THE MEDICALLY-ORIENTED COMMON-SOFTWARE COMPUTER-BASED INFORMATION SYSTEM ADOPTION PROCESS

by

Alan Francis Dowling, Jr.

A. B., College of the Holy Cross
(1969)

M. S., Northeastern University
(1973)

M. C. S., University of Dayton
(1975)

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Signature of Author ______________________
Sloan School of Management
May 1, 1981

Certified by ______________________
John F. Rockart
Chairman, Thesis Committee

Accepted by ______________________
Alvin J. Silk
Chairperson, Departmental Ph.D Committee

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ABSTRACT

Hospital administrators often implement computer-based information systems (CBIS) to improve the effectiveness and efficiency of both patient care and organizational management. Unfortunately, such objectives are frequently not achieved. The use of CBISs in the industry has been characterized by insufficient success and frequent failure. Even technically successful and operationally appropriate systems frequently have very difficult implementations, and often either fail and are removed from the hospital or are not used to their potential. Implementation problems may be even more severe in medical common-software systems (MCSS) than in unique-software systems due to a number of inherent factors. These partial or complete failures adversely affect the hospital's financial and organizational viability, hinder the delivery of quality health care, and on a national level, impair the realization of the benefits of MCSSs and the containment of health care delivery costs.

This research is an attempt to contribute to our understanding of the MCSS adoption processes so as to improve these processes as well as MCSS design. It investigates the adoption of vendor-provided MCSSs by acute care, private sector, non-profit hospitals. The objective is to develop and test a framework for meaningful descriptive MCSS adoption research which will facilitate the identification and measurement of the factors which have the greatest effect on the level of success achieved by an MCSS implementation. The realization of this objective should extend our ability to understand the complex set of implementation sub-processes, enabling the further development of the prescriptive knowledge necessary to increase the probability of success in MCSS implementation.

The research effort has:

(1) Constructed a unified paradigm of MCSS adoption by hospitals. It has integrated existing, relevant adoption/implementation models through a holistic philosophy: that each model has certain explanatory power and that if integrated, the unified paradigm may have sufficient power to explain most, if not all, of the MCSS implementation process.

(2) Developed the Directed Factor Study, a theoretical framework for research into the factors which most affect an implementation's outcome.

(3) Developed a methodology through which to operationalize key elements of the research framework. In particular, an interval scale measure for the "success level" continuum was constructed using Thurstone's Method of Successive Intervals. Also, the concept of factor arrays and factor syndromes was developed.

(4) Conducted exploratory research into recently "completed" MCSS implementations in eight acute care, private-sector, non-profit hospitals to test the applicability of the research framework and implementation paradigm.

The exploratory research confirmed the validity of the implementation paradigm and the applicability and feasibility of the Directed Factor Study as an implementation research methodology. It offered insights to several factor syndromes which were in evidence in all of the case hospitals. These included: the "expectancy curve" of the user's reaction to the system, the deficit of human factors and systems engineering in the typical implementation, the dichotomy between vendor and user expectations regarding training and consultation, and others.

Thesis committee:

Dr. Peter G. W. Keen
Associate Professor of Management Science

Dr. Edward B. Roberts
David Sarnoff Professor of Management of Technology

Dr. John F. Rockart, Chairman
Senior Lecturer and
Director, Center for Information Systems Research

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DEFINITIONS

Medically-Oriented Computer-Based Information System (MCBIS): Any of the class of computer-based systems used interactively by the hospital staff to capture, analyze, store, or retrieve information in the course of their work. It may be managerially or clinically oriented, such as: laboratory information systems; registration, admission, discharge, and transfer systems; patient scheduling systems; hospital information systems; billing and financial management systems; managerial decision support systems, etc. For the purposes of this research, it specifically excludes any computer-based system which can be viewed as a stand-alone device, such as a computerized axial tomography scanner.

Common-Software System: Any hardware/software system whose application software was designed and written for implementation by multiple users.

Medically-Oriented Common Software Systems (MCSS): The common software subset of MCBISs. Herein, we use MCSS to refer to the set of such systems provided by system vendors, rather than by multi-facility in-house staffs.

System Vendor: Any business which develops, and sells or leases MCBISs.

Implementation: the period of time and processes which commence with the decision and commitment by the hospital to specify, design, build or buy, install, make operational, and evaluate a particular MCBIS. It is complete when the MCBIS is institutionalized, or fails and is removed.

Adoption: The processes associated with the transfer of MCBIS technology: awareness of the technology, recognition of its potential uses, search for a relevant system, selection of the system, and implementation.

1. INTRODUCTION

1.1. THE NATURE OF THE MEDICAL COMMON-SOFTWARE SYSTEM IMPLEMENTATION PROBLEM

Although computerized information processing technology has been commercially available for over twenty years, its use in health care delivery facilities has lagged behind its use in other high and even moderate technology industries. The introduction of the computer to the medical field, when it did occur, was marked by some of the more noteworthy system failures of the last fifteen years.

In general, computer system vendors in the 1960's marketed systems which were primarily business transaction oriented with respect to their operating capabilities and efficiencies, and which failed to contend with some of the more unique aspects of the hospital setting. After a relatively small number of systems were installed, many were removed and, generally, only those dedicated to classical business functions such as billing, accounting, payroll, and personnel continued to operate. Isolated medical practitioners and information system researchers who developed their own task-specific application software met with significant success; but, the vendor-generated applications were usually undistinguished and a significant number failed acceptance testing or implementation. The reasons for most of the failures were seldom fully understood and are now lost, as the opinions of vendor and hospital personnel become accepted "fact" with the passage of time. However, the reasons seem to have been many. Frequently, hospital personnel claim that their system failed because its hardware and/or software was unreliable or inappropriate. Conversely, several system vendors assert that their system failed only because some hospital staff members were computer-phobic.

Today, the health care industry is one of America's largest, and the medically-oriented common-software computer-based information system (MCSS) industry is quite active. Many of the largest and best financed medical computer system vendors of the sixties are no longer in the business of developing medical systems software (e.g., IBM markets field developed software (e.g., PCS), Honeywell Control Systems announced their exit from the market, DEC ceased development of extensions to COSTAR V, etc.). However, they have been replaced by many firms which, although usually smaller, are frequently better versed in the hospital's managerial and operational idiosyncrasies. Hardware and software technology, especially in the database and telecommunications areas, are now at a state in which a large variety of medical and managerial applications are feasible. Indeed, a large subset of these applications is in operation in hospitals in either production or prototype states. These applications range from the classical business functions to direct patient care support in the practitioner-patient encounter. Further, much research is underway to crack some of the tougher medical information processing nuts, such as multi-facility shared network "total" hospital information systems and the classical individual patient health records systems. Unfortunately, development efforts are fragmented and the systems available through medical computer system vendors, which include shared systems, service bureau systems, in-house or remote proprietary software systems, and custodial systems, vary significantly in quality, reliability, and cost. Most are usually difficult or impossible to interface with one another. Still, for many applications, systems are available which work well and are cost-beneficial. But even technically successful and operationally appropriate systems frequently have very difficult implementations and often either fail and are removed from the hospital or are not used to their potential.

1.2. NEGATIVE IMPLICATIONS OF THE PROBLEM

Recent research has documented the fact that the frequently used binary view (i.e., "success" or "failure") of the outcome of hospitals' MCSS implementations is inappropriate (Dowling, 1980). Rather, systems were found which were thought to be successful by both the vendor and hospital management, but which were essentially unused by the hospital staff. Other systems had not fulfilled their adoption objectives, but were providing true benefits to the hospital in unanticipated ways. Some systems were successful but degraded by staff interference which included destruction or alteration of patient, billing and other data. Some technically good and appropriate systems "failed" and were removed due to employee sabotage. And still others succeeded in their adoption objectives and produced additional unexpected efficiency and effectiveness benefits. This implies that the previous definition of "success/failure" was statistically inappropriate for estimating both MCSS successes and failures. The net effect was to underestimate the number of attempted MCSS implementations which were not fully successful. Dowling's research indicates that implementation problems, encountered even in the adoption of ultimately successful systems, have increased the costs of adopting MCSSs. Our concern with MCSS failures and partial failures should be greater when we consider their implications.

The most dangerous implication of partial failure is in the area of patient care. Should an implementation problem manifest itself in the erosion or partial and inconspicuous destruction of the database of a clinical application, such as a laboratory information system, the integrity of patient data might unknowingly be lost. Potentially life-threatening patient care situations could result from a practitioner basing therapy on erroneous data. With the similar degradation of a management information database, patient billing charges could be lost, depriving the hospital of earned income. Further, inappropriate management decisions may result and management's loss of confidence in the potential of management information or decision support systems could ensue.

If system failures or interference delays a planned and budgeted implementation, lease or purchase costs of the system may be incurred without the offsetting benefit of the system's productive use. Extra personnel costs would result from temporary overhires and from the salaries of hospital personnel who are working on the implementation. Such a delay may unexpectedly constrict the hospital's cash flow, a potentially serious problem for most hospitals.

Even without a delayed implementation, if an implementation problem causes the disuse of some of the system's functions, the hospital is still responsible for the purchase or rental fees for the entire system. Thus, the cost of the functions actually used is artificially inflated. Ultimately, if the implementation problems lead to the complete failure of the system, there may be no tangible return on the resources invested to select, install, and implement the system. Indeed, the organizational difficulties frequently attendant upon a system failure may result in further intangible costs. In many cases, a system "failure" has caused a hospital to reject the consideration of other systems for a period of years, unnecessarily removing MCBISs as options for improving the hospital's effectiveness and efficiency.

Implementation problems may be even more severe in common-software systems than in unique-software (i.e., specially designed) systems due to a number of inherent factors. Common-software, even with menu-selectable software, can not (by definition) be fully tailored to specific user environments. Common-software design teams are not completely aware of the full spectrum of user needs and problems. Their installation teams usually do not have the access to decision makers and the organizational power that most in-house development staffs have. Common-software systems used in a distributed network system may have additional problems (e.g., communication interruptions).

1.3. MOTIVATION FOR MCSS IMPLEMENTATION RESEARCH

Although hospitals have lagged behind other industries in adopting CBISs, their rate of adoption is now accelerating. Since tertiary care hospitals have lead in the research, development, and implementation of such systems, the greatest increase in MCSS adoption is anticipated to be in primary and secondary care facilities, a projection supported by a comparison of the last two sets of results from the Hospital Financial Management Association's survey of information processing in the health care industry. These are the hospitals with the least CBIS sophistication. As a result, they have a relatively low probability of successfully designing and building unique software systems. This, coupled with the increasing cost of software development and decreasing cost of hardware, makes vendor-provided common-software systems (MCSSs) the major economically feasible alternative for hospitals in this category who wish to implement MCBISs.

Thus, unless we increase our understanding of common-software implementation processes and use the knowledge to improve these processes as well as MCSS design, we should anticipate a significant number of hospital implementations which do not achieve full success. These partial or complete failures will adversely impact the hospital's financial and organizational viability, hinder the delivery of quality health care, and on a national level, impair the realization of the benefits of MCSSs and the containment of health care delivery costs.

Our ability to constructively intervene in the adoption process is dependent on our knowledge of when, where, and how intervention is effective. This presupposes that we have a repertoire of useful intervention mechanisms. In actual system adoptions, such knowledge and techniques have proven inadequate too frequently. The limited understanding of the MCSS adoption process does not even allow most administrators and researchers to diagnose hospital MCSS adoption problems with confidence. Clearly, the first step needed to begin resolving this increasingly significant problem is to improve our understanding of the MCSS adoption process.

