for the studied organizations. I concluded the current DWTM organization structure is a machine bureaucracy, operating in a complex and dynamic environment. This COB will be the same for all organizations in this study. I present balance information only for this particular case, because I cannot envision all possible types of organizations and the best structures for them. Such a task is beyond the scope of this work. I save the implementation details of this COB for "Organization Structure" on page 119.

2. Measurement systems should suit the activities undertaken in the management system. The greater the uncertainty of these activities, the heavier reliance on informal information sources. When activities have more structure, as in projects, a milestone system can be used to measure performance. When milestones or other project management techniques are used in uncertain systems, this COB is out-of-balance. The management tool or measurement system must match "what is managed."

Compare the assumptions of the methods, measurement systems, and other management tools to the actual conditions of "what is managed." For example, PERT and CPM assume activity
3. Data needed by "who manages" for decision making should be captured from "what is managed" by some means. The goal of this condition is to provide data to managers for ad hoc requests. Information that managers need, but isn't reported regularly, should be available to support decision making. This data does not have to be sent through the data-to-information chain, but should be available in the event it's needed. Usually, this data resides at the field sites and is retrieved through a phone call. If the manager receives or is able to retrieve all necessary data for decision making, this COB is balanced. If he or she can usually get what's needed, or get most of what's needed without adversely affecting decision making, this COB is marginally balanced. Not being able to get necessary information will create imbalance. The severity of this lack of data will help in concluding whether this COB is out-of-balance or marginally out-of-balance.

3.5 Instruments Considered for Use in Assessing Conditions of Balance

I used several sources to locate and select psychological instruments for use in this research: Tests (Sweetland and Keyser, 1983 and 1984), Directory of Unpublished Experimental Mental Measures (Goldman and Busch, 1978), and consultation with several professors who are familiar with and/or use psychological tests in their work. I list below those tests I considered, their purposes, the constructs they measure, and why I did or did not use them.
Tests, which contains most of the instruments in common use, does not give statistics on validity and reliability. It merely provides descriptive and ordering information. The Directory of Unpublished Experimental Mental Measures does give validity and reliability statistics, as well as references where the instrument is described, but since it is a directory of unpublished measures, most of the instruments I considered for my research were not listed.

The organizational context I considered brought several constraints to bear on my use of instruments.

1. My subjects are at least tactical if not strategic level managers. Therefore, their time is very limited and I must use instruments that are efficient in terms of data collection and that are of short duration (can usually be completed in thirty minutes or less).

2. My access to these managers is limited because they work with classified materials and I am not cleared to view these materials nor can I freely pass through the subjects' office areas. This constraint also suggests I need efficient and quick data collection instruments. The constraint on time does not allow the luxury of using several different instruments to measure the same constructs.

3. Since I am conducting a descriptive study with no experimental manipulation of variables, any instrument intending to produce organizational change was avoided.

4. Neither I nor any of MSL's staff hold professional certification necessary to administer many of the psychological tests. For the MBTI, I called upon a licensed MBTI examiner, unless recent MBTI results were available.
3.5.1 Instruments I Used

Examining information perception and evaluation suggests the use of cognitive style tests. Cognitive style instruments do not possess strong reliability or validity. The MBTI is generally considered the best of an admittedly weak set of cognitive style instruments, but it does compare well to other cognitive style instruments (Zmud, 1979b). I use Driver’s Decision Style Exercise to provide a second measure of amount of information used, the first being the MBTI’s judging/perceptive construct.

My research is exploratory and my focus is on the process of instrument development and selection through a case study. As this line of research progresses toward a generic set of organizational measurements, more emphasis can be placed on hypotheses and instrument validity and reliability. For now, I will compare observations to expectations and draw implications.

Myers-Briggs Type Indicator (MBTI)

Isabel Briggs Myers and her mother, Kathryn Briggs, developed the MBTI in the fifties to make the theory of Jung’s psychological types understandable and useful in people’s lives. “The essence of the theory is that much seemingly random variation in behavior is actually quite orderly and consistent, being due to basic differences in the way individuals prefer to use their perception and judgment” (Myers and McCaulley, 1985, p. 1).

The instrument is a forced choice, self-report inventory based on a modification of Jungian theory of personality types. The MBTI is popular because (1) it is easy to administer and score, (2) it provides scores on constructs important to both theory and common sense, and (3) it is useful in job counseling, matching people to compatible jobs (Sundberg, 1965).
The MBTI is used in many business and clinical applications to assess personality type. Four constructs are measured: introversion-extraversion, intuitive-sensing perception of information, thinking-feeling judgment of information, and judgmental-perceptive dominance. The MBTI has been validated in many studies by Myers and others.

Reliability and validity statistics are relatively good for the MBTI when compared to other cognitive style instruments. Test-retest reliability averaged near 80% for a sample of mostly college students. In the MBTI Manual, Myers and McCaulley (1985) show correlations with many other psychological assessment measures, such as the Sixteen Personality Factors, Minnesota Multi-Phasic Inventory, California Psychological Inventory, and others. These correlations with proven instruments supply additional evidence for the quality of the MBTI.

Type tables provide evidence for construct validity for the MBTI. A type table shows distributions of the sixteen types for a particular sample (see Figure 19 on page 91 for an example of a type table). By comparing experimental results shown in the type tables to the theorized distribution of types, the researcher can check whether or not the observations support the expectations. For example, I might postulate a majority of accountants are ISTJ's. By checking the type tables, I find 20% of all accountants are indeed ISTJ's, based on a sample of 427. (The general population has only 8% ISTJ's.) This exercise demonstrated that the constructs I believe important for accounting are indeed represented in at least one sample of accountants. Myers does not discuss content validity for the MBTI; instead she directs the reader to the discussion on the development of test items.

The MBTI is an efficient instrument. Subjects usually finish answering the questions in 45 minutes to an hour. To get the same information the MBTI provides would require several different tests and hours of the subject's time.

The MBTI is a powerful instrument and I have several reasons for using it in my research.
1. The MBTI supplies a lot of relevant information for my research.

   a. The intuitive-sensing (N-S) construct reveals how an individual perceives information.

   b. The thinking-feeling (T-F) construct reveals how an individual evaluates information.

   c. The judging-perceptive (J-P) construct implies preferences for either long or short reports.

   d. The extraversion-introversion (E-I) construct tells whether the individual relies mainly on internal or external referents in decision making. Those relying on external referents are more likely to use others' opinions when making decisions; those relying on internal referents may ignore others' opinions altogether.

2. The MBTI helps me decide how much match there is between "who manages" and "what is managed."

3. The MBTI helps in the design of information portrayal formats based on preferences gleaned from its results and other cognitive style tests.

4. The MBTI is a single instrument measuring many of the constructs that would otherwise require several of the instruments under "Appendix D. Instruments Not Used" on page 182. This has the effect of saving time in data collection.

5. MBTI is the best of a relatively weak set of cognitive style instruments.

6. Many people like taking the MBTI, finding it fun and interesting.

7. MBTI provides a scientific basis for understanding individual differences.

The Four Constructs
As mentioned earlier, the four constructs the MBTI measures are: extraversion-introversion, intuition-sensing, thinking-feeling, and judging-perception. I now describe each of these in turn. (Most of the following discussion is based on Keirsey and Bates, 1984, and Myers, 1980.)

**Extraversion-Introversion (E-I):** The E-I construct measures whether an individual relies more on internal or external referents. Those who rely more on external referents are extraverts. They derive their energy from social interaction. Extraverts tend to become bored in extended periods of quiet concentration. Introverts rely on internal referents. Introverts derive their energy from working quietly, reading, or involvement in activities with few or no other people. This does not mean introverts are social outcasts; social interaction tires them much more easily than it does extraverts. Extraverts comprise about 75% of the general population, with introverts making up 25%.

**Intuitive-Sensing (N-S):** The N-S dimension assesses how an individual comes aware of things, people, occurrences, or ideas — how he or she perceives the world around him or her. The sensing person relies on his or her senses in perceiving the world — seeing, touching, hearing. The sensing person wants facts, trusts facts, and remembers facts. Facts come by way of the senses. S’s learn from previous experiences. S’s have their roots grounded firmly in reality. Sensing types notice and react to the actual, whereas the intuitive type focuses on possibilities — what might have been or what could be. Intuitives trust and use their hunches. Intuitives are more apt to daydream than sensing types, and intuitives possess more vivid imaginations. “The possible is always in front of him [the intuitive], pulling on his imagination like a magnet” (Keirsey and Bates, 1984, p. 18).

Intuitives live in anticipation. They seem bothered by reality and constantly seek ways to change or improve existing conditions. Intuitives skip from project to project, many times never completing what he or she has started.

Intuitives take a more holistic view of their world, noticing generalities and the overview. Sensing types look for the details, the bits and pieces that come to them through the senses. Sensing types
should therefore prefer information portrayal in tables and spreadsheets, whereas intuitives should prefer graphs. My research should help in assessing the truth or falsity of this expectation.

Intuitives make up only 25% of the general population, but in engineering intuitives make up almost 65% of the population and in science the figure is 83%, based on Myers (1980, pp. 41-43). This leaves 75% of the general population with sensing methods of perception.

Thinking-Feeling (T-F): The T-F construct tells how an individual judges information he or she perceives — the processes of coming to conclusions about what is perceived. Those more comfortable with impersonal, objective judgments are thinkers. Individuals preferring to include the human element in their analysis are feeling types. T’s evaluate from the viewpoint of true/false. F’s use feeling as bridge between one human being and another. Thinkers judge all human feelings by their own, but their feelings are relatively undeveloped.

Feeling types are naturally friendly; thinkers more brief and businesslike without knowing or intending it. F’s are more suited to the social arts while thinkers are stronger in executive ability. The general population is split 50-50 between thinking and feeling types. Nearly 70% of science and engineering students tested as thinkers in Myers’ research. Occupational therapists are mostly feeling types (83%).

Judging-Perceiving (J-P): This construct shows whether the individual prefers to use judging or perceiving for dealing with the outside world. The trait shown the outside world depends on whether the individual is an introvert or an extrovert. The E’s dominant trait shows on the J-P construct. The I’s auxiliary shows on the J-P construct, and therefore the I shows the outside world this auxiliary trait.

Those preferring judging spend little time poring over data to make decisions — they want to make the decision and move on. P’s spend time carefully looking over the data they have, and often call
for more data before making a decision. J's tend to establish deadlines and take them seriously, while P's ignore deadlines.

J's hold a different work ethic than do P's. J's like to get all work out of the way before playing. P's don't need to have the work done before they play or rest. P's are more concerned with the quality of work life and are more process-oriented; J's are more outcome-oriented (Keirsey and Bates, 1984, p. 24).

The general population is split 50-50 on this construct, too. Sixty-five percent of engineering students tested as J's by Myers, while only 51% of science students were found to be J's.

Summary: For a summary showing cue words for opposites (i.e., N and S, T and F, etc.) see Figure 18 on page 89.

Four Archetypes

By combining the perceptive construct (N-S) with the judging construct (T-F), four basic archetypes result. Many researchers in management and information systems focus on these basic archetypes in their work (Mason and Mitroff, 1973; Taggart and Robey, 1981; Henderson and Nutt, 1980). A brief description of these archetypes follows.

NT — Intuitive with thinking: NT's focus on possibilities but approach them with impersonal analysis. They tend to subordinate the human element. NT's are logical and ingenious and show success in solving problems in fields of special interest. They're good in offering creative, logical solutions. They're also more apt to see the intersection of different planes of thinking, thereby making discoveries more readily than the other three archetypes. Typical NT occupations: scientific research, mathematics, finance.
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<th>E (75% of population) versus I (25% of population)</th>
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<td>Sociability ........................................... Terminationality</td>
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<td>Interaction ............................................ Concentration</td>
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<th>S (75% of population) versus N (25% of population)</th>
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<tr>
<td>Experience ............................................... Hunches</td>
</tr>
<tr>
<td>Fast ......................................................... Future</td>
</tr>
<tr>
<td>Realistic .................................................. Speculative</td>
</tr>
<tr>
<td>Perspiration ............................................... Inspiration</td>
</tr>
<tr>
<td>Actual ....................................................... Possible</td>
</tr>
<tr>
<td>Down-to-earth ............................................. Head-in-clouds</td>
</tr>
<tr>
<td>Utility ....................................................... Fantasy</td>
</tr>
<tr>
<td>Fact ........................................................... Fiction</td>
</tr>
<tr>
<td>Practicality ............................................... Ingenuity</td>
</tr>
<tr>
<td>Sensible ..................................................... Imaginative</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>T (50% of population) versus F (50% of population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective ............................................... Subjective</td>
</tr>
<tr>
<td>Principles .................................................. Values</td>
</tr>
<tr>
<td>Policy ....................................................... Social Values</td>
</tr>
<tr>
<td>Laws .......................................................... Extenuating circumstances</td>
</tr>
<tr>
<td>Criterion ..................................................... Intimacy</td>
</tr>
<tr>
<td>Firmness ..................................................... Persuasion</td>
</tr>
<tr>
<td>Impersonal ................................................... Personal</td>
</tr>
<tr>
<td>Justice ....................................................... Humane</td>
</tr>
<tr>
<td>Categories .................................................. Harmony</td>
</tr>
<tr>
<td>Standards ..................................................... Good or bad</td>
</tr>
<tr>
<td>Critique ..................................................... Appreciate</td>
</tr>
<tr>
<td>Analysis ...................................................... Sympathy</td>
</tr>
<tr>
<td>Allocation ..................................................... Devotion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>J (50% of population) versus P (50% of population)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settled ....................................................... Pending</td>
</tr>
<tr>
<td>Decided ....................................................... Gather more data</td>
</tr>
<tr>
<td>Fixed ......................................................... Flexible</td>
</tr>
<tr>
<td>Plan ahead ................................................... Adapt as you go</td>
</tr>
<tr>
<td>Run one's life .............................................. Let life happen</td>
</tr>
<tr>
<td>Closure ....................................................... Open options</td>
</tr>
<tr>
<td>Decision making ........................................... Treasure hunting</td>
</tr>
<tr>
<td>Planned ....................................................... Open-ended</td>
</tr>
<tr>
<td>Completed ..................................................... Emergent</td>
</tr>
<tr>
<td>Decisive ....................................................... Tentative</td>
</tr>
<tr>
<td>Wrap it up ................................................... Something will turn up</td>
</tr>
<tr>
<td>Urgency ....................................................... There's plenty of time</td>
</tr>
<tr>
<td>Deadline ..................................................... What deadline?</td>
</tr>
<tr>
<td>Get show on the road ..................................... Let's wait and see</td>
</tr>
</tbody>
</table>

Figure 17. MBTI Preference Selection Cue Words: This table summarizes the MBTI constructs in easily understood cue words. (Source: Keirsey and Bates, 1984, pp. 25-26)
**NF — Intuitive with feeling:** NF’s focus on possibilities, such as new projects or new truths. Ideas are imagined by the unconscious processes and then intuitively perceived, like an inspiration. NF’s follow up possibilities with personal warmth and commitment. They show enthusiasm and display insight. In addition to being good communicators, they’re likely to find satisfaction and success in work that requires creativity in meeting a human need. Typical occupations: teaching, preaching, advertising, research, writing.