1.4. OVERVIEW OF THE THESIS

But, how do we research MCSS implementation to gain understanding? This is the main question that this research addresses. Generally, it is intended to investigate the implementation of vendor-provided common-software medically-oriented computer-based information systems (MCSS) by private sector, non-profit, acute care, general medical and surgical hospitals. The objective is limited to three thrusts:

(1) The development of a paradigm of the MCSS adoption process which will provide a frame of reference for further research. (Chapter 2)

(2) The generation of a framework within which to conduct what we will call "directed factor" research. It is a framework for meaningful descriptive MCSS research which will facilitate the identification and measurement of the factors which most affect the level of success of an MCSS implementation. (Chapter 3)

(3) The execution of exploratory research to test the validity of the paradigm and the appropriateness of certain portions of the framework, and to gain preliminary insight into the MCSS adoption process. (Chapter 4)

These thrusts should extend our ability to understand the complex set of implementation sub-processes so as to further develop the prescriptive knowledge necessary to increase the probability of success in MCSS implementation.

Specifically, the thesis:

(1) Develops a unified paradigm of hospital MCSS implementation which will provide a focus for the research of factors affecting implementation success. It is based on the need to integrate the existing relevant implementation models through a holistic philosophy: that each model has certain explanatory power and that, if integrated, the unified paradigm may have sufficient power to explain most, if not all, of the MCSS implementation process. The paradigm integrates the rational (organizational and personal), political, bureaucratic, adoption, gatekeeper, influence leader, and change process models in light of the unique or modifying factors of common-software (e.g., menu-selected software), MCBISs (e.g., differing user acceptance criteria), and the hospital industry (e.g., differing management control mechanisms).

(2) Initiates a framework and associated methodology for MCSS research into the factors which most affect an implementation's outcome. It is designed to facilitate the

identification of the array of such factors and the estimation of the magnitude and direction of each factor's impact. The framework develops a "directed factor" research approach based, in part, on Keen's (1977) conceptual base for implementation research. It deals with the central issues of selection and definition of the dependent ("level of success") and independent (factors) variables. Therefore, it develops an interval scale measure for MCSS implementaion "level of success" using Thurstone's Method of Successive Intervals (Green 1954).

(3) Tests the framework at an exploratory level and, in so doing, logically and non-parametrically test the significance of certain derived hypotheses through descriptive research into several factors' impact on the level of success of several recently "completed" MCSS implementations in private-sector, non-profit, acute care hospitals. This exercise:

(a) Investigates recent MCSS implementations based on an (X O) research design (notation: Campbell and Stanley, 1963). This quasi-experimental design is essentially directed, in-depth, case-based analyses of the attributes and effects of the MCSS implementations. Due to the exploratory nature of the research, eight hospitals are sampled, two from each of four vendors. The MCSSs investigated are restricted to hybrid managerial/clinical systems (e.g., laboratory information systems, nursing unit/ancillary service ordering systems, charge capture/financial systems). These cases are developed in detail sufficient to allow independent assessment of the author's conclusions.

(b) Analyzes the case results, the "success level" measure, and associated information to produce an understanding of the reality of the implementations to:

(i) Determine the validity and utility of the "directed factor study" framework, especially such key components as: the unified implementation paradigm, the "success level" logic and measure, and the concept of the factor and factor syndrome array.

(ii) Correct, if necessary, both the unified implementation paradigm and the research framework.

(iii) Derive implications and possible paths for more in-depth research of the MCSS implementation process and its significant factors.

2. A UNIFIED MCSS IMPLEMENTATION PARADIGM

2.1. INTRODUCTION

2.1.1. The Roles Of Implementation Paradigms

Implementation, according to a common dictionary, is defined: "to give practical effect to and ensure of actual fulfillment by concrete measures" (Merriam Co., 1976, Def.#1). However, when referring to MCSS implementation, this definition fails to reflect reality. One may infer from the definition that an implementation would ordinarily include the necessary and sufficient planning and execution of the "concrete measures" required to assure that the overt or implicit objective of the MCSS adoption is met. In reality, the implementation planning by hospitals and vendors has ranged from nearly non-existent to constrictively overplanned. The same can be said for vendors' implementation planning. Hence, a given implementation may be represented at a point anywhere within Figure 2.1. Further, "actual fulfillment" implies a continued gainful use of the MCSS. However, there are numerous cases of systems and subsystems falling into disuse shortly after their implementations were declared complete (Dowling, 1980).

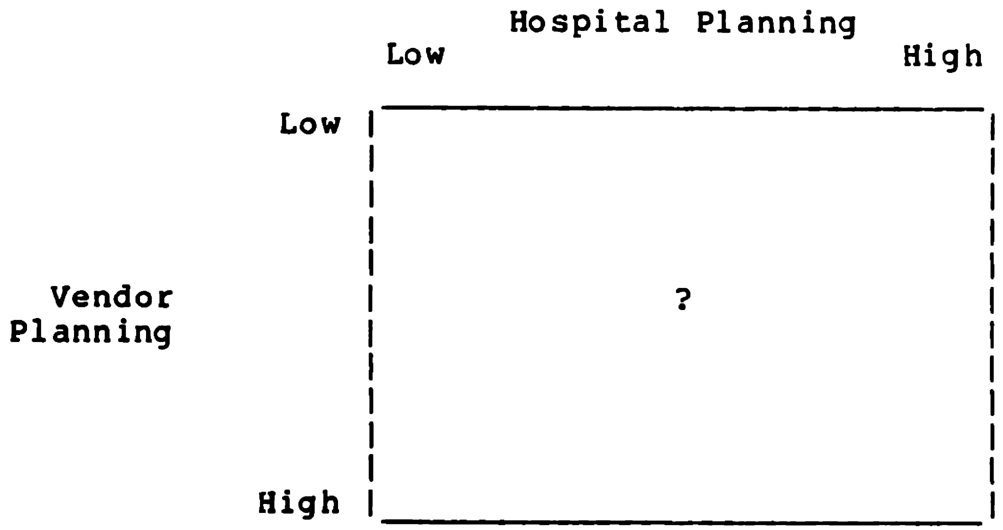


FIGURE 2.1 PLANNING MATRIX

The nature and quality of implementation planning and preparation reflect not only the quality and experience of the management but also their understanding and assumptions about the MCSS implementation process and their role therein. Past the point in time of the decision to implement a system, it is rare to find an involved or affected staff member who has not developed some conceptual view of the ensuing implementation process. Although his individual paradigm may be only loosely coupled to reality and is usually maleable, it still forms the basis for interpreting, understanding and integrating new information about the process. Hence, it forms the individual's frame of reference for judgments and actions and can affect the individual's participation in and, under certain circumstances, the outcome of the implementation.

Clearly, the individual's implementation paradigm is of central importance in affecting the implementation as it progresses. Similarly, the implementation paradigm is a central issue in the impartial observer's understanding of the implementation's processes a posteriori. This is due to the fact that the observer possesses his own implementation paradigm. Since it is his frame of reference for analyzing and judging information about the implementation, it can significantly affect his understanding of the implementation processes and the accuracy with which his interpretation reflects reality.

If the impartial observer's objective is to improve the implementation process through descriptive research, insight and prescription, his implementation paradigm is the foundation for the validity of his work. If it exceeds acceptable error tolerances, all of the insight and prescription which follows, regardless of brilliance, will be of moot validity. Since the ultimate aim of this research is the improvement of the MCSS implementation's outcome by improving its processes, we need to accurately understand them. Hence, we need an MCSS implementation paradigm which reflects reality with sufficient fidelity, thereby providing useful direction for our attention.

2.1.2. Paradigm Development

It follows that the construction and elaboration of a generally applicable implementation paradigm is the appropriate point of departure for further MCSS implementation research. As discussed above, everyone who has participated in an MCSS implementation has developed a personal implementation paradigm. In many cases such development has been at a subliminal level. And even if developed at a conscious level, few paradigms are ever elaborated for dissemination. Those that are are invariably proprietary. In fact, we have found no paradigms in the literature which specifically address MCSS implementation. The academic researcher, therefore, must rely on three major sources of information to construct his implementation paradigm: existing non-MCSS implementation paradigms, the experience of experts in the MCSS field, and his own experience.

An examination of research in general MIS and OR implementation reveals that much of the work is either aparadigmatic or based on paradigms which the author insufficiently elaborates. Similarly, the assumptions derived from the paradigms are frequently only exposed through circumstantial evidence. For example, Gershefski and Harvey (1970, p.B-312) state:

> "We regard an (OR project) assignment as a failure if it does not achieve implementation. We are, therefore, continually concerned with improving our ability to select assignments and manage them in a manner that improves our batting average."

This is their key statement about their implementation paradigm. It reflects their marketing strategy as "vendors" but is unidimensional and fails to deal with such issues as the appropriateness of the technology in light of user needs, the ability of user management to judge the correctness of the system, the fate of the system after the user has decided to accept it, etc.

Alternatively, the research which tends to deliberately explain its underlying paradigm frequently has the justification of the paradigm as its descriptive goal in support of the paradigm's eventual prescriptive use. While this is appropriate when unbiased, it has tended to focus on subsets of the implementation process rather than being integrative or holistic. Keen (1977) partitions OR/MIS implementation research into seven categories which describe almost all of the existing research. His categories are summarized in his Table 1 (here reproduced as Exhibit 2.1).

Reviewing Keen's categorizations, we may observe that the Mutual Understanding, User-Centered, Organizational

CATEGORIES OF IMPLEMENTATION RESEARCH

(from Keen, 1977)

Category	Descriptive or Prescriptive	Main Focus of Attention	Main Methodology
1. Failure Study	prescriptive; draw attention to the primacy of implementation over design	individual case studies	verbal reconstruction
2. Mutual Understanding	mainly prescriptive; descriptive experiments used to support the paradigm proposed by the study	psychology of problem-solving and individual differences in problem-solving	a) conceptual articulation of a "model" of mutual understanding or cognitive processes b) experimental application of cognitive tests c) experimental analysis of behavior relevant to implementation d) case studies
3. User-centered	descriptive; focus on understanding user "needs" and attitudes	measurement of user attitudes, prediction of user responses	questionnaires designed to assess users' overall willingness to adopt system or model
4. Factor Study	descriptive; identify the main dynamics of implementation and key influences on "success"	individual projects	large-scale questionnaires and sampling of many implementation efforts; inductive analysis through multivariate techniques
5. Organizational Factors	descriptive; identify trends in organizational procedures and positioning of OR/MS group	organizations; OR/MS groups within the organizational structure	longitudinal surveys across organizations
6. Contingency Literature	prescriptive; provide researchers and practitioners with conceptual framework for assessing particular situations	strategies for undertaking an implementation effort	schematic, verbal
7. Social Change	a) descriptive; exploration of extent to which social change paradigm "explains" the dynamics of implementation b) prescriptive; specification of strategies for managing organizational change	innovative technical projects from inception to institutionalization	a) special-purpose questionnaires based on stages of change process b) verbal, exploration of implications of particular models of planned change

EXHIBIT 2.1

Factors and Social Change research are all based on paradigms which address particular situations that may be found during system implementations. Contingency literature has attempted to draw on the other paradigms to explain implementations at a macro-level. However, Keen notes that it is prescription and not research. Its integration objective is much needed, but its result may be biased through its adoption of its untested paradigm: that implementations are different and that "there are no fixed rules for implementation" (Keen, 1977, p.3).

Since we find no unified paradigm applicable to MCSS implementation, we must construct one. To do so, we will select certain existing implementation paradigms which appear to have strong explanatory power in the MCSS setting. These paradigms will be meshed into a core paradigm and adapted to the common-software and health care delivery industry setting. The focus of the unified paradigm will be primary and secondary care hospitals' implementation of non-prototype common-software systems.

2.2. THE CENTRAL PARADIGM: THE RATIONAL MODEL

An MCSS implementation poses a complex set of decisions to the implementors. Those decisions for which known, correct answers are available to the decision maker are trivial to him (unless his answer is actually invalid, in which case the error usually later resurfaces as a factor confounding the diagnosis of other problems). Otherwise, the decision may be considered problematic. An examination of MCSS implementation plans often reveal the "rational" thinking mode of their authors in response to such problematic implementation decisions. The implementors propose "reasonable" actions to respond to the various hospital, system and environmental requirements of the implementation. What actions are deemed "reasonable" and what are not, show the bias of their problem solving thought processes, information base, and judgment.

Essentially, the implementation participants' thought processes usually are somewhat akin to Rationalism. That is, that reality is inherently logical and that reason can extend their abilities to comprehend unexperienced problem situations and lead to a logical solution. Rationalism contends that rational insight provides man with knowledge not achieved through experience. Rationalism does not deny empirical knowledge but does deny the Humean epistemological and Empiricists' claim that all knowledge is solely the result of perception. However, the rational problem solving mode with which we are concerned is not true Rationalism, since it does not require or imply a belief in Rationalism. Rather, the rational mode exhibits implementation and decision behavior which is consistent with Rationalism. For instance, hospital implementation meetings are frequently punctuated with anecdotes of other implementations. Those decision makers and observers at the meeting usually try to assimilate the story, determine if it is applicable to their setting (based on their individual implementation paradigms), and, if so, determine its import and effect through extrapolation to their situations. This, in turn, leads to prescription which is incorporated into their implementation plans. The introduction of such anecdotes is an attempt to communicate descriptive empirical data to the decision makers and observers. The inference of prescription from them is the attempt to develop a theoretical construct (consciously or subconsciously) through which they can comprehend and use information unexperienced in their actual settings. Thus, the rational model we believe to be in effect is a blend of elements of the competing thought theories, Rationalism and Empiricism. Its key operating characteristics are that the implementor uses data from experience in a theoretical framework thought to be applicable to the new situation and that he attempts to resolve the problem in a way that is reasonable to himself and believed to be defensible before others.

The participants in an MCSS implementation are not good models for the "economic man" when their information base is examined. Seldom are their academic and professional experiences related to computer science or application software development. Few, if any, are familiar with system backup, system loading, preventative maintenance, conversion methodology, or the many mundane but necessary considerations in an implementation. This leads us to conclude that hospital staff members perform with limited information (imperfect knowledge) with relation to an MCSS implementation. Further, the portion of the implementation participant's information base which is brought to bear on the MCSS implementation often is delineated (limited), in part, by the rational model. The information which he does not consider to be rationally applicable to the decision may well be excluded when he considers the problem. Similarly, during implementation discussions, the information he deems irrelevant is filtered from his conversation. Therefore, each participant acts as his own filter and only discusses information which he considers rational. This behavior can be hypothesized to be mutually reinforcing. Each participant, receiving "rational" information, may be receiving positive reinforcement for the continuation of the filtering process. Additionally, the data he receives, being "rationally" admissable, limits the information that he ultimately uses to formulate action. Clearly, the rational model affects not only the implementation participant's information bases but also his judgment, by definition, the process of forming opinion or evaluation by discerning and comparing. The reason for the widespread adoption of this mode of thinking is not the issue. That this mode is openly advocated and used (often with a simultaneous reference to the correctness of scientific decision making) is the point of interest.

Clearly, there exist constraints on the hospital MCSS implementor's ability to derive consistently and completely rational answers. Any paradigm which attempts to predict such outcomes would not be particularly useful, since it would not be realistic. Therefore, it is appropriate to partition and define rationality for several settings if we are to continue its discussion. Such definitions have been developed by Simon (1976, p.76):

> "...a decision may be called 'objectively' rational if <u>in fact</u> it is the correct behavior for maximizing given values in a given situation. It is 'subjectively' rational if it maximizes attainment relative to the actual knowledge of the subject. ... A decision is 'organizationally' rational if it is oriented to the organization's goals; it is 'personally' rational if it is oriented to the individual's goals."

Consequently, since our MCSS related paradigm acknowledges the information limits the participant faces, it is best described as a paradigm dealing with subjective rationality rather than objective rationality.

So far, we have discussed the rational paradigm at a micro level, that of the individual (personal rationality). The paradigm also exists at the macro level, that of the organization (organizational rationality). In common usage, those involved with the research, development, marketing and adoption of MCSSs often refer to an implementation's participants as monolithic organizational entities capable of behavior which conforms to the rational decision mode discussed above. This organization reference system has numerous implications. First, the referenced organization is credited with the ability to act with a single mind or will. Second, the organization is credited with behaving as though it has objectives that it is trying to fulfill. Third, the organization is credited with behaving in some objective-maximizing way. (Herein, we will use Vancil's definitions for objective and goal: "An objective is an aspiration to be worked toward in the future. A goal is an achievement to be attained at some future date." (Lorange and Vancil, 1977, p.5))

The organization's attributed ability to act as though endowed with a single will is perhaps the most common reference system used by observers in attempting to understand the actions taken by an organization. This frame of reference was described by Allison (1971) in a political science setting. Allison's "Rational Actor Model" is characterized by the analyst's attempt to understand events "as the more or less purposive acts of unified national governments" (p.4-5), and that such organizational behavior "can be most satisfactorily understood by analogy with the purposive acts of individuals" (p.3). This reference system is commonly used by hospital and vendor personnel as well as outside observers of the MCSS implementation. They speak of the <u>hospital's</u> decision to implement a system, or the <u>vendor's</u> behavior in responding to a software bug. When some aspect of an implementation goes awry, it is often said that the <u>vendor</u> did not support the <u>hospital</u> or that the <u>hospital</u> did not know how to use the system. This view is useful in understanding organizational action at the level of first order approximation. Further, it is the frame of reference which most faithfully reflects the organization's status as an individual legal entity, responsible for agreed-upon action.

Implicit in the rational model is the concept that the organization's action is devoted to the achievement of some end. This concept, inverted and restated, is that the organization has objectives and goals. Allison's model does not make this point sufficiently explicit. Essentially, it describes the a posteriori attempt to discover the objectives and goals that, hypothetically, guided the observed action. That is, he correctly indicates that analysts attempt to deduce purposes from observed behavior. This helps in rationalizing outcomes but is not as useful in understanding the true reasons for action. Further, it is almost useless in evaluating the effectiveness of action in achieving a particular outcome. Since objectives, properly stated and clearly communicated, are guides to action throughout the organization (Granger, 1964), their existence is of critical importance to our rational model. In MCSS implementations, the assumption of their existence seem less uncertain than in Allison's political science setting. MCSS's provide well defined functions which usually and by design improve the efficiency and/or effectiveness of hospital operations. Therefore, it seems reasonable to ascribe the goal of improving those operations to the hospital management. This leads the implementation observer to expect those goals to exist and to discern how the actions of the implementation diverged (if they did) from meeting its goals. Hence, the MCSS implementation participants and observers often analyze the situation by starting with the objective and looking forward in time, the inverse of Allison's analysts who look temporally backward.

That an organization has objectives is not synonymous with the desire to behave in an objective-maximizing way. However, objective-maximizing behavior is assumed under the logic of the rational model. One goal of a hospital may be to decrease its outstanding receivables. Let us suppose that its management decides to implement an MCSS accounts receivable system to meet this goal. The existence of the goal implies only that the hospital would procure one of the several available MCSS's which performs accounts receivable functions. However, the existence of objective-maximizing behavior implies far more. Hospital management would be further required to procure the MCSS which, considering all of the hospitals objectives and goals, produces the best cost/effectiveness ratio on a hospital-wide (system-wide) basis. While objective-maximizing behavior is frequently espoused by hospital managers, it is seldom found in reality. Rather, the behavior typically found is that of objective-satisficing (Simon, 1957, p.204) or accepting a resolution or answer which, while not optimum, is nevertheless within acceptable tolerances. Therefore, to construct our version of a rational paradigm, we loosen the constraint of objective-maximizing behavior. To restate, objective-maximizing behavior is advocated by hospital MCSS implementors, but objective-satisficing behavior is usually practiced by them.

The hospital's characteristics may well violate some of the basic assumptions of the rational model at the organizational level. In particular, the concept of the hospital as a unified monolithic actor, the existence of useful objectives and objective maximizing behavior are suspect under various conditions.

Non-profit, primary and secondary care hospitals generally have poorly defined organizational objectives. Their objectives are often thought to be implicit in the nature of their work and therefore thought to be intuitively obvious. When asked about objectives, hospital personnel often respond with such global objectives as "curing disease". While such objectives may be appropriate as mission statements for the World Health Organization and the National Institutes of Health, they fail several requirements to be operable objectives (Granger, 1964). In essence, these hospitals typically have ambiguous objectives which are insufficient to develop goals, guide actions, or suggest control measures. Concurrently, such hospitals often fail to communicate objectives and goals to their operating departments.

The hospitals' organizational charts seldom accurately reflect true lines of authority, communication or power. These hospitals are typically dominated by their professional staffs (Fuchs, 1974, p.57). American physicians have developed and maintained a system whereby they retain the decision processes (whether or not to admit, operate on, discharge, etc. patients) which determine the workload and, consequently, the staffing, resource requirements, and cash flow of our hospitals. This decentralized, transaction-based decision making is, in fact, a determinant in the vitality and survivability of hospitals in an increasingly competitive health care delivery environment. Further, the professional staff members frequently have stronger association and identification with their particular discipline than they do with the hospital as an organization. Coupled with the lack of useful objectives, professional dominance and discipline association have led to the hospital's structure being, in reality, one of loosely federated subsystems (medical, surgical, ancillary and service departments) rather than one of a centrally directed and motivated system (Sheldon, 1970).

Nevertheless, the rational model is often useful in understanding the events of an MCSS implementation. However, its power varies inversely with the observer's proximity to or involvement with those events. It is best to illustrate this point from several perspectives:

(1) To the non-participant, the principals (the hospital and the vendor) appear and usually behave as legal

corporate individuals. The legal instrument which binds them, either a lease or purchase agreement, also treats them as such individuals, laying out the explicit responsibilities of each of the two. Primarily as the result of attributed objectives and goals and reinforced by the legal setting, the process appears quite rational. And this appearance is frequently borne out in fact.

(2) In the closer view of the top management of the two organizations, the implementation still appears to fit the rational model. These managers are aware of their organization's objectives. On the hospital side, if the CEO was not the initiator of the MCSS adoption effort, the adoption would have been screened by several committees (e.g., Budget Committee; Medical, Surgical or Administrative Committees; etc.) and their recommendation to adopt the MCSS would have been presented to him through reports or presentations which conform, at least superficially, to the rational model.

(3) However, the organizational rational model becomes less powerful at the level of the hospital's implementation participant. While still valid when analyzing the individual decision maker's actions (personal rationality), it is far less applicable at the organizational level due to the attributes of the class of hospitals with which we are concerned.

The rational model, while being extremely useful, has limits to its applicability at the personal and, more so, at the organizational level. It has significant but insufficient explanatory power to stand alone in explaining the decisions and actions of MCSS implementations under certain circumstances. Therefore, it needs to be augmented by integrating several relevant paradigms which, when combined, have significantly increased explanatory power.