**ST — Sensing with thinking:** ST’s perceive primarily though their senses and rely on thinking for judgment. ST’s therefore like facts, because facts can be collected and processed by the senses — by seeing, touching, hearing. ST’s use impersonal analysis in their decision making because of their trust in thinking logically following a sequential process leading from premises to conclusions. ST’s tend to be practical and matter-of-fact. Typical occupations: economics, law, surgery, business, accounting, production.

**SF — Sensing with feeling:** SF’s prefer perception through the senses, but use feeling in their judgments. They approach decisions by considering the human elements. SF’s are more interested in facts about people than in facts about things and are therefore, usually friendly and sociable. SF’s like using their abilities in understanding and communicating with people. They tend to be pragmatic, especially when friends or peers need assistance. Typical occupations: nursing, teaching, social work, and other people-serving occupations.

**Sixteen Different Types**

To illustrate the sixteen different personality types, I chose a study of 7,463 managers and administrators from Myers and McCaulley (1985). I can then compare my sample of managers with this larger sample and draw implications about personality type and occupation.

The distribution of the sixteen different personality types in Figure 19 on page 91 shows 32% of the managers and administrators are -STJ’s. Slightly more than 10% of the sample were ENTJ’s.
<table>
<thead>
<tr>
<th></th>
<th>ISTJ</th>
<th>ISFJ</th>
<th>INFJ</th>
<th>INTJ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14.94%</td>
<td>6.28%</td>
<td>3.11%</td>
<td>5.64%</td>
</tr>
<tr>
<td>SSR</td>
<td>1.87</td>
<td>0.64</td>
<td>1.56</td>
<td>1.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>ISTP</th>
<th>ISFP</th>
<th>INFP</th>
<th>INTP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.69%</td>
<td>2.53%</td>
<td>4.56%</td>
<td>3.58%</td>
</tr>
<tr>
<td>SSR</td>
<td>0.53</td>
<td>0.60</td>
<td>1.06</td>
<td>0.60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>ESTP</th>
<th>ESFP</th>
<th>ENFP</th>
<th>ENTP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.71%</td>
<td>2.80%</td>
<td>6.93%</td>
<td>4.89%</td>
</tr>
<tr>
<td>SSR</td>
<td>0.35</td>
<td>0.43</td>
<td>0.98</td>
<td>0.62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>ESTJ</th>
<th>ESFJ</th>
<th>ENFJ</th>
<th>ENTJ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17.04%</td>
<td>7.32%</td>
<td>4.92%</td>
<td>10.06%</td>
</tr>
<tr>
<td>SSR</td>
<td>1.09</td>
<td>1.13</td>
<td>1.41</td>
<td>1.52</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ST</th>
<th>SF</th>
<th>NF</th>
<th>NT</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.38%</td>
<td>18.93%</td>
<td>19.52%</td>
<td>24.17%</td>
</tr>
</tbody>
</table>

**Figure 18. Sixteen Different Types:** This table shows distributions of type for managers and administrators, based on a sample of 7,463. An SSR (self-selection ratio) of 1.0 means the same percent exists in the general population. (Adapted from Myers and McCaulley, 1985.)
Almost one-half the sample of managers and administrators fell into four types — ISTJ, ESTJ, ENTJ, and ESFJ. Over 2/3 of the sample were J's, evidence supporting the stereotype of the manager as a quick decision maker. About 43% of the sample were introverts, surprising since the general population is only 25% introverts and because we usually think of the manager as one who derives energy from co-workers or subordinates.

Knowing preferences people have, specifically when these people act as decision makers, helps in understanding them, designing information systems for them, in matching them to occupations, and in matching them as "who manages" to the other two components of the MSM. Understanding these individual differences and having a framework for explaining these differences should help people as members of organizational systems function more effectively. Knowing what others prefer and why they act the way they do keeps us from forcing others to accept our own preferences. This knowledge should remove some of the mystique in working relationships, thereby exposing possible explanations for various behaviors.

**Driver Decision Style Exercise (DDSE)**

The DDSE assesses decision style by analyzing how information is used to make decisions. It measures the constructs of (1) amount of information used, and (2) focus, the tendency to see either single or multiple meaning in the information processed. These two constructs originally lead to four distinct decision styles (Driver and Mock, 1975), but a fifth style was later added (Driver, 1983).

The DDSE presents the individual with a brief account of a manager’s job transfer. The individual is asked to decide whether the transfer is an encouragement or a reprimand and to answer questions about that decision. Additional facts are provided and the individual is asked to make the same decision with the new information provided. Analysis of the responses identifies the individual’s dominant and backup decision style.
<table>
<thead>
<tr>
<th>Focus</th>
<th>Satisficer</th>
<th>Maximizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uni</td>
<td>Decisive</td>
<td>Hierarchic</td>
</tr>
<tr>
<td>Multi</td>
<td>Flexible</td>
<td>Integrative</td>
</tr>
</tbody>
</table>

Figure 19. Five Decision Styles: Amount of information used and “focus” result in a distinct decision style. (Source: Driver, 1983.)
The five decision styles resulting from the DDSE are: decisive, flexible, hierarchic, integrative, and systemic (see Figure 20 on page 93). A brief description of each decision style follows and is based on Driver's (1983) descriptions.

The *decisive* style uses just enough information to get a good enough decision, and then moves on to other issues. Decisive types dislike going back over a decision once made. Decisives are action-oriented, achievement-motivated, efficient, and consistent.

The *flexible* style uses just enough information to get a reasonable decision, but the flexible is open to changing a decision given new data. Flexibles are highly adaptive, and often use intuitive processes to keep up with the varied conditions.

The *hierarchic* style takes in a maximum amount of information, analyzes it rigorously, and produces a single plan of action. Hierarchics usually consider many contingencies covering a wide range of possible outcomes. The hierarchic is a perfectionist interested in control.

The *integrative* style takes in a maximum amount of information and simultaneously sees multiple, complex options and plans for all of them. Integratives stress decision experimentation and creativity.

The *systemic* style is a combination of decision styles. Systemics begin a problem in an integrative mode but then use a hierarchic style to prioritize multiple options.

I chose the DDSE for my research for several reasons.

1. Both of its measured constructs are useful to my study.
   a. Amount of information use gives implications for information portrayal format preferences.
1) I expect the information maximizer/minimizer dimensions to correspond to the MBTI’s judging-perceptive (J-P) construct. This comparison will allow examination of correlation between similar constructs of these two instruments.

2) Amount of information use has been found to be negatively correlated with decision time (Driver, 1972, in Driver and Mock, 1975).

3) Whether a particular manager is an information maximizer or minimizer is good to know when preparing reports.

b. The focus construct supplies a measure of adaptability in decision making. Managers who focus on a single solution favor consistent, reliable adherence to a solution once it is decided upon. Those focusing on several solutions tend to continually adapt these solutions to changing environments. As a result, flexibles, integratives, and systemics are best suited to dynamic environments.

c. Knowing a manager’s decision style allows me to make comparisons to the organization structure he or she works in, and draw conclusions on the match of decision style to organization structure.

2. The DDSE only requires about thirty minutes to fill out and it does not require an examiner.

3. The theory behind the DDSE makes sense (i.e., has face validity) in light of the current research on human information processing. Several researchers have used DDSE and published their results.

4. Zmud (1979b) used Driver’s earlier version of the DDSE for information system design. Zmud’s thesis was system designers should consider the cognitive styles of the users and avoid incorporating their own styles in information systems. Zmud says most systems designers are sensing-thinkers (ST).
a. MacIntosh (1981) argued information systems need a contextual model. That is, information systems must be designed considering their context of use: types of tasks performed, cognitive styles of the users, and organizational structures. He used Driver's earlier version of the DDSE and concluded different decision styles are needed for different operational contexts.

b. McGhee et al. (1978) argue contingency theory for decision styles, saying human information processing models should consider the nature of the task as well as the way individuals interact with the task.

c. Driver (1983) says personal decision style is a cognitive trait influencing the way individuals use information in task performance.

Driver (1983) claims most people operate with one decision style being dominant and another as a backup. He says no one displays all four basic styles. (The fifth style is a combination of the integrative and hierarchic styles.) MacIntosh (1981) notes Driver's decision style theory does not take into account the type of task faced by the decision maker. Driver responds to this criticism in his 1983 paper by explaining how environmental forces affect one's decision style. Driver also discusses different organizational structures and their fit with individual decision styles.

Maturity Style Match Instrument (MSMI)

The MSMI assesses the fit between the manager's leadership style and follower maturity. The instrument is rooted in situational leadership theory (Blanchard and Hersey, 1982), which says managers need to use different leadership styles based on the maturity of their followers. See Figure 21 on page 97. Situational leadership identifies four styles of leadership — telling, selling, participating, and delegating. Follower maturity is defined in terms of ability and willingness in regard to various tasks. Unable and unwilling followers represent the lowest level of maturity. Situational theory says the manager should use a telling or autocratic leadership style with unable
Figure 20. Situational Leadership: Different leadership styles suit different levels of follower maturity. (Source: University Associates, San Diego, CA.)
and unwilling followers. Managers should delegate work to those willing and able, since these followers have high levels of maturity.

The MSMI requires the manager to first come up with a list of up to six objectives or responsibilities for a follower. (This can be accomplished by the manager alone, by the follower alone, or together.) The manager marks his or her primary and secondary leadership style with respect to each objective or responsibility. The manager then rates the follower on each objective or responsibility on two scales — one is for ability (job maturity) and the other is willingness (psychological maturity).

Analysis is accomplished using the Maturity Style Match Matrix, which combines the two maturity scale rankings and prescribes the appropriate leadership style(s). By comparing the prescribed leadership style to the actual, the manager can see if he or she is overleading, underleading, or if there is a high probability match of leadership style to follower maturity.

The MSMI was designed as a training tool, but is used in graduate level research and in some applied research settings. I selected the MSMI for my research for several reasons.

1. The MSMI provides qualitative data on degree of match between the manager ("who manages") and followers (part of "what is managed").

2. I can directly use the MSMI output in reaching conclusions on the maturity style match condition of balance between "who manages" and "what is managed." The MSMI leads one through the steps necessary for reaching conclusions on maturity style match.

3. MSMI is rooted in contingency theory and I can then say, based on Galbraith (1973, p. 2):

   a. There is no one best leadership style.

   b. Any style of leadership is not equally effective.
The MSMI yields results that are situation-dependent, but yet we can aggregate the manager’s various leadership styles into conclusions on maturity style match. The instrument allows the researcher to note on which follower objectives and responsibilities the manager’s leadership style does not match, and by how much it doesn’t match.

4. Objectives and responsibilities can be analyzed to see if the measuring system properly measures them, and use this as data for conditions of balance between "what is managed" and "what is used to manage."

**Graph Survey**

This survey supplies a method for testing conscious preferences for spreadsheets or graphics in a simulated decision making situation. (A sample copy of the survey appears in “Appendix F. Graph Survey” on page 191.) Managers answer eight questions, seven of which refer to exercises involving several information formats — spreadsheets, bar charts, and pie charts. The last question asks about amount of information supplied. This is used in judging balance between amount of information supplied and decision style of the user.

Each subject received appropriate sets of spreadsheets, bar charts, and pie charts for the questions. Three reports based on the FY 1986 Financial Plan (Operating Expenses, Construction Costs, and Capital Equipment) were used for this survey. The survey required subjects to use some of the supplied materials. Subjects mark the format found most useful in answering each question. Five-point scales record preferences for bar charts, pie charts, and spreadsheets based on this exercise along with their experience.

The graph survey is sequential, eliciting more valuable answers near the end since they are based on all the previous work. Therefore, I analyzed these surveys by looking at the scales for rating bar charts, pie charts, and spreadsheets. I then scanned the survey to see if the subject did indeed
use those materials he or she rated highly. See "Appendix E. Study of Report Format Preferences" on page 187 for more detail and a summary of ratings for various portrayal formats.

3.5.2 Instruments I Did Not Use

I came across many instruments in my research. "Appendix D. Instruments Not Used" on page 182 contains brief descriptions of instruments I did not use, and why I did not use them.

3.6 Chapter Summary

Eight steps constitute the logic behind my application of the MSM to real-world organizations. These steps progress from identification of important MSM component characteristics to conclusions about management system balance. I define balance for each condition, for the interfaces, and for the entire management system. Balance for the management system requires desirable matches of important criteria among components of a management system, resulting in the overall success of that system. From a mechanical analogy, balance is the state when the management system can handle perturbations by stabilizing at an equal or higher rate. Conditions of balance (COBs) provide a means to base measurement of certain management system aspects. Satisfying these COBs helps lead to management system balance.

A description of the instruments used in this research showed their efficacy in assessing several constructs. The Myers-Briggs Type Indicator (MBTI) characterizes information perception and judgment. The MBTI results are useful in matching "who manages" to "what is managed" and in how information is presented. The Driver Decision Style Exercise (DDSE) looks at how managers make decisions and helps in matching managers to the organization structure they work in. The
DDSE results bear implications for amount of information a manager uses in decision making, a variable negatively correlated with decision time. The Maturity Style Match instrument (MSMI) compares leadership style against follower maturity using a situational leadership model.

I've now described the instruments to be used. Next, I discuss the organizations involved in this research — why I selected them, a brief description, and how I collected data from them.
Chapter 4. Applying the Management System Model

4.1 Introduction

This research is exploratory. It explores causes and effects and does not test hypotheses as in confirmatory research. Generality of findings across settings is enhanced by the use of realistically complex organizations.