2.3. INCORPORATION OF THE POLITICAL PARADIGM

One of the strongest reasons to claim that the rational model does not fully explain MCSS implementation behavior is that empirical evidence exists which reveals counter-rational behavior in such implementations (Dowling, 1980). One incident involved the installation of a laboratory information system in the clinical laboratory of a hospital that was part of a multi-facility, non-profit chain. Unused floorspace in the adjacent Radiology Department was to be converted into a computer room to house the host Honeywell 716. The Chief of Radiology acknowledged the importance of the system to the hospital's ability to deliver care. He refused, however, to relinquish the necessary space. Nor did he do so until the hospital Administrator promised to construct a new lead-shielded room for his department. The Chief of Radiology privately justified his demand by claiming that the loss of space might have been construed as a devaluation of Radiology's importance to the hospital and that the new room would allow his department to have facilities comparable to the chain's best-equipped radiology departments.

This incident is not atypical. The radiologist involved exhibited counter-rational behavior if one views the hospital as a unified system. His actions had increased the cost of the implementation since under other circumstances, the shielded-room would not have been constructed. The consensus of the staff was that it was not really needed.

However, the incident does reinforce the previously stated view of the hospital as a federation of subsystems, functional and support departments, with loose central control. In fact, the control systems of most hospitals in this category are also decentralized. Hence, the departments are almost autonomous, professional discipline-segregated subsystems (Sheldon, 1970) with all but fiscal responsibility for the work they do. In such a case, it is to be expected that implicit goals would exist at the subsystem level. Rockart's findings, in his Critical Success Factor (CSF) research (1979), that industry wide CFSs usually exist in conjunction with organization-specific CFSs support this expectation. Thus, the directors of the hospital's subsystems would have goals which are the amalgam of:

1. Their own views, based on their experience and training, of what their departments should be doing.

2. General industry assumptions of what constitutes successful operation of their departments.

3. Filtered and weakly controlled implications for their departments of the hospitals objectives or goals, if they exist.

Such an amalgam of influences may tend to evolve goals which are more general tendencies than actionable objectives. If so, such goals would tend to be somewhat volatile, yielding situationally dependent actions by their owners. Further, the affect that each of these influences has on even commonly-held goals would be subject to the individual department head's biases and decision situation interpretations. Consequently, there is reason to expect that in an MCSS implementation different department heads would be acting on subjective subsystem goals which may or may not be consistent with the hospital administration's objectives and goals for the system. This may lead to interdepartmental competition for scarce resources, non-cooperation and other traits of attempted subsystem optimization which may result in system suboptimization.

The situation which tends to result when a decision must be made which has multi-departmental impact is one of political bargaining. This bargaining occurs among departments and between departments and the administration. Frequently, unaffected departments are drawn into the process based on power structures and debts extant within the hospital.

The department head involved in the political bargaining/decision making process most often is acting in what he considers to be the best interest of his department and the hospital. That hospitals continue to function attests to the fact that most decisions are non-catastrophic in nature, do not involve the entire system, and are satisfactorily resolved through the rational-political process. Like all such processes, there are conventions or rules that allow efficiency. One such rule is interdepartmental respect for the other professional disciplines' physical, functional and fiscal territorial delineation. Another is the convention of mutual support for proposals justified to the administration as medical care delivery improvement. Of course, reciprocation is expected. The IOU or "chit" system is definitely in effect.

The MCSS implementation, however, tends to violate the neutrality assumptions of the interdepartmental codes of conduct. Since these systems manipulate information, the raw material of all decisions, and since information is a source of power and control, the adoption of a system tends to capture the interest of the entire staff.

But there are other, tangential reasons for their interest. Information systems tend to alter interdepartmental working relationships. They frequently require data preparation by one department for processing and use by another. For instance, nursing units prepare lab test requests for processing and use by the clinical laboratory. The implementation of a laboratory information system would, consequently, change the nursing units' test request procedures. In one hospital, an Admissions and Dispositions (A&D) department resisted the implementation of a laboratory information system because of this reason. The clinical laboratory had been responsible for the creation of inpatient administrative data under the manual system. But, with the MCSS, the A&D department was furnished with CRTs so that they could directly create inpatient files upon the admission of the patient. This arrangement would significantly improve the validity of inpatient data. Regardless, it represented a new, uncompensated workload for A&D with no apparent benefit to them. A&D's resistance to the implementation was in response to the fact that cooperation was contrary to their subsystem goals in spite of the fact that cooperation would have supported overall system goals.

MCSS implementations usually have high organizational visibility and CEO interest. However, the organizational power is distributed in the departments. Consequently, there may be (and have been) instances that the weak system-wide objectives provide little guidance with which to appraise the MCSS's contribution to the hospital's "mission". Department heads then appraise the MCSS within the frame of reference of their subsystem goals. In such cases, different criteria are used in individual judgments and allow reasonable people to derive differing opinions as to the efficacy, utility and resource allocation of the MCSS and its implementation.

Conflicting views about the benefits of the MCSS and the course of action to be employed in the implementation can lead to departmental decisions to block, opt out of, comply with, or actively assist in the implementation. Each of these courses of action may have profound effects on the implementation outcome (Dowling, 1980). The implementation is a unique temporal and procedural segment in the existence of the hospital. The way departmental work is performed is different from both the old manual ways and the future automated methods. A successful implementation often requires overt departmental support and action at specific times. Hence, a department's decision to opt out of implementation processes is actually exhibiting passive-resistant behavior. Such behavior, as well as covert or overt attempts to block the implementation can significantly impair the implementation. Conversely, mere compliance with implementation plans may result in implementation success only if no unplanned problems occur. If such problems are encountered, as they often are, active departmental assistance can sometimes help to overcome them and result in a successful implementaton. In the mid-1970s, two sister hospitals implemented an MCSS in an ancillary department. When the same software problems surfaced at the hospitals, increased departmental assistance in one of the hospitals was credited with developing a temporary way to overcome the resultant operational difficulties. The MCSS in that hospital was kept in operation and was soon fixed. In the other hospital, several departments had agreed to comply with implementation procedures but would not extend themselves when needed. There, the MCSS failed and was removed from service. Dowling (1980) offers several examples that show that departmental decisions to opt out of the implementation have increased the difficulties and costs of system implementations and in some cases have assured the system's failure.

Given this nature of hospital MCSS implementation, it is readily seen that the political bargaining process to gain interdepartmental approval and cooperation for the implementation, or failure thereof, is an important determinant of the implementation's success or failure. It is also important in understanding how a particular MCSS implementation outcome occurred. When considered in conjunction with the rational model, it greatly extends our framework for understanding MCSS implementations. At first glance, the integration of these two paradigms may seem inappropriate. They seem immiscible. However, this is not the case. At the monolithic organizational level, hospital activity usually appears consistent with the rational process. When viewed more closely, at the subsystem or departmental level, the hospital's rational behavior is shown to be the result of political and rational processes decided upon by individuals who are still primarily using the rational model for individual decisions. The key difference is that of objectives. The hospital level decisions are seen to be made based on system-wide objectives while departmental decisions are made using subsystem objectives and goals. Thus, the individual rational mode would call for departments and individuals to fulfill the set of goals which for them is their reality: subsystem goals. Inconsistency is derived from the fact that hospital and departmental goals are sometimes inconsistent.

2.4. THE INTEGRATION OF ELEMENTS OF SEVERAL ADOPTION PROCESS PARADIGMS

Rogers (1962) defined an innovation adoption theory which identified five stages of the adoption process:

(1) Awareness Stage. In this stage, the individual (the potential user) is aware of the existence of the innovation but has little information about it and is insufficiently motivated to research it further. Information assimilation at this stage is generally not purposive.

(2) Interest Stage. Here, the individual favors the innovation based on the information received in the Awareness Stage. This leads him to seek more information about it. While not yet determining the innovation's utility, his information search is deliberate.

(3) Evaluation Stage. This stage is characterized by the individual's mental simulation of the innovation's use. He attempts mentally to integrate the innovation into his work setting and then to evaluate its utility. He often seeks validation of the results of his cerebral evaluation through discussion with peers and other

opinion leaders. This stage results in a decision to either discontinue consideration of the innovation's adoption or to actually use it.

(4) Trial Stage. Here, the innovation is used on a "small scale" in order to determine its actual utility. The result may be a decision favoring the innovation's "complete adoption". Rogers implies that the trial may be other than the individual's first-hand implementation and use of the innovation.

(5) Adoption Stage. In this stage, the individual decides to continue the "full use" of the innovation.

Roger's adoption paradigm is highly applicable to the MCSS environment, with but little adaptation to the hospital setting. Although we are concerned with the MCSS's implementation, it should be obvious that the activities occurring in the stages which precede implementation determine if the implementation is to occur at all, and if it does, the organizational climate and setting in which the implementation is carried out. Consequently, they are logically and practically inseparable from the implementation that they precede.

Discussions with clinicians and administrators indicate that stages one and two are usually carried out by someone at the department level who performs a function associated with the system of interest. Thus, it tends to be a clinical laboratory manager or pathologist who exhibits interest in automated lab systems, outpatient clinicians or outpatient clinic managers who become interested in computerized outpatient scheduling systems, and the registrar or assistant administrator who investigates admission, discharge, and transfer (ADT) systems. Most MCSS vendor managers are acutely aware of the fact that departmental rather than hospital-level interest is the key source of inquiry about their wares. This occurs because one of the major ways information about these systems is transferred is through professional and social contacts between physicians and managers of kindred disciplines from different hospitals.

The transfer of information about new technology is enhanced, to the degree that it exists, by the nature of the physician. His blend of art and science has led him to be susceptible to (indeed some claim infected by) the "technological imperative" (Harris, J., from a class discussion in MIT course 14.21, "Health Economics"). The technological imperative is the drive to procure and to attempt to use the latest and most sophisticated technology available. In part, such tendencies have increased because "in recent years, explosive changes have occurred at the interface between medicine and other (scientific and engineering) disciplines" (Rushmer, 1972, p.9). These changes have reemphasized the "science" over the "art" of medicine and have increased the physician's traditional interest in the development and use of medical technology (Sheldon, 1970). Similarly, information transfer is enhanced by the new breed of non-physician hospital managers. These managers are technology oriented due to self-selection, efforts to legitimatize their profession (McLaughlin, 1970), and the fact that current MBA and MHA programs often stress system management and scientific decision making techniques which are technology (computer, communications, etc.) assisted.

In this environment, it is clear that most "technology gatekeepers" exist at the department level. Because of a pre-existing inclination toward MCSS technology, it is the gatekeeper who is sensitized to sift information about new or pertinent MCSSs from the mass of information that constantly barrage those in the health industry. Likewise, it is the gatekeeper who is likely to perform the mental testing of the system's applicability which occurs in the evaluation stage. However, he usually seeks peer validation of his findings if they warrant a trial of the system.

However, that the department has one or more gatekeepers who serve the function of making their peers aware of the existence and potential utility of new technology does not imply that conditions exist for the adoption and use of that technology. If there is departmental indifference to the system the gatekeeper favors, more often than not, the adoption idea withers. However, if the gatekeeper has legal, traditional, or fiscal power within the department (e.g., he is the department's chairman), he may continue consideration of the adoption unilaterally. Similarly, if the gatekeeper is an opinion leader within the department, based on the power of information and expertise or charisma, he may keep the adoption process alive by exercising his power and influence to generate departmental interest. But, if the gatekeeper is neither influential nor powerful, and the adoption idea survives initial departmental disinterest, it is usually because he has secured the aid of one or more influential or powerful department members or, as occurs occasionally, he has sought such support at a higher organizational level (e.g., from the chief of medicine, the hospital administrator, a member of the board of directors, etc.).

It is at the trial stage that Rogers' paradigm requires augmentation if it is to continue to be applicable to the MCSS environment. Rogers indicates a "small scale" trial occurs in this stage. Such a trial actually does occur, but may manifest itself in several ways due to the longer term contractual requirements of the vendor.

Especially if the system is a prototype or a new product offering and if technically possible, the vendor may grant the hospital experimental use of the MCSS for a short time. Portable terminals may be lent to the hospital so that its staff may load part of their database and exercise the system on a portion of their transactions. This, of course, presupposes the use of the vendor's regional or central CPU(s). When this happens, and with the hospital or departmental management's permission, the vendor frequently will invite clinicians and managers from nearby hospitals to see their system in use. The fact that the esteemed members of one institution seem to be seriously considering the adoption of the system adds credence to the advertised utility of the system. The fact that the other hospitals' staffs will come to see the system in operation is positive reinforcement that the interest of the experimenting hospital's staff is professionally acceptable and worthwhile. In effect, the vendor is using one institution as an influence leader for the other. Unfortunately, the hospital experimenters seldom realize the artificiality of such a trial. As a result, they seldom understand that the vendor's level of support for such a trial is extraordinary or that the system's real adoption will entail changes in work, power, and reward structures of the people who interact with it. Nevertheless, the effort serves as a useful, low cost, small scale trial of the MCSS.

More often than not, a pre-contractual trial, as described above, is not possible. If not, the trial may take the form of vicarious experience. The interested staff may arrange one or more site visits to see the system in use. These visits may be arranged by interested staff members or by the vendor's staff. The site visited may be another hospital that is using the MCSS, or the vendor's offices. These site visits are clearly artificial trials. Should the vendor arrange the visit, it will most assuredly be to a pro-system environment. And even when the interested hospital staff members select the site, they usually pick a site where the system is nearly or completely implemented. In either case, such observations have multiple biases. Still, much information can be derived from site visits, especially if the visiting staff recognizes the potentially confounding factors.

Even if preceded by the above trials, an actual implementation may be viewed by one or more key hospital staff members as a short-term trial. Unless the system is leased with the full knowledge of all staff members that the implementation is a temporally defined trial of the system, severe implementation difficulties may ensue. This situation usually arises when most staff members believe that the reason for the implementation is the gainful use of the system on an on-going basis. Some staff members, however, are not committed to the implementation and allow their peers to implement the system while they reserve judgment of the system. For these staff members, the actual implementation becomes little more than Rogers' small scale trial, with the recognition that, should the trial fail their acceptance criteria, they will counter its continuance in the hospital. Another phenomenon which sometimes accompanies this situation is the conversion of members who behave as though the implementation is in earnest into members who behave as though the implementation is a trial. The two conditions which foster this conversion are: (1) when implementation difficulties are noticeable and, (2) when it is known that some of their peers view the implementation as only a trial. Whenever the implementation is viewed by a subset of the staff as a trial, the system's survival becomes tenuous.

Rogers' adoption stage occurs when a critical mass of the staff has decided to use the MCSS on an on-going basis. It now can be seen that under some conditions, one staff member's trial stage may be another's adoption stage. Therefore, any attempt to define the "implementation phase" of the MCSS's adoption must be viewed as conditional. A priori, we may not know the intent of all of the hospital's staff. Hence, the implementation, a posteriori, may be recognized as a trial, an adoption, or a combination of both Rogerian stages.

2.5. ADDITION OF THE BUREAUCRATIC PROCESS MODEL

Until now, we primarily have been discussing paradigms which are related to decisions derived from individuals' analyses of decision situations. But, experience has shown that the outcomes of decision processes undertaken within organizational settings are often affected by those settings. The (subsystem) political decision process, discussed above, is an example. Departments within the hospital may make rational decisions based on their own subsystem goals; however, the ultimate outcome may be a decision which bears the marks of inter-departmental political processes which resolve departmental conflict.

Another paradigm which is applicable to the MCSS adoption setting has been partially described by Allison (1971) as it applies to governments. He refers to it as the "Organizational Process" paradigm, but the name "bureaucratic process" is more accurate and will be used here to adapt the paradigm to the hospital. In our context, a bureaucracy is an organization "characterized by specialization of functions, adherence to fixed rules, and a hierarchy of authority" (not necessarily hierarchical) (Merriam, 1976, Definition #2). The effects of bureaucratic processes on the outcome of system decisions are often observed, especially in large organizations with decentralized control and/or organizations whose staffs identify with departmental goals more strongly than with overall system objectives (e.g., governments, hospitals, etc.).

Allison bases his organizational process paradigm on the existence of bureaucratic departments within the government (1971, p.67):

> "To be responsive to a wide spectrum of problems, governments consist of large organizations, among which primary responsibility for particular tasks is divided. Each organization attends to a special set of problems and acts in quasi-independence on these problems. But few important issues fall exclusively within the domain of a single organization. Thus government behavior relevant to any important problem reflects the independent output of several organizations, partially coordinated by governmental leaders. Government leaders can substantially disturb, but not substantially control, the behavior of these organizations. "... At any given time, a government consists of existing organizations, each with a fixed set of standard operating procedures and programs. The behavior of these organizations - and consequently of the government - relevant to an issue in any particular instance is, therefore, determined primarily by routines established in these organizations prior to that instance."

In the MCSS frame of reference, the bureaucratic paradigm describes the outcome of the hospital decision process as an amalgam of departmental bureaucratic outputs. The departmental outputs are often only loosely coordinated and sometimes not coordinated at all.

A hospital's departmentalization is partially due to the hospital's effort to be responsive to the frequent need for specialized care. The result of this departmentalization, as discussed above, is that the departments have substantial existences of their own. They usually have their own goals and control systems. Their individual goals often reflect their belief in the primacy or near-primacy of their own work and the needs of their own constituency. And, their individual control systems reflect their subsystem view of what is important (note that interdepartmental activities such as communication and patient transfer are usually the most loosely controlled) and assure the decentralization of authority since departmental control systems are seldom duplicated or overseen at the system-wide level.

Therefore, at any given time, the hospital's organization may be thought of as a confederation of quasi-autonomous departments engaged in a mutual effort to deliver health care. This departmental structure or configuration corresponds to the mode of organization acceptable to existing departments and seen to be roughly appropriate for the fulfillment of delivery needs or demands. The configuration is perceived to be workable because most needs or demands fall into known or recognized disease, need, or demand syndromes. The departmental response to such syndromes is the creation and maintenance of care protocols or other response patterns. In other organizations these patterned responses are called, among other things, standard operating procedures. Each department, then, has programmed responses (Simon, 1977, p.46) for many activities including clinical and managerial decisions and actions. Although bureaucracy is often criticized, its standard responses do have several benefits. They add a measure of stability and consistency to the department and its behavior. They facilitate the dissemination of protocols found to be effective for dealing with certain situations. Also, they are useful as a component of the department's control functions. Nevertheless, these routines, once established, have behavioral inertia which resists change. One reason for this is that the individuals who devoted time and effort to create these routines have a vested interest in their continued existence. Further, staff members operating in this bureaucratic environment often attempt to fit a new problem or decision into a known syndrome so that an established protocol may be used to resolve it. As a result of these programmed responses, the department tends to behave today as it did yesterday. Or, as Allison notes, "the best explanation of an organization's behavior at T is (its behavior at) T-1".

As may be expected, the sub-decisions associated with an MCSS implementation may elicit a routinized response from some departments. Since the MCSS implementation is recognized as a complex event, hospital staff, management and implementors may and usually do attempt to factor the event's semi-structured and unstructured decisions (Keen and Scott Morton, 1978, p.11) into more manageable sub-decisions (Simon, 1957, p. 190). So, although the implementation is an atypical event, some of its factored decisions may be perceived to be similar to past routinized decisions and, hence, forced into "resolution" by existing protocols. Essentially, this bureaucratic process may convert a decision situation into a non-decision, reaction-only situation. Sometimes the programmed resolution is appropriate, at other times it is not.

When the effects of bureaucratic behavior on an MCSS implementation are neither sub-clinical nor appropriate, they are often manifested as counter-intuitive behavior as perceived by those who are familiar with the situation. In one hospital, emergency room technicians often failed to use a recently implemented computerized poison control system. They all were trained to use it. They all agreed that it significantly improved their ability to identify poisons and retrieve treatment information. However, they said that they were so familiar with the standard operating procedures of the old manual card system, that under stress they would revert to using it. In another situation, a physician in an outpatient setting had developed a rather common decision process with respect to management affairs. They would be processed only after all pending clinical decisions were complete. Further, if they came from the hospital administrator, they would be processed last because they were perceived to be associated with the administrator's attempt to control the physician's clinic. As might be expected, patient billing for this clinic invariably lagged behind service rendered, placing the facility in a financial bind. Consequently, when a new financial MCSS was implemented, the physician assumed it was another control mechanism, and refused to alter his thinking or action with regard to the system. His encounter/billing forms were invariably submitted after the system's close-out date for processing the forms. Another example deals with an individual found to have deliberately and covertly destroyed patient information in the MCSS's database. The inertia of standard personnel procedures caused her first personnel action, after the discovery of her sabotage, to be a promotion. The chief pathologist, not having a protocol for such a situation, allowed her promotion to stand and she continued working with the MCSS. Obviously, management was perceived by other workers not to view data sabotage with concern.

MCSS vendors are also liable to bureaucratic processes. One vendor's software correction process used the first in - first out (FIFO) complaint method.

Unfortunately, this forced one hospital to discontinue the use of the system. That hospital had identified a software deficiency of a serious nature. The bug was destroying the integrity of a clinical database. However, the vendor's FIFO complaint system precluded the intervention of a decision process. The immediate evaluation of the seriousness of a software problem was not possible given the standard operating procedure. Consequently, the serious problem was queued behind less serious, and in some cases trivial, problems which antedated it.

Although bureaucratic processes can always be found in hospitals, their effect on an MCSS implementation is intermittent. Its occurrence depends on the actions and perceptions of the staff members of departments involved in the implementation. Its occurrence varies inversely with staff behavior which recognizes that an implementation exists as a transition state, neither routine in terms of prior nor future work states (Beckhard and Harris, 1977, p.45). Their behavior must also reflect their understanding that the implementation requires the resolution of non-routine decisions, most of which do not fit existing protocols. Thus, if the staff acts to acknowledge and manage the transition state, including its non-routine decisions, negative bureaucratic impact on the implementation should be expected to be minimized.

2.6. INTEGRATION OF A THEORY OF CHANGE

The implementation of an MCSS represents the addition of a new technology-based method to a pre-existing, human-directed organizational environment. The result is a man-machine complex intended to accomplish some given work in the health care delivery system. Imbedded in these two statements are several important characteristics of MCSS implementation which bear elaboration since they represent the core of an MCSS "change" paradigm.

(1) The implementation is a process of planned change. Even in the most poorly planned MCSS implementaion, minimal levels of effort are needed to procure a system. Further, there is inevitably a reason for the expenditure of that effort. The reason or goal for the system is usually rationally tied to the nature of the system. A clinical laboratory information system is usually adopted to improve laboratory processes and control. Such organizational rationalism (discussed above) is not necessarily the basis for all adoptions, but even in its absence, personal rationalism is evident. For example, one hospital administrator ordered the implementation of an MCSS although the hospital was not in need of it. He did so for political (personally rational) reasons: a key member of

his hospital's board of directors was also a corporate officer of the MCSS's vendor company. Still, the system was justified through its proposed contribution to organizational goals. So, these goals and efforts demonstrate that there is intent to change the organization from its present state to some proposed future state. Thus, MCSS implementations are not totally random events, even though some appear to be so. They are planned attempts to effect change even if the change is ill understood. Parenthetically, Mumford and Pettigrew observe: "A danger associated with the use of computers has been an attraction to this technology as a means for change without significantly precise thought about the kinds of change likely to prove most worthwhile" (1975, p.xiii).