The organizations involved in the application of the MSM are government oversight agencies (GOAs). Specifically, they are divisions within the Office of Defense Waste and Transportation Management (DWTM). I approached managers of these divisions in person to collect data about their management systems.
4.2 Classifying the Research

I have said earlier my research is exploratory, but did not define my terms. Exploratory research does not test hypotheses like confirmatory research does. Delbecq, Van de Ven, and Gustafson (1975, p. 109) explain exploratory research as it applies in their developmental planning work:

The term "research" even when applied to developmental planning, often suggests the following situation:

1. The problem is clearly defined and the task is merely to obtain detailed elaborating or supporting information.
2. The essential causal relationships are known and agreed upon.
3. Critical variables and interrelationships can be quantitatively reduced and manipulated.

The world of planners engaged in exploratory or pilot research is, however, quite different. A number of critical differences are immediately apparent:

1. The involvement of consumers often means that attitudinal, emotional, and interpersonal variables may be important research concerns.
2. Little clinical, let alone analytical, understanding of some variables may exist.
3. Language barriers exist between professionals, administrators, and laymen, all of whom are important reference groups.
4. Multiple professional disciplines are often involved, such that analytic models within a particular discipline may not be easily communicated across disciplines.
5. Political variables and vested interests of institutions become important.
6. Qualitative political and emotional concerns may not be easily subjected to quantitative reduction and manipulation.

By definition, then, exploratory research is concerned with the investigation of complex problems whose qualitative and quantitative parameters are unknown. (Delbecq, Van de Ven, and Gustafson, 1975, p. 109).

As is evident from the literature review, this research engages the work of many disciplines — management, psychology (industrial, organizational, and clinical), and information technology, to name a few. Attempting to quantify effects of variables from all these disciplines is nearly impossible nor is it something valuable to do. I take a broader approach and therefore conduct exploratory research by searching for cause-and-effect relationships between conditions of balance and management system balance.

Chapter 4. Applying the Management System Model
The complexity of my research (i.e., many variables in a real-world setting) has the advantage of providing more information about the relationships among variables: "Experiments that explore the effects of a number of changes in independent variables generate valuable information for the purposes of making statements about the generality of the findings" (Johnston and Pennypacker, 1980, p. 397). Lopes (1986) says generality across settings requires an increased emphasis on research occurring in or focusing on realistically complex environments.

I conduct my research in a natural setting with no experimental manipulation of variables. In Cook and Campbell's words I have a correlational study, also referred to as a passive-observational study (1979, p. 295). Correlational studies search for the causes of effects. My desired effect (for domains) is balance, but I will not manipulate causes to determine how they affect the system's balance. My conditions of balance identify a first-cut at the causes of balance. Once identified and related to balance, these conditions can be manipulated and effect on balance observed in later research.

For this research to be useful, the results must be applicable to more than just the studied organizations. Therefore, I have designed the application methodology to enhance the generality of my findings. Of the three types of generality of findings (Barlow and Hersen, 1984, p. 50) — across subjects, across behavior change agents, and across settings — I am most concerned with generality across settings. As such, I have selected managers who work in DOE division-level organizations. By studying mission and function statements of these managers' organizations and augmenting this with mine and others' observations of those organizations in action, I conclude these organizations are similar enough to allow me to generalize my findings across settings. I later detail my reasoning for this conclusion.

Johnston and Pennypacker (1980, p. 396) note researchers are concerned with generality of the interpretation of the data, and not with the generality of the data itself. They further state (p. 397) "In the case of truly good data, it is clearly interpretations that are the cause of poor generality." When making inductions from data believed to be interpreted generally, Sidman (1960, p. 61) has this advice: "the degree of confidence that prevails in a scientific community with respect to any
particular induction will be a function of the extent to which the members of that community share a common history of experience."

4.3 Selection of Organizations

I carefully chose organizations with several academic and pragmatic considerations in mind. I first wanted to produce valid results and conclusions for the organizations under study. Second, I wanted these results to be generalizable to other similar organizations — other GOAs.

I have selected several tactical-level managers within Defense Waste and Transportation Management (DWTM) who have similar domains of responsibility. This will supply me with generality of findings across subjects, as well, making this research more valuable and applicable. I will focus on generality of settings, so my findings can be applied to other GOAs. I will make limited use of generality across subjects.

I chose managers in several organizations within DWTM to provide for replication of the MSM application. Replication enhances generality of findings (Barlow and Hersen, 1984, p. 325) by establishing reliability of previous findings and by determining generality of findings under differing conditions. I also use replication to enhance generality of findings across subjects by studying several managers in each organization, when possible.

Replication is not the cure-all for exploratory research. Effective data collection alone (getting the right data) produces generalizable findings; efficient data collection (getting a lot of data) cannot guarantee generalizability.
4.4 Description of Organizations

To allow generality across settings, I focused on organizations within DWTM. These organizations operate in similar and sometimes overlapping environments. See Figure 22 on page 107 for an organization chart. Four division-level organizations represented are: Operations and Projects, Waste Research and Development, Transportation Management, and Hazardous Waste and Remedial Actions.

I claim these four organizations have similar settings because they all (1) work with defense wastes, (2) operate under the Office of Defense Waste and Transportation Management (DWTM) and are subject to DWTM's guidelines and policies, (3) are division-level organizations, (4) are oversight agencies in the Department of Energy, in the U.S. Federal Government, and therefore exhibit properties of government oversight agencies (GOAs) (Mallak and Kurstedt, 1985; also see "Appendix B. Characteristics of Government Oversight Agencies" on page 174 for GOA characteristic discussion), and (5) have similar physical settings (same buildings, adjacent office space, share common environmental components).

I will make limited use of generality across subjects. I provide subject generality information for those who wish to continue this research with special emphasis on "who manages" (i.e., the subject). I can identify two bases for subject generality. First, my test subjects were all at least tactical-level managers, concerned with planning and coordination of operations and reporting performance to upper-level managers. Second, these managers work in similar organizations. GOAs are generally conservative in terms of risk-taking and innovation, attracting conservative people (Ackerman, 1984). Therefore, some generality of subjects exists in this research.
Figure 21. DOE Organization Chart: shows where DWTM fits in DOE and the structure of DWTM.

Chapter 4. Applying the Management System Model
4.5 Testing Protocol

4.5.1 Organizational Entry

To facilitate the data collection, application of the MSM to a real-world organization required I produce more than just academic results. This was accomplished by analyzing the collected data in two perspectives. The academic perspective checked management system balance by looking at instrument results in light of the conditions of balance. The more tangible perspective judged decision makers' preferences for spreadsheet versus graphic portrayal of information.

MSL recently developed a set of decision support software packages for DOE use. These DSS packages have in common a spreadsheet format for displaying information. By analyzing the data I collected for information portrayal format preferences, my research suggests MSL should include graphics in the existing DSS. The studied managers learned about their own and their co-workers' decision and management styles as a result of involvement in this research. For the report on this study, see “Appendix E. Study of Report Format Preferences” on page 187.

The data collected for the report format study provides information on the interface between "what is managed" and "what is used to manage." By examining other aspects of the system under study, I can reach conclusions about management system balance.

4.5.2 Collecting the Data

Figure 23 on page 109 shows the conditions of balance between the components of the MSM. I call this model MSM-2, because it provides the next level of system detail based on the Manage-
Figure 22. MSM-2: Conditions of balance are represented on the MSM.
ment System Model as shown in Figure 1 on page 4. This model helped me in developing conditions of balance and in giving me a structure for my data collection effort. I went through several iterations of the MSM-2 before and during of the data collection effort. As I discovered new useful instruments or ways to make use of constructs already measured, I would incorporate them into the MSM-2. When I introduced new COBs, another condition was usually removed to keep the number of COBs at each interface no greater than four.

Most of the managers in this study had already taken the MBTI as a precursor to a team building workshop held a few weeks prior to my data collection efforts. This had at least two advantages: (1) one item of data was already collected for my research, pending the managers' permission to release their reports to me, and (2) since the workshop had gone well, the managers spoke highly of the exercises and were open to other instruments; this enthusiasm spread to others in DOE who were not involved in the team building workshop. This second advantage made easier my job of selling the managers on the instruments I asked them to take.

Usually, on the first meeting with research participants, I would explain and distribute materials for the Driver Decision Style Exercise and the Maturity Style Match instrument. On the second meeting I would supply feedback on the MSMI. (The DDSE required 2-3 weeks turnaround for a mail-in scoring service.) Also at this second meeting, I would have participants take a short survey which asked information about the DOE budget. The purpose of this survey is to surface preferences for particular information portrayal formats. I supplied them the same information in three different formats — spreadsheets, pie charts, and bar charts — and allowed them to refer to any or all formats to work the exercises. After each exercise, I asked them to choose which format was most useful. At the end of the survey, I asked them to rate the usefulness of spreadsheets, pie charts, and bar charts based on their experience and on the survey exercises.

Following the second meeting, I obtained reports these managers used in their decision making and looked at their current measurement systems. I also supplied feedback on the DDSE. This completed the data collection necessary to apply the Management System Model.
4.6 Chapter Summary

This research is exploratory, a passive-observational study with no experimental manipulation of variables. Exploratory research investigates complex problems whose qualitative and quantitative parameters are unknown. By selecting similar organizations to study, I produce findings more likely to be generalizable to other similar organizations. A large sample size for replication is not important in exploratory research. Getting the right data (i.e., being effective) is important.

Organizations in this study are government oversight agencies (GOAs) at the division level in the Office of Defense Waste and Transportation Management (DWTM). Similarities in what they manage lead to generalizable results. I collected data from these organizations and their managers through a series of personal visits at their workplaces in DOE’s headquarters.

Results of my study for the most relevant cases are presented in the next chapter. I draw conclusions about management system balance for each case after reviewing the conditions of balance.
Chapter 5. Results of MSM Application

5.1 Introduction

This chapter details the results of the MSM application described in Chapter 4. Results are presented on a case-by-case basis, progressing from each condition of balance to the interfaces to the entire management system. I discuss the most relevant cases, which contain tactical- and strategic-level managers.

I started with 14 subjects for my research, knowing I would only get between 2 and 6 complete data sets. The four complete sets are presented and analyzed in this chapter. I provide data for the incomplete cases, in "Appendix G. Additional Data from MSM Application" on page 194, if they are of any use to later researchers. My research was designed for the upper-level manager, who relies more on information about physical things than the physical things themselves. These managers had several people reporting to them.
5.2 Case #1

This case’s domain is the Operations and Projects Division. Six professionals and two secretaries work for the manager of this domain. “Who manages” is a male, 49, tactical-level manager. His division “oversees the management of radioactive waste operations at multiple DOE sites, supports the landlord programs at two DOE sites, and is responsible for phasing into operation major new facilities such as DWPF [Defense Waste Processing Facility] and the WIPP [Waste Isolation Pilot Plant].” Figure 24 on page 114 shows the MSM-2 with instrument results for Case #1.

I’ll now step through these results starting at the interface between “what is used to manage” and “who manages” (the information-portrayal-to-information-perception interface). Terms in quotes refer to data points on the MSM-2.

5.2.1 Conditions of Balance for “What Is Used to Manage” versus “Who Manages” (information-portrayal-to-information-perception)

Reading Ease/Fog Index

The managers in this study all have at least four years of college, most in a technical area, and their work utilizes this education. Therefore, reports with a fog index of 16 or less, reading ease > 28 ("Readability Reqs," in the format (reading ease, fog index)), should be understandable and balance this COB. Based on a sample of reports some or all managers in DWTM receive, I calculated an average reading ease of 23.28, with the fog index of 13.50. Although reading ease is slightly below 28, the fog index of 13.50 indicates “who manages” should be able to understand most of the reports he receives. In this case, “who manages” writes with an reading ease of 20.03 and a fog index of

5 For each case, quoted descriptions of management system functions are taken from mission and function statements based on the January 1986 reorganization.
Figure 23. Case #1: Conditions of balance and results of measurement are shown.
18.24 ("Report Sample"), bringing down the reading ease of information supplied to others in DWTM. The information supplied to this manager is in line with his education level. However, his writing does circulate to others in DWTM, decreasing reading ease and raising the fog index for the information supplied. I conclude this COB is marginally balanced because this manager's writing reduces the average reading ease of DWTM materials.

Analysis of this COB will be similar for the DOE managers in this study, since they all have college degrees. I will mention what level each manager writes at, to suggest whether that manager adds to or detracts from the reading ease of DWTM materials.

Result: Reading ease of 20.03, fog index of 18.24

Conclusion: Marginally balanced

Information Portrayal Format

"Who manages" in Case #1 is an ISTJ personality type (MBTI). The sensing mode of perception suggests a preference for hard facts and data, i.e., tabular or spreadsheet data. The graph survey showed a preference for both spreadsheets and bar charts ("Info Pref"). This is not conflicting; Lucas (1981) found sensing types had high performance with both graphs and tabular data, while he found intuitive types scored lower when presented with tabular data and higher when presented with graphic data.

Based on the MBTI and graph survey, the balance at this COB can be improved by including bar charts in reports, where appropriate. Since spreadsheets are the only format currently provided ("Info Format"), I conclude this COB is marginally balanced.
Result: Prefers spreadsheets and bar charts

Conclusion: Marginally balanced

Amount of Information Supplied

For this COB, I compared how much information "who manages" receives to the preference revealed by the information use dimension of the DDSE. The last question on the graph survey asked whether too much, too little, or just the right amount of information is supplied. This "who manages" responded he receives too much information ("Amt Info Supplied"). The information use dimension of the DDSE classified this manager as a maximizer ("Min/Max User"). This COB is marginally balanced, since reducing the amount of information supplied to this manager will not likely suit his decision style.

Result: Too much information

Conclusion: Marginally balanced

Decision Style

This COB compares the manager's decision style to the organizational structure. I have classified all the organizations I'm considering in DOE to be machine bureaucracies, but with complex and dynamic environments. This structure is best suited for integrative and systemic decision styles ("Org Structure"). The decision style of "who manages" is integrative ("Decision Style"), with hierarchic backup. Assessing this COB in light of "who manages," I conclude it is balanced.

Result: Integrative, with hierarchic backup
Conclusion: Balanced

Interface Balance

I conclude this interface is marginally balanced. Only one of the COBs at this interface was balanced; the other three were marginally balanced. The combined effect of these marginally balanced COBs is not enough to throw the interface out-of-balance. For example, the presentation of information in spreadsheet format only, when this manager prefers both spreadsheets and bar charts, requires he work harder at analyzing the information. He is not likely to make poorer decisions than if presented bar charts or other graphs; he will likely just take more time to make his decisions.

Result: 1 COB balanced, 3 marginally balanced

Conclusion: Interface is marginally balanced.