(2) There is more than just a "technological" change during an MCSS implementation, as the common but simplistic view purports. As Mumford and Pettigrew note, "All change has human consequences and computers are no exception" (1975, p.214). The implementation alters the existing man-machine environment and has implications in the area of human factors engineering. Man-machine systems are "systems that are a combination of <u>people</u> and <u>machines</u> and the <u>environment</u> in which they function" and we "consider 'machine' to consist of virtually any type of physical object, device, equipment, facility, thing, ..., or 'what

have you' that people 'use' in carrying out some activity..." (McCormick, 1970, p.5, underline emphasis added). Therefore, even if the MCSS replaces a manual system, its implementation changes the man-machine system. Not only are the machines changed, but the role of the individual as a system component and the environment in which he functions is changed.

(3) The change engendered by the implementation affects the work behavior of the hospital and of the individual staff members. Most MCSS implementation planning is devoted to the change in the hospital's work behavior. It focuses on the structure of the change: new work processes, new interdepartmental dependencies and responsibilities, and so forth. While such planning is absolutely required and is consistent with the rational paradigm, it usually fails to devote sufficient attention to the individuals who are the critical human components of the system. The work behavior of these human components will be subject to alteration as soon as they are aware of the impending change of systems. Their cognitive, reward, risk, etc. structures will be affected even if only at a sub-clinical level. Consequently, the success of the organization's transition to a new system is inextricably tied to the ability of a "critical mass of people" (Beckhard and Harris, 1977, p.53) to accept change at a personal level.

Lewin (1952) and Schein (1971, 1972) have developed a powerful theory of change which is highly applicable to the MCSS implementation setting. Although their theory has been successfully and appropriately applied to the implementation of general management science and management information system projects by Ginzberg (1975), his extension is normative (Ginzberg, 1975, p.84). Since this MCSS implementation paradigm is intended to be descriptive rather than normative, "what is" rather than "what should be", it is more appropriate for us to incorporate into it the basic Lewin/Schein model rather than Ginzberg's extension. We can only develop normative models when we are sure that our descriptive models reflect reality within our acceptable error tolerances. Otherwise, the internal and external validity of the foundation of the normative model will be uncertain.

Schein (1971, p.119) provides a synopsis of the theory which describes three phases of change: unfreezing, changing, and refreezing.

> "UNFREEZING. An alteration by the agent of influence of the forces acting on the person such that the existing equilibrium is no longer stable. Subjectively one can think of this as the induction of a need or a motive to change; i.e., the person who has been unfrozen with respect to some belief desires to change or abandon that belief.
>
> "CHANGING. The provision by the agent of

> influence of information, arguments, models to be imitated or identified with, etc., which provide a direction of change toward a new equilibrium, usually by allowing the person to learn something new, redefine something old, reevaluate or reintegrate other parts of his personality or belief system, etc. Subjectively, this would be experiences as 'seeing the light', having insight, seeing that the other fellow's viewpoint has a lot of merit, beginning to understand how someone else thinks about things, and so on.
>
> "REFREEZING. The facilitation by the agent of influence of the reintegration of the new equilibrium into the rest of the personality and into ongoing interpersonal relationships by the provision of reward and social support for any changes made by the person. Sometimes, however, it is not within the agent's power to determine whether the new belief will in fact fit into the rest of the personality or will be accepted by the person's significant others. Subjectively this would be experienced as discovering that others shared one's new point of view, that they were pleased with the change, that the new belief was quite congenial with other parts of the self image and other beliefs, etc."

There are several assumptions of the Lewin/Schein theory. Schein stated that the "beliefs, attitudes, values, and behavior patterns" (1971, p.117) of any individual are integrated and developed about the individual's "self-concept". This tends to provide an anchor which inhibits outside influence on the individual. It is a force resisting change unless the change offers a greater degree of integration of beliefs, attitudes, values, behavior patterns, etc. This integration then is not static. Rather, it represents a dynamic equilibrium of the array of forces which continuously act on the individual. Schein defines these forces as "all those internal and external events which the person perceives at a conscious or semi-conscious level as pulling or pushing him in some direction: needs, motives, desires, impulses, restraints, demands, questions, orders, temptations, goals, etc." (1971, p.118). It follows that Schein's "agent of influence" may be an array of individuals and situations which are potential influences or forces acting on the current "equilibrium". The re-establishment of the desired equilibrium during refreezing depends not only on the forces remaining consistant with the change but also with a subset of them representing a "safe" environment which provides the individual with positive reinforcement that the change is socially and personally acceptable, appropriate, and/or desirable.

There are several reasons for the Lewin/Schein theory's applicability to the MCSS implementation situation. First, the theory is compatible with the fact that the MCSS implementation is a planned change. It accounts for the activties, both planned and unplanned, of change agents. In this respect, it meshes especially well with the concepts of influence leaders, technology gatekeepers, etc. elaborated earlier. Second, it can account for technological, personal, and environmental factors which interact to effect change in the man-machine environment. These arrays of factors can be partitioned and described as arrays of influencing "forces" in each of the three stages of change. Third, The theory is useful in describing the change at both the organizational and individual (personal) levels. It does so not only for "desirable" change, but can be used to understand why such desirable change failed to come about or why undesirable change resulted. This capability is essential to understand any implementation setting, buc is especially useful in the MCSS situation which may be affected by the individual's ability or inability to accept change to a greater degree than less labor intensive and professionally dominated settings. It seems to explain many of the events which MCSS implementation observers have noted such as superhuman efforts to assure the success of implementations or to sabotage them. In his study of staff interference with hospitals' implementations of computer systems, Dowling (1980) compiled a list of eight sets of factors which he found contributed to the interference problem. The Lewin/Schein theory of change has implications for at least six of them:

> "Pre-existing organizational problems which the system or its implementation may or may not aggravate. The system, due to its management support and/or visibility may serve as a platform for individuals to express pre-existing dissatisfactions.
>
> "Failure of the change process. Management, if it attempts to manage the change process (Beckahrd and Harris, 1977) at all, may move into the change phase before the unfreezing phase has been successful. Or, psychological support which

reinforces the adoption of new organizational norms may be either non-existent or prematurely removed before 'refreezing' occurs.

"Confounding and magnifying the change engendered by the system with other organizational change. Often, management attempts to introduce other changes, which are irrelevant to the system's operation, in conjunction with its implementation. Extensive experiential data indicate that a system is not automatically a cure for organizational ailments and that compound changes may cause stress which is vented through system interference.

"Lack of user involvement. Allowing early user involvement has its risk. However, it usually assists unfreezing since staff members may come to perceive the system as their own. Early user involvement is also important since it is the primary mechanism for assuring that the system's functions are actually usable in a real environment.

"Neglect of staff reward structures. Frequently, the implementation process may alter the individual's reward and risk structure in such a way that he is motivated to actions that are detrimental to the system.

"Failure to meet staff expectations. Often, system advocates raise user expectations excessively in an effort to 'sell' the system and gain initial cooperation. Usually, this is more detrimental than beneficial."

Further, the Lewin/Schein theory fits well with the other paradigms which we are integrating in an intuitively appealing fashion; it makes sense.

2.7. SUMMARY

The basis for developing a unified MCSS implementation paradigm by integrating and extending several pre-existing paradigms lies in these paradigms' high degree of integratability and applicability to the hospital setting. Alone, each of the constituent paradigms has been insufficient to explain the implementation's events. They have tended to focus on circumscribed subprocesses or aberrations, or unrealistic overviews of a perceived monolithic event. But, taken together, they provide the insight necessary to explain most of an MCSS implementation's events, especially those once described as counter-intuitive. Therefore, the unified paradigm is in juxtaposition to the two prevailing approaches to the observation of implementations actually used: the wide angle view which concentrates solely on outcome, and the close up view that focuses on individual subprocesses.

The unified MCSS implementation paradigm is based on the human factors engineering definition of man-machine systems. This provides the logical climate for integration of the separate paradigms. The resultant paradigm is deliberately general. It provides a perspective of the implementation as a dynamic process having rational, political, bureaucratic, personal and other forces extant to varying degrees at almost all times. These processes may be partitioned in three dimensions which affect the MCSS implementation. The first tends to be those processes pushing for logical/functional outcomes at the system (organizational) level. The second is comprised of processes leading to logical/functional outcomes at the subsystem (departmental and individual) level (but which may lead to sub-optimization at the system level). The third is the set of processes which constrict the ability to derive logical/functional outcomes. The unified implementation paradigm indicates that its sub-paradigms may influence more than one of these dimensions at a given time or in a given situation (Figure 2.2). Further, it implies that the influences of any single partition may be in conflict with either or both of the other dimensions at any given time.

We claim neither that this unified paradigm is the single "right" paradigm nor that it explains all events found in an MCSS implementation. However, if it explains 80 to 90 percent of an implementation's events, it will represent a significant advance over pre-existing approaches to this process.

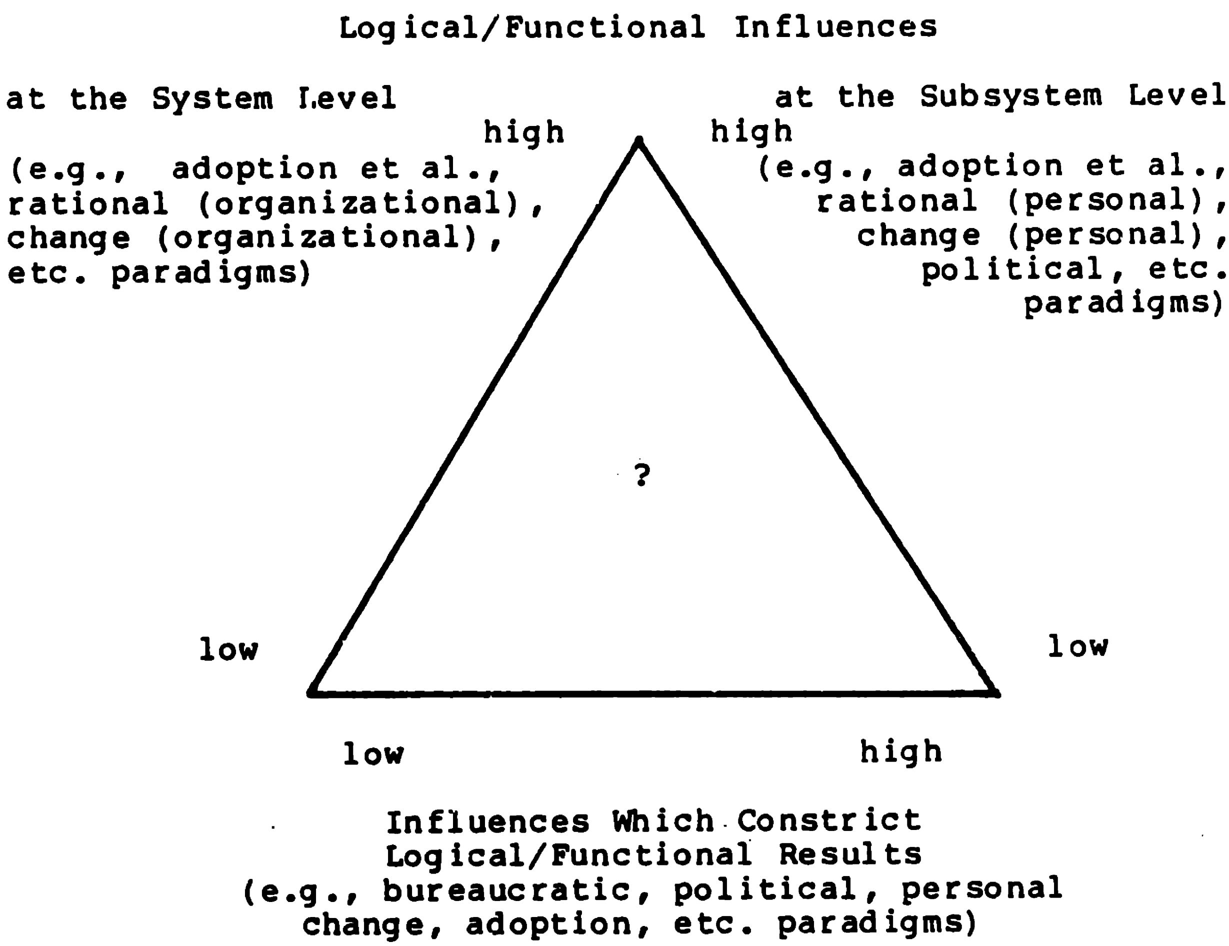


FIGURE 2.2 IMPLEMENTATION FORCES

3. A FRAMEWORK FOR RESEARCH

3.1. RESEARCH OBJECTIVES

A foundation objective of any research, whether or not such an objective is acknowledged or even recognized, is to achieve increased understanding of the basic nature of the phenomenon under investigation. This objective is the driving force of "basic" research. Another objective, that of "applied" research, is to determine the relationships of the basic research findings in real problems and to use this resultant descriptive understanding to develop and prescribe the processes which resolve or at least ameliorate the problem. In the view of many scientists,

basic research : applied research :: science : engineering.