5.2.2 Conditions of Balance for "Who Manages" versus "What Is Managed" (decision-to-action)

MBTI

The ISTJ manager in this case ("Personality Type") matches well with the sample of managers studied by Myers. Almost 15% of their studied managers were ISTJ’s, the second most frequently occurring type. The ST archetype prefers hard data and facts and uses an impersonal decision making process. This allows for objectivity in decision making and should make a good type for division managers in DWTM. ("Type Needed" will be various for all cases.) This COB is balanced.
Result: ISTJ

Conclusion: Balanced

DDSE

Organizations with complex and dynamic environments often demand quick decisions. The DDSE classified this manager as a maximizer on both dominant and backup styles (integrative with hierarchic backup). This implies slower decision making ("Decision Time"). Using these instrument results, this COB is out-of-balance, since this manager cannot be expected to act as an information satisficer ("Response Needed") when necessary.

Result: Maximizer

Conclusion: Out-of-balance

Maturity Style Match

The manager in this case uses mostly a participative leadership style, with some selling and some delegation ("Leadership Style"). However, based on the rating of several of his followers, he should use more delegation ("Follower Maturity"). He overleads his people; he should provide less support and guidance given he has accurately rated his people on the listed responsibilities. The value of P (points/objective) is 0.8, making this COB marginally out-of-balance.

Result: Participative style, P = 0.8

Conclusion: Marginally out-of-balance
Interface Balance

I conclude this interface is marginally out-of-balance. The MBTI is compatible with occupation, but the decision and leadership styles do not match "what is managed". The MBTI is the only condition keeping this interface from being out-of-balance.

Result: 1 COB balanced, 1 marginally out-of-balance, 1 out-of-balance

Conclusion: Interface is marginally out-of-balance.

5.2.3 Conditions of Balance for "What Is Managed" versus "What Is Used to Manage" (measurement-to-data)

Organization Structure

This COB will be the same for all GOAs in this study ("Org structure needed"). These organizations are machine bureaucracies ("Current Structure"), which assumes (according to Mintzberg, 1980) a simple and stable environment. The environment of these organizations is anything but simple and stable. It is complex and dynamic, responding quickly to the needs of Congress, managing complex and sensitive technologies, and all within a strict organizational hierarchy. The DOE organizational structure shares many attributes of Mintzberg's machine and professional bureaucracies. However, it needs the adhocracy's ability of responsive environmental interaction.

The organizational form needed is an machine bureaucracy combined with the flexibility to interact in its complex and dynamic environment. Design of an organizational form to best suit the work of these DOE divisions is beyond the scope of this research. However, deciding whether or not the current form creates balance at this condition should be based on a comparison of the current
structure to a "best" structure. In lieu of choosing a "best" structure, I based my conclusion for this COB on the following question: Does DOE's organization structure allow it and its members to be responsive to its complex and dynamic environment?

The very same system that creates a need for government and its bureaucracy — Congress, citizens — creates an environment that is both complex and dynamic. Bureaucracies typically respond slowly, often requiring approval up and down several levels before decisions are made and action taken. The organization structure must carefully balance its position in a large government hierarchy with the forces moving it toward a more responsive adhocracy.

I stop short of suggesting an organization structure. My task is to reach a conclusion about balance for this condition. I conclude the current machine bureaucracy matches the work undertaken, but does not match its environment. The structure does not allow its members to be as responsive to the environment as they should be. Constraints imposed by laws, regulations, and citizens (acting either individually or through elected officials) may never allow this COB to be fully balanced. I conclude this COB is marginally balanced.

Result: Machine bureaucracy, with dynamic and complex environment

Conclusion: Marginally balanced

Measurement Systems

"What is managed" consists of operations and projects ("Activities"). Four basic reports act as management tools ("Measures"): (1) monthly reports on projects, (2) milestones for operations, (3) milestones for construction, and (4) budget reports. Measurements provided by these reports match the structure and certainty of the projects being managed. Milestones would not be applicable to
activities lacking known durations, nor would they apply to simple, repetitive processes. This COB is therefore balanced.

Result: Milestones, budget reports

Conclusion: Balanced

Data Capture

"Who manages" receives many reports, memos, and other information ("Data Produced"), of which only a small part is needed. Not all information needed by "who manages" is contained in these reports. Verbal media supplied all of the desired data not contained in the reports delivered to this manager. This manager was able to track down missing information with a phone call, usually to the field offices. With "who manages" being able to retrieve all necessary data from "what is managed" ("Data Captured"), I conclude this COB is in balance.

Based on interviews with the DOE managers in my study, I found the managers in Case #2 and #3 had similar success in retrieving information necessary for decision making. Therefore, this COB will be balanced for all but one case.

Result: All necessary data retrieved

Conclusion: Balanced
Interface Balance

I conclude this interface is balanced. Two of the three COBs are in balance. The slight imbalance at the organization structure COB does not strongly affect the processes that capture data from "what is managed" and feed into "what is used to manage."

Result: 2 COBs balanced, 1 marginally balanced

Conclusion: Interface is balanced.

5.2.4 Management System Balance for Case #1

I conclude this management system is marginally balanced. The causes for this conclusion come partly from the decision-to-action interface between "who manages" and "what is managed," with response time being out-of-balance and leadership style not closely matching follower maturity. Of the 10 COBs, only 1 is out-of-balance and 1 marginally out-of-balance, with 4 balanced and 4 marginally balanced.

Another interface showing trouble is the information-portrayal-to-information-perception between "what is used to manage" and "who manages." This manager needs to simplify his writing to be in line with the educational background of his audience.

My definition of management system balance offered in Chapter 3 had two requirements. One was there be balance at all critical COBs. Critical COBs differ from one management system to another. Leadership style is critical, and marginally out-of-balance in this case. This manager prefers graphics, but is not supplied any. Therefore, not all critical COBs are balanced. The second requirement was the management system be successful overall, given balance for critical COBs and all three interfaces. This requirement covers those cases where all COBs are in balance, but the
management system is not successful. These cases, if and when they arise, provide the best test of this management system analysis. I claim a balanced system is a successful system, so when a system is balanced based on this analysis but is not successful, the procedure for reaching those conclusions of balance must be revised.

**Result:** 1 interface balanced, 1 marginally balanced, 1 marginally out-of-balance

**Conclusion:** Management system is marginally balanced.

### 5.3 Case #2

This case has as its domain the Waste Research and Development Division. Two professionals and a secretary work for the manager of this domain. "Who manages" is a male, 55, tactical-level manager. His division "supports implementation of Defense Programs responses to legislation and regulations governing treatment, storage, and disposal of hazardous wastes and restoration of inactive sites containing hazardous materials, and manages the Defense Programs Decontamination and Decommissioning Program."

Figure 25 on page 124 shows the MSM-2 with instrument results for Case #2. I'll now step through these results starting at the interface between "what is used to manage" and "who manages" (the information-portrayal-to-information-perception interface).
Figure 24. Case #2: Conditions of balance and results of measurement are shown.
5.3.1 Conditions of Balance for "What Is Used to Manage" versus "Who Manages" (information-portrayal-to-information-perception)

Reading Ease/Fog Index

In this case, "who manages" writes with a reading ease of 28.86 and a fog index of 16.52, which is very close to the requirements of DWTM managers, based on educational levels. His writing is below the average of DWTM materials, but it meets the requirements of his audience. The information supplied to this manager is in line with his education level. I conclude this COB is balanced.

Result: Reading ease of 28.86, fog index of 16.52

Conclusion: Balanced

Information Portrayal Format

"Who manages" in Case #2 is an ISTJ personality type (MBTI). The sensing mode of perception suggests a preference for hard facts and data, i.e., tabular or spreadsheet data. The graph survey showed a preference for both spreadsheets and bar charts.

Based on the MBTI and graph survey, the balance at this COB can be improved by including bar charts in reports, where appropriate. I conclude this COB is marginally balanced.

Result: Spreadsheets, bar charts

Conclusion: Marginally balanced

Chapter 5. Results of MSM Application
Amount of Information Supplied

For this COB, I compared how much information "who manages" receives to the preference revealed by the information use dimension of the DDSE. The last question on the graph survey asked whether too much, too little, or just the right amount of information is supplied. This "who manages" responded he receives too much information. The information use dimension of the DDSE classified this manager as a satisficer. This COB is therefore out-of-balance, and can be brought back in balance by supplying just the needed information.

Result: Too much information

Conclusion: Out-of-balance

Decision Style

This COB compares the manager's decision style to the organizational structure. I have classified all the organizations I'm considering in DOE to be machine bureaucracies, but with complex and dynamic environments. This structure is best suited for integrative and systemic decision styles. The dominant decision style of "who manages" is decisive, with an integrative backup. Driver (1983) says, in general, decisives are ill at ease in complex, unstable structures. Assessing this COB in light of "who manages," I conclude it is marginally balanced. The dominant decisive style would make it out-of-balance, but the integrative backup offsets the decisive.

Result: Decisive, with integrative backup

Conclusion: Marginally balanced
Interface Balance

I conclude this interface is marginally out-of-balance. “Who manages” is a satisficer but feels overrun with information. This information does not come in the form of graphics, a format he rated highly. His dominant decision style does not mesh with the organization.

Result: 1 COB balanced, 2 marginally balanced, 1 out-of-balance

Conclusion: Interface is marginally out-of-balance.

5.3.2 Conditions of Balance for “Who Manages” versus “What Is Managed” (decision-to-action)

MBTI

The ISTJ manager in this case matches well with the sample of managers studied by Myers. Almost 15% of their studied managers were ISTJ’s, the second most frequently occurring type. The ST archetype prefers hard data and facts and uses an impersonal decision making process. This allows for objectivity in decision making and should make a good type for managers. The preference for judging suggests quick decision making. This conclusion is supported by the DDSE’s classification of this manager as an information satisficer. This COB is therefore balanced.

Result: ISTJ

Conclusion: Balanced
**DDSE**

The DDSE classified this manager as decisive, a satisficer, for the dominant decision style, with integrative as backup. Using these instrument results, this COB is balanced. The manager can be expected to respond quickly to the demands of the organization and its environment.

*Result:* Satisficer

*Conclusion:* Balanced

**Maturity Style Match**

The manager in this case tends to overlead nonprofessionals by using a selling leadership style when participative or delegative is appropriate. However, for most of the listed objectives, this manager matched his style to follower maturity. When dealing with professionals, he tends to underlead, using participation where delegation could be used. Again, for most of the listed objectives for his professionals, this manager matched leadership style to follower maturity. He scored 7 points on 16 objectives, for a $P = 0.4375$, making this COB marginally balanced.

*Result:* Selling, participative, with $P = 0.4375$

*Conclusion:* Marginally balanced

**Interface Balance**

I find this interface in balance. The maturity style match is the only COB that wasn’t fully satisfied, but this does not throw the interface out-of-balance. The compatible decision style and personality type should work well with "what is managed," putting the manager’s decisions into action.
Result: 2 COBs balanced, 1 marginally balanced

Conclusion: Interface is balanced.

5.3.3 Conditions of Balance for "What Is Managed" versus "What Is Used to Manage" (measurement-to-data)

Organization Structure

See "Organization Structure" on page 119 for the discussion on this COB.

Result: Machine bureaucracy, with dynamic and complex environment

Conclusion: Marginally balanced

Measurement Systems

The manager in this case was still in his first month as division director of Waste R&D, having moved from the Hazardous Waste and Remedial Actions division. He described Waste R&D as more unstructured, less certain than what he managed in Hazardous Waste. Milestones do not apply to his new domain since the research programs defy specification of starting and completion times. This manager relies mostly on verbal media — via the telephone and face-to-face contact — to provide feedback on what he manages. He cited the lack of structure in communication systems (perhaps a formal organization structure that is too formal or an informal organization that is too weak) as a roadblock to feedback on performance of his management system. He also cited the unclear agendas of DWTM's upper management as adding uncertainty to an already uncertain management system. This COB is out-of-balance.
Result: Ad hoc, unclear, and lack of feedback

Conclusion: Out-of-balance

Data Capture

See "Data Capture" on page 121 for discussion of this COB.

Result: All necessary data retrieved

Conclusion: Balanced

Interface Balance

This interface is marginally out-of-balance. The primary reason for this is the manager's lack of experience in his current position. This results in an ad hoc measurement system that needs refinement before this interface will be in balance. His domain lacks the structure necessary for formal measurement systems, but steps can be taken to implement measurement systems that begin to put structure on his domain.

Result: 1 COB balanced, 1 marginally balanced, 1 out-of-balance

Conclusion: Interface is marginally out-of-balance.
5.3.4 Management System Balance for Case #2

I conclude this management system is marginally out-of-balance. This conclusion results from two interfaces that are marginally out-of-balance — the information portrayal-to-information perception between "what is used to manage" and "who manages" and the measurement-to-data between "what is managed" and "what is used to manage." Of the 10 COBs, 4 are balanced, 4 marginally balanced, and 2 are out-of-balance. My conclusion for this system is based more on how these COBs collectively produce balance or imbalance at the interfaces, than on their results alone.

This manager has a satisfying decision style, but receives too much information. Most of this information is not in the preferred format of graphics, but is in spreadsheet form. His decisive decision style does not fit well with the organization's complex and dynamic environment, but the integrative backup style kept this COB from complete imbalance.

Although I have concluded this management system to be marginally out-of-balance, this is not to imply that it is very close to being completely out-of-balance. This conclusion was made considering the other cases in this research (judged marginally balanced) and finding this case less balanced. The two out-of-balance COBs produced two marginally out-of-balance interfaces, making this management system less balanced than Case #1. I compared these cases to each other when drawing conclusions. As this work progresses, researchers can compare the management systems they're studying to those in previous research. This relative comparison process will help in refining the procedure of concluding balance for interfaces and management systems.

_result:_ 1 interface balanced, 2 marginally out-of-balance

_conclusion:_ Management system is marginally out-of-balance.
5.4 Case #3

This case has as its domain the Transportation Management Division. Five professionals and a secretary work for the manager of this domain. "Who manages" is a male, 47, tactical-level manager. His division "directs the DOE transportation R&D, Transportation Operations and Traffic Management, and Packaging Operations and Management Activities." Decommissioning Program.

Figure 26 on page 133 shows the MSM-2 with instrument results for Case #3. I'll now step through these results starting at the interface between "what is used to manage" and "who manages" (the information-portrayal-to-information-perception interface).

5.4.1 Conditions of Balance for "What Is Used to Manage" versus "Who Manages" (information-portrayal-to-information-perception)

Reading Ease/Fog Index

As discussed in Case #1, this COB is balanced. This manager writes with an reading ease of 42.38 and fog index of 13.08, supplying the easiest reading reports to DWTM, based on this study. Although he receives materials much below the level he writes at, his capability for understanding written reports is a function of his education and has no direct bearing on the balance of this condition. This COB is balanced.

Result: Reading ease of 42.38, fog index of 13.08
Figure 25. Case #3: Conditions of balance and results of measurement are shown.
Conclusion: Balanced

Information Portrayal Format

"Who manages" in Case #3 is an ENTJ personality type (MBTI). The intuitive mode of perception suggests a preference for summary reports and overviews, i.e., charts and graphs. The graph survey showed a strong preference for both spreadsheets and bar charts.

Based on the MBTI and graph survey, the balance at this COB can be improved by including bar charts in reports, where appropriate. The MBTI showed a preference for graphics. The graph survey showed preferences for spreadsheets and graphics. This manager receives his information in spreadsheet form. I conclude this COB is marginally balanced. It is not out-of-balance because he rated the spreadsheets highly.

Result: Spreadsheets, bar charts

Conclusion: Marginally balanced

Amount of Information Supplied

For this COB, I compared how much information "who manages" receives to the preference revealed by the information use dimension of the DDSE. The last question on the graph survey asked whether too much, too little, or just the right amount of information is supplied. This "who manages" responded he receives just enough information. The information use dimension of the DDSE classified this manager as a satisficer. This COB is therefore balanced; the manager receives just the right amount of information.
Result: Just enough information

Conclusion: Balanced

Decision Style

This COB compares the manager’s decision style to the organizational structure. I have classified all the organizations I’m considering in DOE to be machine bureaucracies, but with complex and dynamic environments. This structure is best suited for integrative and systemic decision styles. The decision style of “who manages” is flexible. The flexible style does not work as well in a complex environment, but this manager’s backup style, systemic, creates a fit with the organization. Assessing this COB in light of “who manages,” I conclude it is marginally balanced, since the manager’s backup style makes the fit.

Result: Flexible, with systemic backup

Conclusion: Marginally balanced

Interface Balance

This interface is marginally balanced. Two of the four COBs are balanced. The two marginally balanced COBs, information format and decision style, are enough to prevent me from classifying this interface as completely balanced.

Result: 2 COBs balanced, 2 marginally balanced.
Conclusion: Interface is marginally balanced.

5.4.2 Conditions of Balance for "Who Manages" versus "What Is Managed" (decision-to-action)

MBTI

The ENTJ manager in this case matches well with the sample of managers studied by Myers. Over 10% of their studied managers were ENTJ’s, the third most frequently occurring type. The NT archetype prefers summaries and overviews and uses an impersonal decision making process. ENTJ’s usually “rise to positions of responsibility and enjoy being executives” (Keirsey and Bates, 1984, p. 179). This COB is therefore balanced.

Result: ENTJ

Conclusion: Balanced

DDSE

The DDSE classified this manager as flexible, a satisficer for the dominant decision style, with systemic as backup. This is supported by his preference for judging (J), as measured by the MBTI. Using these instrument results, this COB is balanced. The manager can be expected to respond quickly to the demands of the organization and its environment.

Result: Satisficer
**Conclusion:** Balanced

**Maturity Style Match**

This manager matched his leadership style to follower maturity on nearly all objectives for 2 of the 3 people he completed the instrument for. He tends to overlead one of his people, using a participative style when the instrument prescribes a delegative style. He scored just 5 points on 13 objectives, for a $P = 0.3846$, making this COB marginally balanced.

**Result:** Participative, with $P = 0.3846$

**Conclusion:** Marginally balanced

**Interface Balance**

I find this interface in balance. The maturity style match is the only COB not fully satisfied, but this does not adversely affect this system. The compatible decision style and personality type should work well with "what is managed," putting the manager's decisions into action.

**Result:** 2 COBs balanced, 1 marginally balanced.

**Conclusion:** Interface is balanced.
5.4.3 Conditions of Balance for "What Is Managed" versus "What Is Used to Manage" (measurement-to-data)

Organization Structure

See "Organization Structure" on page 119 for the discussion on this COB.

Result: Machine bureaucracy, with dynamic and complex environment

Conclusion: Marginally balanced

Measurement Systems

This manager described his domain as dynamic and ambiguous. He spends a lot of his time fighting fires, making quick fixes, and practicing "ad hoc management." He makes no use of milestones, simply because there are so few projects they would apply to. This manager had been in his position as division director of Transportation Management for eight months. He recognizes the need to put more structure on what he manages, and is responding to this need with a Transportation Information Communication Center (TICC). This center would allow formulation of schedules and milestones where applicable, putting structure on those parts of "what is managed" where these apply.

I conclude this COB is marginally balanced. Establishment of the TICC would reduce some of the "seat-of-the-pants" management that keeps this COB from being balanced. This division will always require firefighting and quick fixes because of the nature of its business — transporting nuclear materials across state lines to safe repositories.
Result: "Seat-of-the-pants," with structure in the works

Conclusion: Marginally balanced

Data Capture

See “Data Capture” on page 121 for discussion of this COB.

Result: All necessary data retrieved

Conclusion: Balanced

Interface Balance

This interface is marginally balanced. Its balance can be improved by further action taken to put more structure into capturing data from "what is managed." This manager’s ad hoc measurement system needs refinement before this interface will be in balance. His domain lacks the structure necessary for formal measurement systems, but he is taking steps to implement measurement systems that begin to put structure on his domain.

Result: 1 COB balanced, 2 marginally balanced.

Conclusion: Interface is marginally balanced.
5.4.4 Management System Balance for Case #3

I found this management system to be marginally balanced. This system was more balanced than Case #1, having 5 COBs balanced, and 5 marginally balanced, with none either out-of-balance or marginally out-of-balance. This manager has a good fit with what he manages. Like the other cases, he would make use of bar charts and other graphics if they were provided. His measurement systems are progressing, but as of this study were only enough to provide marginal balance. This manager does not have any out-of-balance conditions, but balance or marginal balance on all the COBs justifies my conclusion for the management system, based on my definition.

Result: 1 interface balanced, 2 marginally balanced.

Conclusion: Management system is marginally balanced.

5.5 Case #4

This case has as its domain the Hazardous Waste and Remedial Actions division. This manager has several professionals at field sites reporting to him, as well as a secretary. "Who manages" is a male, 41, tactical-level manager. See Case #2 for a description of this division's responsibilities.

Figure 27 on page 142 shows the MSM-2 with instrument results for Case #4. I'll now step through these results starting at the interface between "what is used to manage" and "who manages" (the information-portrayal-to-information-perception interface).
Figure 26. Case #4: Conditions of balance and results of measurement are shown.
5.5.1 Conditions of Balance for “What Is Used to Manage” versus “Who Manages” (information-portrayal-to-information-perception)

Reading Ease/Fog Index

This manager writes with an reading ease of 13.97 and fog index of 20.46, not meeting the requirements of DWTM managers. His writing brings down the reading ease of DWTM materials, which have reading ease of 23.28 and fog index of 13.5. One person’s difficult writing cannot greatly affect the quality of division materials. This COB can only be out-of-balance if materials supplied are below the reading level of “who manages.” This COB is marginally balanced.

Result: Reading ease of 13.97, fog index of 20.46

Conclusion: Marginally balanced

Information Portrayal Format

“Who manages” in Case #4 is an INTP personality type (MBTI). The intuitive mode of perception suggests a preference for summary reports and overviews, i.e., charts and graphs. The graph survey supported this finding, showing strong preferences for graphs, and little for spreadsheets.

Based on the MBTI and graph survey, the balance at this COB can be improved by including bar charts and/or pie charts (and other types of graphics) in reports, where appropriate. I conclude this COB is out-of-balance.

Result: Bar charts, pie charts
**Conclusion:** Marginally out-of-balance

**Amount of Information Supplied**

For this COB, I compared how much information "who manages" receives to the preference revealed by the information use dimension of the DDSE. The last question on the graph survey asked whether too much, too little, or just the right amount of information is supplied. This "who manages" responded he receives too much information. The information use dimension of the DDSE classified this manager as a maximizer, with a satisficing backup style. With "who manages" classified as primarily a maximizer receiving too much information, and having a satisficing backup, this COB is marginally balanced.

**Result:** Too much information

**Conclusion:** Marginally balanced

**Decision Style**

This COB compares the manager's decision style to the organizational structure. I have classified all the organizations I'm considering in DOE to be machine bureaucracies, with complex and dynamic environments. This structure is best suited for integrative and systemic decision styles. The decision style of "who manages" is integrative, with decisive backup. The integrative style makes a good fit with the organization, balancing this COB.

**Result:** Integrative, with decisive backup

**Conclusion:** Balanced

Chapter 5. Results of MSM Application
**Interface Balance**

This interface is marginally balanced. This is mostly due to the type and amount of information from "what is used to manage." "Who manages" does not receive information in his preferred graphical formats. He is supplied too much information. His writing reduces the reading ease of division materials.

*Result:* 1 COB balanced, 2 marginally balanced, 1 out-of-balance

*Conclusion:* Interface is marginally balanced.

5.5.2 Conditions of Balance for "Who Manages" versus "What Is Managed" (decision-to-action)

**MBTI**

The INTP manager in this case is not representative of the sample of managers studied by Myers. Only 3.5% of their studied managers were INTP's, having an SSR of 0.60. The NT archetype prefers summaries and overviews and uses an impersonal decision making process. This allows for objectivity in decision making. The preference for perception may result in slower decisions, but these decisions will be more thought out. INTPs like the nonroutine, the theoretical, and scientific work. Considering this preference for perception and his attraction to nonroutine work, I conclude this COB is marginally balanced.

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6 An SSR (self-selection ratio) of 1.0 means the same percent exists in the general population.
**Result:** INTP

**Conclusion:** Marginally balanced

**DDSE**

The DDSE classified this manager as integrative, a maximizer, for the dominant decision style, with decisive as backup. This “who manages” will generally take longer to make decisions, but can compensate for this by using his backup decision style. His decisive backup style saves this COB from being entirely out-of-balance, and I conclude this COB is marginally out-of-balance.

**Result:** Maximizer

**Conclusion:** Marginally out-of-balance

**Maturity Style Match**

This manager’s followers require a combination of participative and delegative leadership. He matches his leadership style to follower maturity on most of their objectives, with P = 0.3333. This COB is marginally balanced.

**Result:** Participative, delegative, with P = 0.3333

**Conclusion:** Marginally balanced
Interface Balance

Considering the two marginally balanced COBs and the marginally out-of-balance one, I conclude this interface is marginally balanced. "Who manages" in this case had the best maturity style match \( (P = 0.3333) \), but his decision style and MBTI do not make the best fit with "what is managed."

Result: 2 COBs marginally balanced, 1 marginally out-of-balance

Conclusion: Interface is marginally balanced.

5.5.3 Conditions of Balance for "What Is Managed" versus "What Is Used to Manage" (measurement-to-data)

Organization Structure

See "Organization Structure" on page 119 for the discussion on this COB.

Result: Machine bureaucracy, with dynamic and complex environment

Conclusion: Marginally balanced

Measurement Systems

This manager provides project management support for 15-20 projects currently underway in the Hazardous Waste division. He therefore makes use of milestones, at least at the macro level, to control and influence the progress of projects. Daily contact with field office personnel provides current information on projects. Monthly reports formally communicate this information.
He does suffer from a lack of budget data. He receives the data via normal reporting routes, but can’t get the latest updates off his terminal. Coincidentally, this problem was being fixed during our interview. Until he becomes proficient at retrieving budget data from his terminal, I must conclude this COB is marginally out-of-balance.

**Result:** Milestones, but lacks budget data

**Conclusion:** Marginally out-of-balance

**Data Capture**

This COB is marginally balanced, because of the problems with measurement systems just discussed. “Who manages” is not getting all the information he wants, when he wants it. Based on my interview with this manager, once he is able to retrieve budget data efficiently from his terminal, he should then receive all data he needs in decision making.

**Result:** Not getting all information needed

**Conclusion:** Marginally balanced

**Interface Balance**

This interface is marginally out-of-balance, mostly due to the roadblocks in getting data from the system. The marginally out-of-balance measurement condition and the marginally balanced data capture condition create most of the imbalance for this measurement-to-data interface.

**Result:** 2 COBs marginally balanced, 1 marginally out-of-balance

Chapter 5. Results of MSM Application
**Conclusion:** Interface is marginally out-of-balance.

### 5.5.4 Management System Balance for Case #4

I conclude this management system is marginally out-of-balance. Of the 10 COBs, only 1 was balanced and 1 was out-of-balance, with 6 marginally balanced and 2 marginally out-of-balance. Two of the 3 interfaces were marginally balanced, with the other being marginally out-of-balance. The measurement-to-data interface is blocking the supply of good data to reach “who manages” through the management tools.

Another COB needing attention is the information format preference. This manager prefers graphics — bar charts, pie charts, and probably other types of graphics not tested — yet he receives his information in spreadsheet form. His leadership style, however, is the closest to being balanced of the four cases presented.

**Result:** 2 interfaces marginally balanced, 1 marginally out-of-balance

**Conclusion:** Management system is marginally out-of-balance.

### 5.6 Chapter Summary

Results of the MSM application were summarized for the cases studied. See Figure 28 on page 150 for a summary of the conclusions reached for each case. Two of the cases were found marginally balanced, with the other two being marginally out-of-balance. Several conditions of balance exposed some common problems. For information portrayal, satisficers should receive only the
information they need for decision making. The lack of graphs created out-of-balance and marginally balanced conditions since all surveyed managers preferred graphs for their decision making. Properly satisfying these information needs will improve balance for the information portrayal-to-information perception interface. Lucas (1981) found intuitives perform better when supplied graphics, but found sensing types perform equally well with either tabular or graphic formats. My research supports Lucas' findings. The two ST's and one NT in my study preferred both spreadsheets and bar charts, and the other NT manager preferred bar and pie charts, but not spreadsheets. This was the only interface not completely balanced for any of the cases.

Measurement systems created problems in the more uncertain domains. One manager in my study had begun steps to put structure on his relatively uncertain and ambiguous management system. Others should follow suit and improve the quality and frequency of feedback on system performance, where possible.

The instruments used at the decision-to-action interface showed good fit between "who manages" and "what is managed" for two of the cases. The manager in the other case did not have a good match between leadership style and follower maturity.