In this sense, an investigation of the implementation processes of MCSSs philosophically has objectives at both the basic and applied levels. Although we are interested in issues surrounding a technology, we must recognize that there exist scientific underpinnings to the development and employment of the technology in a real environment.

This research is intended to investigate the implementation of vendor-provided common-software medically-oriented computer-based information systems (MCSS) by general medical and surgical, acute care, private sector, non-profit hospitals. The research is undertaken to contribute to the following objectives:

(1) To increase our understanding of MCSS implementation processes;

(2) To improve the design and probability of successful implementation of future MCSSs. ("System" is used here in the human factors engineering sense to include the machines, human users, and environment of use.)

The first goal is in the basic research partition. It draws upon and attempts to unify the knowledge bases of the physical and social sciences. The second objective is in the applied research partition. It attempts to effect change in the ergonomic engineering of the technology and its adoption processes.

No single research project could expect to fulfill these objectives since the relevant empirical MCSS knowledge bases which pre-exist this research are sparse and, in many cases, of questionable validity. Therefore, it is incumbent upon this research to limit itself to develop a foundation which will guide future research and which future research can exploit gainfully. The nature of this foundation can be defined by the goals this research is intended to achieve:

(1) To develop an implementation paradigm which unifies existing, applicable paradigms that bear on the implementation process and to tailor this unified paradigm to the MCSS environment so that it explains a majority of an implementation's events.

(2) To develop and test, at an exploratory level, a framework for meaningful descriptive MCSS research which, guided by the unified MCSS implementation paradigm, will facilitate the identification and measurement of the factors which most affect the level of success of an MCSS implementation.

The achievement of these goals should extend our ability to understand the complex set of implementation sub-processes so as to further develop the prescriptive knowledge necessary to increase the probability of success in MCSS implementation.

3.2. GENERAL RESEARCH APPROACH

The research of MCSS implementation poses distinct problems in research design and methodology. Given our human factors engineering view of MCSSs, we must contend with technological, behavioral, organizational, and other issues. While not alone in the need to consider diverse factors, other such situations are usually sufficiently different so that extant research designs are only partially adaptable to current needs. Furthermore, there is continuing disagreement with respect to methodology:

> "Methodologically, since 1940 one new centre of philosophical debate has developed, this time in the behavioral sciences. Ever since Descartes and Hobbes, there has been sharp disagreement about the legitimacy of extending the methods and categories of physical science to the sphere of the higher, distinctly human mental processes... Some psychologists insist that human actions are subject to laws and mechanisms of the same kind as physical processes; others deny that any direct analogy exists between rules of conduct and laws of nature." (S.E.T., 1976, p.381)

Such arguments are basic to handling the behavioral and organizational issues of MCSS implementation. While it is not our intent to resolve these conflicts, we must account for them. we must find some methodological middle ground upon which meaningful work can be performed:

> "Scientific investigators working in different

> fields, or at different times, apparently face theoretical difficulties of quite different kinds. One must therefore begin by studying the specific needs and tasks of each particular science, at one or another stage in its evolution, separately - seeking to recognize, in each individual case, the particular intellectual demands to be met..." (S.E.T., 1976, p.387)

Unfortunately, MCSS implementations do not lend themselves to experimentation as do some physical processes. Therefore a framework for such research must form the composite of a range of methods selected for their utility at specific points in the course of the research. Case analysis, non-parametric statistics, and parametric statistics used in quasi-experimental and true experimental research designs all have their place in MCSS research. However, their use must be logically integrated, both temporally and spatially, if this MCSS research is to resolve the problems identified by Keen and ultimately is to result in meaningful prescription.

Further, unless the researcher is to begin with an ethnographic tactic, he must have an interdisciplinary background with strengths and experience in computer science, health systems, management, etc. Only then can the researcher take advantage of existing knowledge bearing on the MCSS implementation process so as to make the research more effective and efficient and to avoid re-inventing the wheel.

3.2.1. Implication Of Prior Research

Prior writings on the topic of MCBISs have primarily fallen into:

(1) Descriptions of developed systems (e.g., Austin and Greene (1978), Brandeis (1977), Drachman et al. (1979), Gunji (1978), McGehee et al. (1981), etc.);

(2) Descriptions of peripheral development issues (e.g., Agbaljobi (1979), Story et al. (1981), Szolovits and Pauker (1972), Tolchin et al. (1981), etc.);

(3) Prescription for system development, adoption, etc. and general tutorials (e.g., Barnett (1968, 1977), Evans and Campbell (1970), Sobolewski (1978), Veazie and Dankmyer (1977), etc.).

"Research" into MCBIS implementation has been limited to prescription generally induced from a single or a few system implementations (e.g., Sobolewski (1977), Corby (1978), Ashcroft (1978), etc.). Furthermore, public domain MCSS implementation research is virtually nonexistent. Most of the research undertaken to investigate the MCSS adoption process has been carried out by system vendors and is proprietary.

Therefore, this research has little MCBIS literature from which to draw, and that which does exist has limited external validity. Resorting to the general MIS implementation literature, we find it of only limited use also. This conclusion is reinforced by Keen's (1977) perceptive analysis of existing implementation research in the MIS/OR area.

Keen has analyzed the extant MIS/OR implementation research and has partitioned it into seven categories summarized below. (Quotes in this section are from Keen (1977) unless otherwise noted.)

(1) Failure Study. Failure studies are not research and in most cases are not research by intent. For the most part, they represent the attempt to make known the importance of implementation issues other than application design. Others, however, are presented by the "gadfly" who is "a wise old man bent on mayhem rather than sage advice". Regardless, failure studies are expositions of system implementations which were ultimately rejected by the user or adopted with "disastrous results". The constructive studies subjectively induce prescription for disaster avoidance from too small a sample size to provide external validity. Further, since the analysis is so subjective, its internal validity is unknown. Even if this were not the case, these studies offer moot insight into success.

The situation is analogous to programmed decisions for three states of nature symbolized by +1 (successful implementation), 0 (ambiguous implementation), and -1 (unsuccessful implementation). Knowing the decision action appropriate for state of nature -1 does not provide information for action for 0 or +1. Knowing how to avoid failure is not synonymous with knowing how to assure success.

(2) Mutual Understanding. These studies represent the advocacy of an issue. They are based on the concept that the difference in cognitive styles between managers and system developers "are a major constraint on implementation and require specific strategies to ensure mutual understanding". Keen comments:

> "There is much indirect evidence to support this argument but it is only an assertion, unsupported by data. ... Again, the prescriptive aim seems to discourage the long-term empirical work needed to develop a precise framework."

In many cases improved understanding does lead to a better design. However, in the MCBIS setting, especially when the "technological imperative" phenomenon is evident, improved understanding of system design constraints has, sometimes, led to the development of less than operationally optimal systems. In some cases, had the manager been less capable of understanding and had he been forced to rely on managerial heuristics, the development effort would have been rightfully aborted. Conversely, in MCSS settings, improved mutual understanding may significantly decrease unrealistic user expectations, thus ameliorating a major implementation problem. These arguments illustrate the fact that the mutual understanding studies are useful but are only a subset of the implementation issue.

(3) User-Centered. This research is oriented toward the users' involvement in and attitudes toward the adoption. Keen indicates that it relies on the assumption that attitude is a reliable indicator for behavior and that "implementors should avoid change" to improve the likelihood of implementation success which is defined as user satisfaction. Keen correctly states that these assumptions are "contentious". These studies are mostly measurement based. The argument is that prescription can evolve from the information (we assume strong descriptive understanding is implied here) derived from measurements of real situations.

(4) Factor Study. Once the dominant thrust of implementation research, these studies attempt to atheoretically construct an overall description of implementation. They argue that implementation does have amorphous attributes and that "the first requirement is therefore to define its bounds and to answer the question

'what factors affect the likelihood of success?'". This work has primarily relied on small to large scale sample, questionnaire-based data. It is deliberately exploratory and relies on empirically derived correlations of "factors" with "success" to reveal important relationships (where the attempt to define "success" is quite rare). The work, as Keen notes, has several, almost always unstated, assumptions: (1) the existence of absolute factors, (2) that the right questions have been asked to reveal the important factors, and (3) that the methodology will generate a valid factor map. Each of these assumptions are disputable. Nevertheless, Keen states that "the question (What factors affect success?) remains the key one ...".

(5) Organizational Factors. Organizational factors work is exploratory, descriptive and inductive. However, it is limited to examining certain aspects of organizational structure and procedure. Keen indicates that its focus is on issues such as the development group's organizational location, role, user characteristics and user relationships. These can be important issues in an implementation, but are only a subset of the issues. This research does have one extremely important methodological aspect: it recognizes the dynamics of the implementation over time and therefore uses longitudinal, comparative techniques.

(6) Contingency Literature. This work is prescriptive and argues, "in explicit contrast to Factor study, that there are no absolute rules for implementation; a project must be matched to its context". It primarily represents the diagnostic application of findings from other research sources. As such, it is more advice than research, untestable but potentially useful.

(7) Social Change. This research is both descriptive and prescriptive. A basic framework for this research is the Lewin and Schein change theory presented in Chapter 2. It has the following view: that the introduction of a technology is tantamount to the management of a change process. There are numerous elaborations of this theme which are valid and useful. The main problem is that this work deals with a subset of implementation issues. Although it is both powerful and useful, it can not explain a sufficient enough portion of the implementation to stand alone.

All of these research efforts have yielded benefits to our knowledge of the implementation process. However, none is sufficiently global or integrative to prevent skewed observations of the implementation process by the uninitiated reader.

After analyzing his research typology, Keen then proceeds to outline the attributes necessary to perform meaningful implementation research. He answers his main question, "Is implementation a researchable subject?", in the affirmative but with qualifications:

> "The conclusions drawn here are that it is researchable only if the problem of definition is resolved and a perspective adopted in which paradigms are formulated in terms that facilitate description and measurement and which in turn point towards prescription. ... The practical issue of implementation is vital to the future of MS/MIS; implementation research therefore has great potential value. The work to date represents at best a tentative exploration; this analysis hopefully provides pointers toward a synthesis and extension."

Keen distinguishes two settings for implementation research:

> (1) Fully-Defined. "where the intention of the project is reasonably clear so that the extent to which it meets its aims can be assessed; in this situation, the definition of 'success' is intrinsic and criteria for evaluation apparent;
>
> (2) Undefined. "where there is a clear indication of the project but insufficient definition of operational goals to be able to relate outcome to intent."