The conclusions from the MSM application bear implications for this research. These implications, the value of this research, and suggestions for further research are the subject of the final chapter.
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<td><strong>Management System</strong></td>
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**Figure 27.** Results Summary by Case: A quick read on balance conclusions. (Legend: B = balanced, MB = marginally balanced, MOOB = marginally out-of-balance, OOB = out-of-balance)
Chapter 6. Discussion and Conclusion

6.1 Introduction

This chapter places the MSM application in perspective. I describe how this research accomplished its objectives. I discuss limitations of the study and generality of the findings. I make suggestions for further research, and comment on the value of this research.

6.2 Discussion of Results

The results and conclusions I reached in Chapter 5 can only be as good as the conditions of balance and instruments used to assess them. This is a first-cut at defining management system balance. I stated earlier my focus is on the process of instrument development, with less emphasis on the results of the MSM application. One of the long-range objectives of the research I’ve begun is to reach the point where we can take quantitative measurements (or reduce qualitative measures into quantitative ones), plug them into equations of balance, and draw conclusions based on the result. We can’t do that now. Several iterations of my research are needed to provide a better definition of balance through specification of COBs and selection or development of instruments to assess
them. Once the management system analysis is refined through better conditions of balance and instruments, more confidence can be put in the conclusions. The emphasis can then shift from process to results and conclusions.

6.2.1 Transitory Management Systems

While I have not resolved the problem of analyzing balance for stable systems versus those in transition, I acknowledge this as a continuing research issue. I present two possible ways to begin resolving this issue. One is to consider the mechanical analogy of blocks and dashpots. Another is realizing out-of-balance is sometimes a good thing. I now briefly discuss these ideas.

Mechanical Analogy

I can describe balance for management systems based on a mechanical analogy. Consider a lumped parameter system of three objects linked by dashpots. This system exists at a certain energy level and let’s assume it’s stable. When one of these blocks or dashpots is perturbed, the system reacts by trying to absorb the input energy. There are four possible and mutually exclusive outcomes of this perturbation: (1) the system stabilizes at a higher state, (2) the system stabilizes at the same state, (3) the system stabilizes at a lower state, or (4) the system goes out-of-control.

The first outcome is desired for our management system. Stability at a higher state means the system regained balance at a higher (and more mature) level. The second outcome means the management system did not change for the better, but did regain balance. The third outcome means the system changed for the worse, but did regain balance. If change causes the management system to go out-of-control, one or more of the system components was not ready for the change.
Good and Bad Out-of-Balance

Successful change must be (1) for the better, and (2) manager-oriented. The manager must have the ability and willingness to make the change, and “what is managed” must be prepared. When change is for the better, manager-oriented, and “what is managed” is prepared for the change, the management system will likely stabilize at the same or higher level. This type of change creates out-of-balance that is good, since the system will stabilize at the same or an improved state.

If change causes the management system to go out-of-control or stabilize at a lower level, the change created bad out-of-balance. Change that is not manager-oriented, or for the better, or if “what is managed” is not prepared for the change, will probably cause the management system to go out-of-balance and remain out-of-balance. This change is bad because the system is not ready for it. If “what is managed” changes or the environment changes, the manager must react and tame the effect of the change on his management system. If the tools cause imbalance, the manager does not receive the information he needs to make decisions, or he receives bad information and makes poor decisions. This state of imbalance is undesirable.

We need to know when out-of-balance is good and when it is bad. We need to know what kinds of changes create good and bad out-of-balance. This knowledge will help in properly classifying management systems as they undergo change. As these ideas on management systems in transition mature, and as new ideas are added, they should be incorporated into the management system analysis.

6.2.2 Sharing Results and Conclusions

I did not share my conclusions with the participating managers, though I did share the results (e.g., decision style, graph survey, maturity style match). Sharing conclusions on management system balance with the managers participating in my research may be unwise at this point. Telling a
manager his system is out-of-balance can be dysfunctional and impair later research efforts. Sharing of conclusions should take place when a high level of confidence exists for those conclusions. Then we can tell a manager his or her system is out-of-balance, having confidence in that conclusion and offering suggestions for balancing the system.

There should be no problem in sharing results of individual instruments, such as the MBTI, DDSE, Maturity Style Match, and the graph survey. These instruments furnish information that has less potential for damage. Personality types, decision styles, leadership styles, and information portrayal preferences are not as sensitive as conclusions on management system balance. The balance conclusions are more subjective than the instrument results. Progression of this research to a more quantitative phase will make the process of reaching conclusions more objective.

6.3 Value of This Research

6.3.1 As Exploratory Research

Earlier, I referred to this work as exploratory research, meaning I would not test hypotheses, but would observe management system behavior, compare against a priori personal judgments, and draw implications. Three assumptions, in particular, do not apply to exploratory research (as discussed in "Classifying the Research" on page 103):

1. The problem is clearly defined and the task is merely to obtain detailed elaborating or supporting information.
2. The essential causal relationships are known and agreed upon.
3. Critical variables and interrelationships can be quantitatively reduced and manipulated.

(Delbecq, Van de Ven, and Gustafson, 1975, p. 109).

The value of this exploratory research is in the formulation of objectives, the development of qualitative models to explore cause-and-effect relationships, and in its direction and background for
later research. My work should move the MSM application closer to the point where it can be used in confirmatory studies.

6.3.2 In Accomplishment of Research Objectives

For research to be useful, it should accomplish what it sets out to do. Below, I list my objectives and state how I believe each one was satisfied.

Objective #1: Develop a preliminary set of instruments to characterize management systems.

The MSM-2 (Figure 23 on page 109) shows the culmination of my work on this objective. These instruments operationalize the application of the MSM to real-world organizations. My work is indeed preliminary. With the thousands of instruments available, it is likely another person could formulate conditions of balance with no overlap. This objective could be better accomplished with the help of professional certification, opening the door to nearly any instrument. Professional certification would improve the value of this research, but limit use of the MSM application process to those with the proper certification.

Objective #2: Define and describe management system balance in terms of measured characteristics.

In Chapter 3, I offered my definitions of balance for COBs, for interfaces, and for management systems. Assessing COBs with various instruments supplied data used in concluding balance for the management systems involved in my study. These balance conclusions are contingent on the quality of the conditions of balance used and on the instruments used to assess those conditions. The evolutionary process of revising and improving COBs and applying the improved MSM to
domains of responsibility should increase the quality of resulting balance conclusions. The logic behind my MSM application was detailed earlier, telling how I proceed from identification of component characteristics to conclusions on management system balance. Implementing this logic in several case studies gives the researcher balance conclusions based on measured characteristics.

*Objective #3: Observe management system behavior, compare against personal judgments, and draw implications.*

I observed management system behavior through my application of the MSM to GOAs. COBs supplied information on contributors to interface balance. I analyzed these observations not through formal statistical tests, but against a priori personal judgments. These "personal" judgments often formed from studies used to norm the instruments used in my research (e.g., Myers and McCaulley, 1985, published extensive experimental data relating MBTI types to occupation), and from knowledge of the instruments used and organizations studied. I then drew implications on this comparison of observations to personal judgments in the form of conclusions on conditions of balance. The aggregation of these COBs led to conclusions on management system balance.

This objective should evolve with the research to reflect the movement toward confirmatory studies. As later research investigates known variables and mathematically models cause-and-effect relationships, hypotheses can be tested through experimentation. Experimental results can be compared to the hypotheses, and conclusions drawn. Nonparametric statistical tests may prove useful here.
6.4 Generality of findings

One of the ultimate objectives of my line of research is to define a set of measurements useful for analyzing any management system. This job can be made easier by designing the research so it can be generalizable to other organizations. Very little has been done to aid the researcher in generalizing across settings. Setting generalization is nonexistent in most statistical texts. Hammond (1986) refers to the "double standard of induction" that plagues behavioral science research. The double standard of induction is high standards for generalization across subjects and no standards for generalization across settings. I provided detail of my operational context and chose organizations to study with the objective of making conclusions generalizable to other similar management systems. Future research should investigate the generality of my findings.

6.5 Suggestions for Further Research

6.5.1 Correlate variance in balance to actual performance of system.

I reached conclusions about management system balance, but did not compare the variance in these conclusions to actual system performance. Performance measurement indicators will provide a standard of comparison to help in evaluating the quality of balance conclusions as reached using management system analysis. Later research should correlate variance in balance to actual system performance.
6.5.2 Need a more efficient data collection scheme.

My one-on-one approach with DOE managers helped preserve and develop positive attitudes toward the use of psychological assessment measures. It did, however, require more time than a group administration of instruments. A nearly ideal data collection scheme would be a workshop where the exercises consist of research instruments. The benefits of participating in such a workshop would have to be clearly spelled out and sold to the managers.

This workshop has several advantages. First, it provides motivation to complete the exercises. Second, it creates a more controlled and centralized data collection environment. Third, a workshop creates an environment where participants can discuss feedback results with their peers. The major drawback to this idea, as with any workshop, is the logistical problem of getting all the right people together at the same time. Other problems are the development of workshop materials and the costs involved.

6.5.3 Investigate generality of findings.

One way to check the generality of my findings is to apply the MSM to other GOAs and see if the conditions of balance lead to plausible conclusions about those GOAs. The MSM can also be applied to private organizations to see if my findings generalize outside the public domain. Should my findings not be generalizable, one of two conclusions is possible: (1) the findings hold only for the specific GOAs studied, (2) the conditions of balance need to be revised to reflect characteristics common to organizations to be studied.
6.5.4 Try other instruments.

There are literally thousands of instruments to choose from. My instrument selection represents just one small group of assessment measures. Others, such as those listed in "Appendix D. Instruments Not Used" on page 182 may be applicable as the research continues. The library, professionals, and professors are good sources of information on instruments.

6.5.5 Measure management system balance, over time.

While looking at the summary of balance conclusions for the cases in this study, out of curiosity, I tried to rank each case relative to each other. I then performed a relative ranking process where I assigned "1" to the most balanced of the group, down to "4" for the least balanced of the group. This was done by eyeballing the data. I wanted to put some structure on this process so it could be repeated by others, and so I could check my management system balance conclusions for accuracy. I developed a heuristic for performing this relative ranking.

I summarized the number of Bs, MBs, MOOBs, and OOBs for each case for both the COBs and the interfaces. I assigned values as follows: $B = 4$, $MB = 3$, $MOOB = 2$, and $OOB = 1$. Since interface conclusions are based on three or four COBs, they should carry more weight than individual COB conclusions. I used a multiplier of "3" for interfaces, and unity for COBs. So the equation for the ranking score ($RS$) is:

$$RS = 4(3I + COB)_B + 3(3I + COB)_MB + 2(3I + COB)_MOOB + 1(3I + COB)_OOB$$

The scores for the four cases are: Case #1 — 58, Case #2 — 54, Case #3 — 65, and Case #4 — 51. These scores support the earlier intuitive ranking process, with higher scores representing greater balance. This is interesting, but not necessarily meaningful. Comparison among several management systems is not very useful because of the uniqueness of each system. I suggest this heuristic
be used on the same management system over several years to see if the score indicates improvement. I did not have the proper data nor the time in this study to perform this exercise.

6.5.6 Check for information gaps.

The "data capture" COB was based on personal interviews with DOE managers. None of these managers could think of information they need, but cannot obtain. A comprehensive questionnaire should be designed and used to check for information these managers want, but never knew they wanted.

6.5.7 Update reading level scale.

Flesch and Gunning did their reading level research in the late fifties and early sixties. The popular reading materials they used to compare writings were The Atlantic Monthly, Harper's, Saturday Evening Post, and others. Also, in the twenty-five years that have passed, the writing styles and reading levels most likely have changed across the board — for magazines, newspapers, novels, etc. Men and women of the eighties read Newsweek, Rolling Stone, People, Enquirer, BusinessWeek, USA Today, for example. An updated reading level scale based on analyses of these and other popular reading materials will provide more meaningful standards of comparison.

6.5.8 Conduct research on narrower pieces.

My research covered many aspects of the management process, using the concept of management systems. Previous researchers have focused on areas that correspond to just one of my conditions of balance. For example, theses and dissertations have been written on the performance of decision makers under varying information portrayal formats. When a researcher introduces a new instru-
ment, he or she supplies specific conclusions regarding the measured constructs. These conclusions are usually at the level of my conditions of balance.

With research as broad as mine, depth was limited. I was more concerned with the process of selecting and developing instruments to apply the MSM to organizations than I was with the results of that application. Jenkins (1983) undertook a broad line of research, but he basically studied the information-portrayal-to-information-perception interface. My research supplies a broad base for further studies of more limited scope on any of the three components or interfaces. With the extensive literature cited in this work, later researchers can devote more time to correlational studies and experiments and spend less time digging up what has already been done.

6.5.9 Examine instrument correlations.

When measurement of several constructs is required, very often more than one instrument will measure the same construct. Follow-on research should use mine and other data to investigate correlation between similar constructs. For example, I would expect the judging construct of the MBTI to be correlated to Driver's satisficer and the perceptive correlated to the maximizer. Correlation studies may uncover subtle differences between seemingly similar measures, and may help in arriving at better, more refined COBs.

6.6 Chapter Summary

Research objectives were accomplished by (1) developing a preliminary set of instruments to characterize management systems, (2) defining and describing management system balance in terms of measured characteristics, and (3) by observing management system behavior, comparing against
judgments, and drawing implications. Generalizability of my results can be checked by applying the MSM to other similar organizations and comparing the two sets of results. If similar settings produce similar conclusions, then my study has setting generality. I offer nine suggestions for further research: (1) correlate variance in balance to actual performance of system, (2) use a more efficient data collection scheme, (3) investigate generality of findings, (4) try other instruments, (5) measure management system balance, over time, (6) check for information gaps, (7) update reading level scales, (8) conduct research on narrower pieces, and (9) examine instrument correlations.
References


Appendix A. Research Methods for "Who Manages"

Using the Wall Street Journal's classified "Job Mart" found in Tuesday editions, the advertisements were scanned for high-level managerial positions. These positions were commonly referred to as CEO, CFO, COO, President, Executive VP, and some top-level managers. A list of adjectives describing the requirements for the position was compiled. The jobs were predominantly with the private sector.

A.1 Characterizing "Who Manages"

A variation of Glaser's constant comparative method for qualitative model building (Glaser, 1965) was employed to categorize the dimensions of "who manages." The Wall Street Journal's Job Mart (appearing each Tuesday) was used as the database. Specifically, our database was built using descriptors for desired applicants for high-level managerial positions such as CEO, COO, CFO, president, executive vice-president, and top-level managers. Positions in industry accounted for most of these ads used in the database, simply because of the few ads for public sector positions. The assumption I have made is that the characteristics of "who manages" at strategic levels between government and industrial positions do not vary significantly. This assumption can be checked
with a database of government jobs. I claim that the primary difference between government and industrial organizations is in "what is managed."

Using the constant comparative method, I placed each adjective or descriptive phrase from the Job Mart into a list based upon the adjective's relation to the previous item that was placed there. For example, I compared the third item is compared to the second item in my database. If the third item was different than the second, I compared it to the first item. If the third item was related to the first, I added it to the list containing the first item. If when I compared the third item to the second item I found a relation, I would have placed it in the list containing the second item. If the third item did not fit into any existing list, then I would a new list with this item. This process continued until all items were exhausted. For the next step I checked each list to be sure each item was in the proper list. I moved items between lists in this cleanup phase. I named each list based upon the contents of the group. Unlike traditional methods of grouping, list naming here was done after categorization.

I generated three lists using this method. These lists represent categories, and I have named them: history, cognitive style, and human characteristics. History includes subcategories such as experience, education, and recognition (track record and professional certifications). Cognitive style includes analytical and organizational skills. I subcategorized human characteristics as personal or interpersonal and included sub-subcategories of ambition, age, communication skills, and diplomacy.

History
Experience
hands-on
supervisory
multi-national
Education
degree

Appendix A. Research Methods for "Who Manages"
field (technical expertise)
which school
class rank, grades
Recognition
proven, successful track record
professional certifications (e.g., PE, CPA, JD)

Cognitive Style
analytical skills
financial skills
planning skills
intelligent
conceptual thinker
integrative
problem solving ability
controlling skills
ability to organize information

Human Characteristics
internal
subjective
ambition
risk-taker
dogmatic
drive
ambition
quick mind
leadership ability
aggressive
innovative
managerial responsibility
energy
integrity
judgment
dedication
commitment
innovative
timeliness
assertive
tactful
entrepreneurial
creative
adaptable
flexible
organized
ability to motivate
dynamic
self-starter (self-reliant)
visionary
action-oriented, results-minded
goal-oriented, objectives-oriented
hard worker
fast tracker
sense of urgency
serious personality
competitive
resourceful
capable of making decisions
able to meet challenges
maturity
Demographic
age
sex
marital status
race
socioeconomic status
height
weight
External
communication skills
oral
written
foreign languages
presentation
present complex information clearly
conciseness
interfacing skills with upper and lower levels of management
skills of manipulation
persuasion
negotiating skills
diplomacy
social characteristics
good appearance
pleasant personality
Appendix B. Characteristics of Government
Oversight Agencies

Viewing government organizations as information processors, I will first summarize several distinct
differences between government and industrial management. I selected a federal government or-
ganization at the deputy assistant secretary level. I will discuss the organization only in terms of its
characteristics. From my experience, I believe the characteristics I will discuss represent most
government oversight agencies.

B.1 Government Managers Have Special Needs for
Management Tools.

I find organizations with widely varying responsibilities in the public sector. Government organ-
izations range from oversight agencies (close to the legislative bodies to which they correspond) to
field agencies and public works functions (close to the provision of services to the public). Most
government organizations, in my experience, are oversight agencies who manage information rather
than physical things. The physical things are mostly contracted out and the oversight agency
oversees the formulation and execution of the contract. Public works functions are the "doers" in
government, "street-level" bureaucrats in Lipsky’s (1971) terms, although they still can be partially viewed as information processors. I will consider government organizations as oversight agencies and argue that the management tools these agencies use should reflect an information processing orientation. For these organizations, the MIS embodies their very function.

Government management systems are concerned with more ill-defined pursuits. See "Framework #3: The Pursuits" on page 15. Emergency management is an example of a perplexity. Because there is no clear corporate benefit to be gained by managing emergencies, highly speculative research, or research for programs susceptible to public whims, these needed but ill-defined pursuits fall to government agencies.

Industrial managers are often criticized for fighting brush fires and lacking forward thinking. Government managers spend even more time both in fighting fires, and in developing plans. Government is marked by more changes and restrictions. They deal with things that industry doesn’t touch, e.g., disasters, poverty, and social reform. By the nature of managing ill-defined pursuits, brush fires occur more often in government because even the best plans, policies, and procedures can foresee only so far. Much time is also spent in routine paperwork communicating and supplying the information needs throughout the government hierarchy.

Government managers are more attentive to consistency, fairness, and accountability. For example, when administering disaster aid, the amount Virginia gets for flood aid and the amount Missouri gets for toxic waste clean-up should both be considered "fair." Those who make these decisions are held accountable, and they must provide good reasons for their actions. Hence, the need exists for reliable and timely information in government. Private industry operates differently. Decisions are made with more thought to profit and less thought to equity. Accountability is often sketchy, if at all possible to track. Defense contractors are concerned with making money by making weapons. The government’s purpose in making weapons is to protect the country.
Data and information that pass through the many different levels of government hierarchy go through aggregation and summarization at each level. This tosses in the biases of those doing the aggregating and summarizing and causes each subsequent information release to be slightly different from the previous one. After passing through many levels, the resulting information is likely to vary substantially from the original information. For example, a letter from a deputy assistant secretary to a Congressman may be written by someone who is many levels below the deputy assistant secretary. This person is accountable to the deputy assistant secretary and not to the Congressman, and will write the letter more so to satisfy his boss’s evaluation. He will not focus on the fact that the Congressman is the audience of the letter.

Besides being bogged down in internal communication, government organizations are subject to media and public scrutiny. Agencies in the public sector are, more than their private-sector counterparts, visible to the public and to special interest groups who wish to interpret any data about the agency according to their own perspective (bias) and hold the resulting information up for scrutiny. The public has an interest in and a right to know about the activities of the agencies they support. They exercise this right through requests for information by which they scrutinize and evaluate the government.

Many government agencies apply high technology in an open society. With any modern high technology solution, some technical expert will disagree. The burden to prove or disprove the challenge falls solely on the agency; citizens who challenge an agency’s action have to prove nothing. The media have greater access to government than to private affairs, and their public has a broader interest in government affairs of which they are all a part than in industrial affairs of which only a few are a part.

High scrutiny highlights any problems with inconsistencies or conflicts among data. The result is a greater need for structured, verifiable, repeatable data-to-information chains and logic for decision making. With this kind of scrutiny and visibility, some government managers are concerned about protecting that data which they believe could be subject to improper interpretation. Government
oversight agencies tend to protect their data to minimize the number of requests for information or actions resulting from seeing inappropriate data. The real issue here is managing the repeatability of data. They work hard to ensure that requested data is presented clearly and properly for consistent interpretation.

Leadership turnover is a problem that affects the public sector even harder than the private sector. Consider for example that the average length of service for an Assistant Secretary in the Department of Energy is 15-18 months. Both sectors share managerial changes due to family considerations and professional appointments. Government management is additionally affected by elections, reductions in force, and transfers between agencies, especially at the higher levels. The greatest problem that results from this turnover is a lack of continuity in planning.

In the private sector, cost-benefit analyses provide rational justification for allocation of resources for new technologies. In the public sector, legislative bodies do not like to allocate for large procurements of management tools that will be replaced in a couple of years. Cost estimates are easily derived; it is the determination of benefit that poses problems for government cost-benefit analyses. How do we measure the satisfaction of the public? Contrast this with industry’s relatively easier task of putting dollar amounts on the selling price of an improved product or service. The government manager needs to see far enough into the future to be able to secure tools that will endure technological change.
B.2 Government Managers Must Organize to Manage Information

Government organizations having information as their product should structure themselves accordingly and function as information processors. Galbraith (1973) and Knight and McDaniel (1979) support this in a more general sense, claiming all organizations are information processors. They claim organizations should therefore design structures to facilitate the information processing function. Even though many government agencies are not largely responsible for the initiation or termination of information, they are responsible for verifying, adjusting, updating, and interpreting information.
Appendix C. Reading Ease and Fog Index Heuristics

C.1 Flesch's Reading Ease

Flesch provides a heuristic for testing samples of writing (Flesch, 1960, pp. 298-304), and has a taxonomy for classifying writings based on their reading ease scores. The heuristic for reading ease is as follows.

1. Select samples. Flesch suggests 100-word samples be chosen randomly. Use 3-5 samples for an article; longer documents will require more samples. Words are defined by Flesch to be all character strings delimited by white space. For example, C.O.D. is one word; don’t is one word. For small pieces of writing, use the entire piece for analysis.

2. Figure average sentence length (ASL). Count a sentence for each period, exclamation point, question mark, semicolon, and colon encountered. Divide number of words in sample (here, 100) by number of sentences in sample and round to nearest whole number. This is your average sentence length.

3. Figure average word length. Count all syllables in the 100-word sample. Leave this figure in units of syllables per 100 words. I use SYL for the variable representing syllables per 100 words.
4. Calculate reading ease score.

\[
\text{Reading Ease} = 206.835 - 1.015(\text{ASL}) - 0.846(\text{SYL})
\]

C.2 Gunning's Fog Index

Gunning's fog index (1952, pp. 36-39) differs from Flesch's reading ease by not counting proper nouns. I used both heuristics on samples of writing and found they correlated at -0.591. The fog index is calculated as follows:

1. Choose a sample of 100 words or more.

2. Divide the number of words by the number of sentences to find the average number of words in a sentence.

3. Count the words of three or more syllables. Do not count proper nouns or figures (e.g., 16,752). Divide the total by the number of words in the sample. This gives the percent of difficult words in the sample.

4. Add the average number of words in a sentence to the percent of difficult words.

5. Multiply the resulting total from step 4 by 0.4. This will give you the fog index for the sample.

The conversion factor is designed to equate ease of reading with years of schooling; an index of 12, for example, means the material should be easily read by anyone with a high school education.

The following table combines Flesch's reading ease and Gunning's fog index and gives representative examples of reading materials.
<table>
<thead>
<tr>
<th>Reading Ease Score</th>
<th>Fog Index</th>
<th>Description of Style</th>
<th>Typical Magazine</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 to 100</td>
<td>5</td>
<td>very easy</td>
<td>comics</td>
</tr>
<tr>
<td>80 to 90</td>
<td>6</td>
<td>easy</td>
<td>pulp fiction</td>
</tr>
<tr>
<td>70 to 80</td>
<td>8</td>
<td>fairly easy</td>
<td>slick fiction</td>
</tr>
<tr>
<td>60 to 70</td>
<td>9</td>
<td>standard</td>
<td>digests, <em>Time</em></td>
</tr>
<tr>
<td>50 to 60</td>
<td>10</td>
<td>fairly difficult</td>
<td><em>Harper's, Atlantic</em></td>
</tr>
<tr>
<td>30 to 50</td>
<td>13</td>
<td>difficult</td>
<td>academic, scholarly</td>
</tr>
<tr>
<td>0 to 30</td>
<td>19</td>
<td>very difficult</td>
<td>scientific, professional</td>
</tr>
</tbody>
</table>
Appendix D. Instruments Not Used

Following are short descriptions of instruments I considered for my research but did not use. I supply this information to let the reader see what the alternatives were. This list may be useful to later researchers interested in investigating the utility of some of these instruments.

I used several sources to locate and select psychological instruments for this research: *Tests* (Sweetland and Keyser, 1983 and 1984), *Directory of Unpublished Experimental Mental Measures* (Goldman and Busch, 1978), instrument publisher catalogs, literature review, and consultation with professors and other professionals.

**Embedded Figures Test (EFT)**

The EFT assesses cognitive style in perceptual tasks. It measures cognitive style in terms of field dependence/field independence, which tells whether the subject relies more on internal or external referents. I did not use the EFT because the MBTI’s extraversion-introversion factor measures nearly the same construct.

**Rod-and-Frame**

The rod-and-frame tests the cognitive style dimension of field dependence/field independence, as does the EFT. I did not use rod-and-frame for the same reasons I did not use the EFT. An additional reason I did not use the rod-and-frame is that it requires expensive lab equipment. The
EFT shares close validity to rod-and-frame. Had I wished to measure field dependence/field independence I could have used the relatively inexpensive EFT and achieved very good results.

Ambiguity Tolerance (AT-20)

The AT-20 tests for tolerance of ambiguity. Using twenty true/false items, the AT-20 results in a score between 0 and 20. This would be useful for matching the manager to "what is managed." The AT-20 is not listed in any of the tests or measurements references, and to my knowledge, has only been used in research with undergraduate students. I have not found other papers (besides the author of the instrument) that reference the AT-20. Since my conceptual framework is more concerned with uncertainty rather than ambiguity, I decided not to use the AT-20.

Organizational Health Survey (OHS)

The OHS uncovers managers' attitudes about the organization. Constructs measured are: productivity, leadership, organization structure, communication, conflict management, participation, human resource management, and creativity. This instrument appears to be somewhat useful for assessing management systems on the whole. I did not consider the OHS because of the limited amount of subjects' time and because I wanted to limit instruments to assessing conditions of balance between the components. Later research may wish to use the OHS to check entire management system balance.

X-Y-Z Inventory

The X-Y-Z Inventory exposes underlying managerial assumptions in terms of theories X, Y, and Z. While this instrument could supply data on management style, it does not reflect the situational aspects of managing, as does the Maturity Style Match Instrument.
Minnesota Multi-Phasic Personality Inventory (MMPI)

The MMPI assesses individual personality in clinical diagnosis and in psychopathological research. Ten constructs are measured: hypochondriasis, depression, hysteria, psychopathic-deviate, masculinity-femininity, paranoia, psychasthenia, schizophrenia, hypomania, and social introversion. These constructs are too clinical and do not supply practical results usable in my research.

Adjective Check List (ACL)

The ACL describes self and relations with others. It measures 37 personality dimensions on a variety of scales. I did not use the ACL because it requires professional certification. A second reason for not using the ACL is the difficulty in interpreting the subjective data produced.

California Psychological Inventory (CPI)

The CPI assesses normal adult personality as an aid to educational, clinical, counseling, and vocational guidance. Constructs measured are socially desirable behavioral tendencies such as sociability, dominance, social presence, and others. Like the MMPI, the CPI offers data on clinical constructs, and most of its results are not useful to me.

Sixteen Personality Factors (16PF)

The 16PF evaluates the normal adult personality. It’s used in clinical evaluations, personnel selection and placement, and in vocational and educational guidance. Again, like the MMPI and the CPI, 16PF offers mostly clinical results. Although it does supply some usable information, I found other instruments to be more efficient in terms of data collection.
Executive Profile Survey (EPS)

The EPS compares subjects to a database of 2,000 upper-level managers. EPS measures "11 distinct personal qualities common to successful business executives," according to information supplied by its publisher. These qualities include ambition, creativity, perceptiveness, and adaptability. The EPS would be a good instrument for assessing "who manages," but I found the information supplied by the MBTI and DDSE to be more immediately useful, and the MBTI has proven its validity much more so than EPS.

Survey of Organizations (SOO)

SOO measures perceptions of organizational behavior and evaluates employee attitudes and morale. The survey focuses on organizational and group functioning. Since I am more interested in assessing the interfaces between the MSM components than the entire management system, I did not use SOO.

Management Appraisal Survey (MAS)

The MAS assesses an individual's style of management from the subordinate's view. This survey is based on the Blake-Mouton managerial grid. Because of the time constraint, I did not choose any instruments that assessed qualities of subordinates.

The Decision Making Inventory (DMI)

The DMI identifies an individual's preferred decision making style. Having already been familiar with Driver's Decision Style Exercise and read about its use in several papers, I did not judge the DMI to be better than DDSE.
Problem-Solving Decision-Making Style Inventory — Self/Other

This inventory, developed by Hersey and Natemeyer, evaluates individual problem solving and decision making styles for management training and organizational development. The constructs measured are directive and supportive behavior, part of the Situational Leadership Theory. This 12-item instrument results in a profile that is discussed with an associate. The results of this instrument would not give me useful information in determining the state of balance of the management system, nor do I believe a test can capture decision style in 12 items.

Interpersonal Checklist

The Interpersonal Checklist measures self-concept. Constructs measured relate to personality type: managerial/autocratic, competitive/narcissistic, rebellious/distrustful. Responses result in scores for two factors: dominance and love. These factors are similar to Hersey and Blanchard's directive and supportive behavior, respectively. Validity for this instrument was not acceptable for males, and since most of my subjects are male, I eliminated the Interpersonal Checklist from consideration.
Appendix E. Study of Report Format Preferences

E.1 Executive Summary

This study of report formats empirically surveyed DOE managers on their conscious preferences for graphic versus tabular portrayal of information. Data from this survey suggest bar chart graphics should be included as part of the decision support systems provided to DOE users. Other types of graphics may be appropriate to add, pending further studies or generalizations from this study.

E.2 Brief Description

I selected the FY 1986 Financial Plan, specifically Form 10 — Operating Expenses, Form 10C — Capital Equipment, and Form 10P — Construction Costs. These reports are routinely received by the DOE managers in my study. Using Lotus 1-2-3’s graphics software package, I converted the original spreadsheet data (a form of tabular portrayal) into appropriate bar and pie charts. I produced the following charts: bar chart and pie chart for operating expenses by field site, bar chart showing both construction costs and capital equipment costs by field site, and a pie chart for construction costs.
E.3 Method

I constructed a graph survey (see "Appendix F. Graph Survey" on page 191) which asked questions about operating expenses, construction costs, and capital equipment costs. Managers could refer to any of the supplied materials, spreadsheets, bar charts, and pie charts while answering survey questions. After each exercise, managers chose the one format most useful in reaching their answer. At the end of the survey, managers rated the usefulness of the spreadsheets, bar charts, and pie charts based on this survey and on their experience.

E.4 Results

Managers rated bar charts and spreadsheets highly, regardless of cognitive style. They used bar charts in making decisions involving relative comparisons (e.g., items #4 and #6 on survey). See Figure 29 on page 189 for a summary of the results by manager.

E.5 Conclusions

E.5.1 Bar charts should be included in decision support systems.

Both intuitives (N) and sensing (S) types used bar charts and rated them highly in the study. Two of the four managers were ST’s, and I expected them to prefer detailed data provided by the spreadsheet, but they made use of the bar charts and gave them good ratings. Henry Lucas found
<table>
<thead>
<tr>
<th>Name</th>
<th>MBTI</th>
<th>DDSE</th>
<th>Survey Freq</th>
<th>Survey Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case #1</td>
<td>ISTJ</td>
<td>I/H</td>
<td>1/3/1</td>
<td>4.0/4.0/1.0</td>
</tr>
<tr>
<td>Case #2</td>
<td>ISTJ</td>
<td>D/I</td>
<td>2/3/1</td>
<td>3.5/4.8/2.0</td>
</tr>
<tr>
<td>Case #3</td>
<td>ENTP</td>
<td>F/S</td>
<td>2/3/0</td>
<td>5.0/5.0/2.0</td>
</tr>
<tr>
<td>Case #4</td>
<td>INTP</td>
<td>I/D</td>
<td>0/4/1</td>
<td>2.0/5.0/5.0</td>
</tr>
<tr>
<td>Case #5</td>
<td>ESFP</td>
<td>H/I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case #6</td>
<td>ESFJ</td>
<td>F/S</td>
<td>4/0/1</td>
<td>4.0/3.0/3.0</td>
</tr>
<tr>
<td>Average (all)</td>
<td></td>
<td></td>
<td></td>
<td>3.7/4.4/2.6</td>
</tr>
<tr>
<td>Average (mgrs)</td>
<td></td>
<td></td>
<td></td>
<td>3.6/4.7/2.5</td>
</tr>
</tbody>
</table>

Figure 28. Graph survey results show preferences for both spreadsheets and bar charts.
N's make better decisions when supplied graphics, but performed well when supplied either graphical or tabular formats. My study supports Lucas' findings.

E.5.2 Other types of graphics should be studied.

The report used in this study, the Financial Plan, lent itself more to bar charts than to other graphical formats. Studies should investigate the use of other graphical formats such as line graphs for time-dependent data, and pie charts for proportionate data.

An alternative to retesting managers is to generalize from my results. If I generalize across report formats, I can conclude this group of managers would make use of other graphics besides bar charts. The assumption underlying this generalization is bar charts, pie charts, and line graphs are similar methods of information portrayal.
Appendix F. Graph Survey
GRAPH SURVEY

Name __________________________

This survey asks about your preferences for spreadsheets and graphs. The results of this study will be combined with the results of the other instruments you have taken. We'll use these results to conclude the best format for your use, and then decide whether or not to include graphics in MSL's decision support systems.

If you do not normally use the reports we're asking questions about, answer as if you were the person having responsibility for using this information in your decision making.

Items 1-3 refer to the materials for operating expenses. Note previous and revised spreadsheet figures are exactly the same.

1. Using any of the supplied materials, rank the following field sites by amount of operating expenses (1=highest, 9=lowest).

   ____ AL ____ ID ____ RL
   ____ CHI ____ NV ____ SF
   ____ HQ ____ OR ____ SR

Which format helped you the most in answering this question?

   a) bar chart  b) pie chart  c) spreadsheet

2. How many field sites have total BA figures that are at least $0.2 million higher than their BO figures? ____

Which format helped you the most in answering this question?

   a) bar chart  b) pie chart  c) spreadsheet

3. When examining operating expenses, do you (or would you) refer more often to:

   a) dollar figures for line items
   b) subtotals for field sites

For items 4-6, refer to the materials for capital equipment and construction costs. BA figures are used for graphs. Note previous and revised spreadsheet figures are exactly the same.

4. At which field sites do construction costs (BA figures) exceed $25 million? __________________________
Which format helped you the most in answering this question?

a) bar chart    b) pie chart    c) spreadsheet

5. To the nearest $10 million, what is the combined cost (BA) of construction at Albuquerque, Idaho, and Savannah River? $_______ million

Which format helped you the most in answering this question?

a) bar chart    b) pie chart    c) spreadsheet

6. Which three sites have the least amount of capital equipment?

Which format helped you the most in answering this question?

a) bar chart    b) pie chart    c) spreadsheet

7. Based on your experience and your responses to the above items, rate how often you would use the bar chart, pie chart, or the spreadsheet for your decision making, assuming the represented data would support some decisions you make.

Bar charts

1..............2.............3.............4.............5
never use     use frequently

Pie charts

1..............2.............3.............4.............5
never use     use frequently

Spreadsheets

1..............2.............3.............4.............5
never use     use frequently

Item 8 is a general question referring to your everyday work. It does not refer to any of the graphs or spreadsheets as did previous items.

8. In your everyday work, do you feel the reports you receive contain:

a) too much information
b) too little information
c) just the right amount of information

Thank you for taking time to fill out this survey.

0164m
Appendix G. Additional Data from MSM Application

Data from cases not given in the body of the text are presented here. To aid later researchers, I include all cases where most or all of the data was collected. See Figure 30 on page 195 for a summary of the data collected on these cases.

G.1 Case #5

The "who manages" in this case is in the Office of Nuclear Materials Resource Management, Budget Division. "Who manages" is a female, 29, budget analyst. This division "manages and directs the financial management, administrative, personnel management, program planning, and procurement support activities for the Nuclear Materials programs." I'll now step through these results starting at the interface between "what is used to manage" and "who manages" (the information-portrayal-to-information-perception interface).

For each case, quoted descriptions of management system functions are taken from mission and function statements based on the January 1986 reorganization.
<table>
<thead>
<tr>
<th>What Used vs Who</th>
<th>Case #5</th>
<th>Case #6</th>
</tr>
</thead>
<tbody>
<tr>
<td>reading ease/fog info. preference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>info. supplied decision style MB</td>
<td>MB</td>
<td></td>
</tr>
<tr>
<td>Who vs. What MBTI B B DDSE (response) B B MSMI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What vs. What Used org. structure measures data capture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management System</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 29. Results Summary by Case: A quick read on balance conclusions. (Legend: B = balanced, MB = marginally balanced, MOOB = marginally out-of-balance, OOB = out-of-balance, blank = no data)
G.1.1 Conditions of Balance for "What is managed" versus "Who manages"

(information-portrayal-to-information-perception)

Reading Ease/Fog Index

No data collected.

Information Portrayal Format

"Who manages" in Case #5 is an ESFP personality type (MBTI). The sensing mode of perception suggests a preference for hard facts and data, i.e., tabular or spreadsheet data. There is no graph survey data for this subject. I cannot reach a conclusion for this COB.

Amount of Information Supplied

This COB relies on the last question of the graph survey. Since this subject did not take the survey, I cannot make any conclusions about this COB.

Decision Style

This COB compares the manager's decision style to the organizational structure. I have classified all the organizations I'm considering in DOE to be machine bureaucracies, but with complex and dynamic environments. This structure is best suited for integrative and systemic decision styles. The decision style of "who manages" is hierarchic, with integrative as backup. Assessing this COB in light of "who manages", I conclude it is marginally balanced.
Interface Balance

No conclusion.

G.1.2 Conditions of Balance for “Who manages” versus “What is managed” (decision-to-action)

MBTI

The ESFP analyst in this case matches well with samples of bookkeepers and clerical workers studied by Myers. Forty to fifty percent of bookkeepers and clerical workers had the SF archetype. This archetype prefers hard data and facts and considers people in the decision making process. This COB is therefore balanced.

DDSE

Because of this person’s level in the organization, she does not have nearly as many crises and brushfires confronting her. As such, her maximizing style of information use matches her position. This COB is therefore balanced.

Maturity Style Match

This instrument does not apply here, since no one reports to this person.
Interface Balance

No conclusion.

G.1.3 Conditions of Balance for "What is managed" versus "What is used to manage" (measurement-to-data)

Organization Structure

See "Organization Structure" on page 119 for the discussion on this COB.

Measurement Systems

No data collected.

Data Capture

No data collected.

Interface Balance

No conclusion.
G.1.4 Management System Balance for Case #5

No conclusion.

G.2 Case #6

The "who manages" in this case is in the Office of Nuclear Materials Production (NMP). "Who manages" is a female, 38, secretary, reporting to the NMP director. This Office "carries out the nuclear materials planning function to assure the production of sufficient quantities of material to meet national defense needs." I'll now step through these results starting at the interface between "what is used to manage" and "who manages" (the information-portrayal-to-information-perception interface).

G.2.1 Conditions of Balance for "What is managed" versus "Who manages"

(information-portrayal-to-information-perception)

Reading Ease/Fog Index

No data collected.
Information Portrayal Format

"Who manages" in Case #6 is an ESFP personality type (MBTI). The sensing mode of perception suggests a preference for hard facts and data, i.e., tabular or spreadsheet data. There is no graph survey data for this subject. I cannot reach a conclusion for this COB.

Amount of Information Supplied

This COB relies on the last question of the graph survey. Since this subject did not take the survey, I cannot make any conclusions about this COB.

Decision Style

This COB compares the manager's decision style to the organizational structure. I have classified all the organizations I'm considering in DOE to be machine bureaucracies, but with complex and dynamic environments. This structure is best suited for integrative and systemic decision styles. The decision style of "who manages" is flexible, with systemic as backup. Assessing this COB in light of "who manages", I conclude it is in marginally balanced, because the style fitting the organization is this person's backup.

Interface Balance

No conclusion.
G.2.2 Conditions of Balance for "Who manages" versus "What is managed"
(decision-to-action)

MBTI

The ESFJ secretary in this case matches well with the sample typists and receptionists studied by Myers. Almost 47% of the typists and receptionists studied had the SF archetype. This archetype prefers hard data and facts and considers people in the decision making process. This COB is therefore balanced.

DDSE

This person reports to a high-ranking Office director. Her satisfying use of information allows for quick decision making, an attribute valuable for her position. This COB is therefore balanced.

Maturity Style Match

This instrument does not apply here, since no one reports to this subject.

Interface Balance

No conclusion.
G.2.3 Conditions of Balance for “What is managed” versus “What is used to manage” (measurement-to-data)

Organization Structure

See “Organization Structure” on page 119 for the discussion on this COB.

Measurement Systems

No data collected.

Data Capture

No data collected.

Interface Balance

No conclusion.

G.2.4 Management System Balance for Case #6

No conclusion.
Vita

Larry A. Mallak was born in Urbana, Illinois. He received his bachelor’s in industrial engineering from the University of Illinois in Urbana-Champaign in 1984. After a brief stint as a science reporter for WOSU radio in Columbus, Ohio, he entered the master’s program at Virginia Polytechnic Institute and State University. While in the industrial engineering program at VPI, he researched planning processes and system development for their applications in solving management problems of government and industry.

Upon graduation, Larry will take a consulting position with SunHealth, a Charlotte (NC)-based health care services firm with a network of hospitals located across the Southeast. His position will involve strategic planning for SunHealth-affiliated hospitals and cost management for health products and services.

Larry A. Mallak