Recall that Keen is dealing with MS/OR projects in general. Applying his concepts to the MCSS setting, "aims" refers to the systems adoption objectives, goals or reasons, including those at the organizational, departmental and individual levels. We are restricting our discussion to systems adopted to perform a known function, not research systems or known prototypes. Hence, the project's nature is clear. It is uncertain, even in a fully-defined setting, that the definition of success is "intrinsic" or that the criteria for evaluation are always apparent. Rather, the specification of evaluation criteria should be included in the development of a framework for MCSS implementation research. Keen provides the following definitions which are essentially compatible with those already developed herein.

(1) "Implementation is the effort to design and bring to completion a non-routine, technical program that requires explicit initiation and sanction." Although the MCSS design (without modification) has been completed, the human factors design of the man-machine environment is equivalent to the design effort of which Keen speaks.

(2) "The measure of success of the implementation effort depends on its (the system's) intended level of adoption." This implies two things. First, "level of adoption" includes the adoption goals. Second, these goals may have a functional component but they may also indicate no intent to integrate the systems into the organization on a permanent basis. Although counter to the setting with which we are concerned, even in the MCSS setting we must

not ignore the possible individual, departmental or organizational goals which view the adoption as merely a test. In such a case, a key individual may covertly wish that the system have but a short-lived tenure in the institution.

(3) "An implementation effort is successful if it meets or exceeds its intended level of adoption."

(4) "The term implementation refers to the full cycle of activities from initiation through to completion." By "completion", Keen means that the system is institutionalized consistent with objectives or that no more resources will be allocated to the implementation. That is, the implementation will advance no further.

(5) "An implementation effort can be evaluated only when it is complete." It is assumed that "evaluated" means final evaluation of outcome. Longitudinal study of an implementation requires evaluation over time, not just at completion, in order to monitor progress.

Generally, Keen's comments hold true for the study of MCSS implementations.

3.2.2. Description Leading To Prescription

Keen (1977, p.1) observes:

> "A central distinction (of prior implementation research) is between discussions motivated by prescription, which thus define normative strategies, and by description, which explore the dynamics of implementation. Meshing the descriptive and prescriptive has been difficult and seems to be a major explanation of the fragmentation in the research effort so far."

Part of the problem has been that the linkage between description and prescription has been either unrecognized or ignored in prior work. Some research methodology has started with prescription and ended with description. It has postulated normative strategy, attempted to implement the strategy, and then has descriptively analyzed the result. But without a strong understanding of the phenomena on which to base prescription, this process is analogous to alchemy.

Therefore, the inverse approach would be suspected to be more effective and is adopted herein; descriptive research must precede prescription. This does not preclude iteration of the sequence (Figure 3.1) when appropriate. However, it does force prescription to be based on knowledge of the issue and its environment, rather than on assumption.

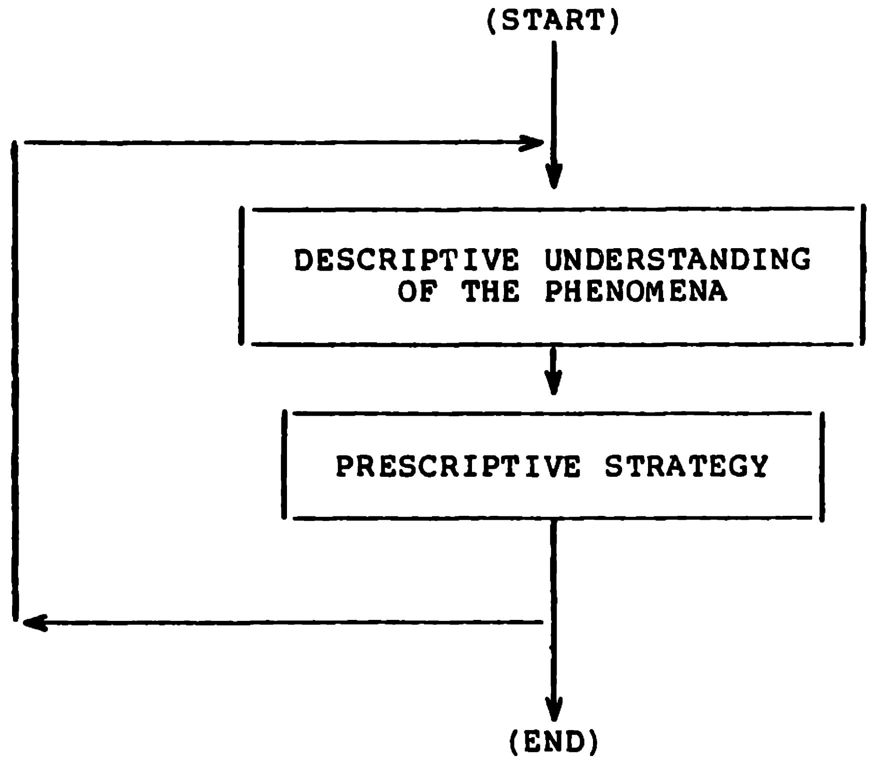


FIGURE 3.1 DESCRIPTIVE-PRESCRIPTIVE ITERATION

Descriptive research into the MCSS implementation process is the initial concern in the development of a general MCSS research framework. It must give us insight into MCSSs, hospitals, and the intersection of these two sets, the adoption of MCSSs by hospitals. Then, with a strong descriptive foundation, prescriptive research can be undertaken; strategy for effecting positive change can be researched and developed.

As Keen notes:

"The review of existing research ... strongly suggests that descriptive measurement is a critical need, that the prescriptive paradigms do not really go much beyond plausible assertions. However, the necessary output of the overall research must be prescription."

Further, an appropriate point of departure for such needed descriptive research is the investigation of the attributes or factors of the MCSS implementation which have the greatest effect on the level of success it achieves. Therefore, the first step to ultimately improving MCSS implementation is by descriptive research into its dynamics, specifically, into the dynamics of those factors having the greatest impact on the MCSS implementation's level of success.

3.2.3. Factor Vs. Other Approaches

Considering Keen's seven categories of implementation research, an observer may judge each category to be somewhat useful for achieving its objectives, in spite of its methodological drawbacks. So, if we were to divorce ourselves of methodology, we might observe that the factor study is the only type which does not restrict itself to a subset of the implementation issue. Its objective, determining which factors influence success, is, in fact, the appropriate question for the MCSS, or even MCBIS, implementation researcher who is trodding relatively unexplored territory.

But Keen's typology is partly defined by methodology. Keen states that mass factor studies are flawed because their assumptions (absolute factors exist, the correct factors are included, the factors will generate a reliable map) are moot, key definitions (e.g., of "success") and situational factors are missing, and their results are inconclusive. However, he continues: "that said, the question asked in this descriptive category (what factors affect the likelihood of success?) remains the key one, and it is hard to see how implementation research can progress without the map the factor study aims at".

Keen appears to be correct on all counts. Some implementation factors may be universal but are still not absolute. Rather, they may be dominated by other factors and may only surface in the absence of such domination. For example, system sabotage by the end user, wrought by change process failure, may not be possible if cutover is prevented by software bugs.

The shotgun approach to factor identification may or may not be of sufficiently fine grain and may either miss key factors or becloud them by the inclusion of too many, less important factors. Ginzberg (1974), in analyzing 14 implementation research projects, found that of 140 problem factors, 73% appear in only one study and only three are common to more than three reports. Thus, if there exist common factors impacting implementation, the research has not revealed and verified them.

The unguided empirical approach may lead to an incorrect map. If the researcher includes enough factors in a multi-variate least-squares linear regression, he will get a potentially useless model which reflects an artificially high correlation with its dependent variable. Even if this does not occur, he may be unable to resolve spurious correlations or determine causal relationships since this type of study is essentially atheoretical.

Hence, the identification of the key factors which affect success is important but rendered meaningless unless these problems Keen discusses are resolved.

3.3. THE DIRECTED FACTOR STUDY

Thus far, we have proffered the following points, based on the current state of MCSS adoptions:

(1) Research is needed that provides an understanding of the entire adoption process and ultimately leads to the development of interventions which are useful in improving the design and adoption of MCSSs;

(2) Prescriptive research is required to develop such interventions, but must be based on a valid understanding of the process, as provided by descriptive research;

(3) The objective of the factor study, developing a map of factors which affect the adoption's level of success, is an appropriate next step for MCSS implementation research. The map should identify each factor's effect vector (defined in Sec. 3.3.3.), operational characteristics (when, where and how it comes into play), and whether or not it is immune to potential interventions.

(4) Factor study methodology, as defined by Keen, has not produced findings of sufficient internal and external validity.

It follows from these points that a hybrid research framework is required, one that will adapt and extend the useful logic of prior research efforts, and provide a linkage for the various research types which will still have a contribution to make. In the following sections, the skeleton for such an MCSS research design is suggested. We shall call it the "Directed Factor" study.

3.3.1. A Hybrid Research Design

The point was made earlier that methodology should be adapted to fit the objectives of the research. The reader should not lose sight of this point since it underlies the framework proffered as the following set of postulates.

Proposition (1): The object of MCSS implementation rsearch is to derive a basic understanding of the MCSS adoption process and to derive useful prescription for improving that process.

Proposition (2): Descriptive research should precede and provide the foundation for prescriptive research, which in turn will derive prescription.

Proposition (3): The first goal for descriptive research is to develop a map of the effect of factors on the MCSS implementation's "success level".

Proposition (4): "Success level" (the dependent variable) must be related to the adopter's objectives and intended degree of adoption. Elaboration of the specifications for the dependent variable is presented in Section 3.3.2.

Proposition (5): The factors' (the independent variables) selection must be guided or directed by an MCSS adoption paradigm which is global; that is, it is designed to explain the major events of an adoption, not just subsets thereof. Elaboration of the specifications for the independent variables is presented in Section 3.3.3.

Proposition (6): The use of any adoption/implementation paradigm must be preceded by a logical demonstration of its applicability.

Proposition (7): The factor map should be derived through a true experimental design such as,

R O X O		Where:	R	random selection
			O	observation
R O O			X	treatment (event)

(notation: Campbell and Stanley 1963), to minimize threats to internal and external validity. However, it may well prove impossible in this country to mobilize the resources necessary to conduct such experimentation with more than a trivial sample size. Therefore, every reasonable effort should be made to approximate this experimental design while identifying potential confounding and validity threats.

Proposition (8): While the use of analytical techniques, such as multi-variate least squares linear regression, is appropriate in the modelling of the factor map, they must be supported by other research techniques, such as participant observation or ethnographic cases to assure that causal relationships and the differentiation of symptom and underlying problem are properly interpreted.

Proposition (9): The research settings (system adoptions) should be "fully defined" (according to Keen's definition) and their randomized selection should be restricted to "completed" adoptions of all states ("successes" through "failures").

Proposition (10): The pre- and post-treatment observations should be non-invasive to minimize the Heisenberg effects, and longitudinal to capture dynamic phenemona.

Proposition (11): If possible, the factor map, once developed, should facilitate the identification of issues which require further study, so that the issues may be partitioned and investigated by more traditional disciplinary study methods. However, the nature and significance of partition interfaces must not be ignored.

Proposition (12): Based on insight derived from the implementation paradigm and factor map, prescriptive research, especially intervention development and testing, should be undertaken.

As indicated in (4) and (5), the development and specification of the dependent and independent variables are so important that the following sections have been devoted to their elaboration.

3.3.2. The Dependent Variable

3.3.2.1. Attributes

Clearly, the major required attribute of the dependent variable is that it be as closely related to the phenomenon to be researched as practicable. Were we thermodynamicists of an earlier age researching the measurement of heat, the coefficient of expansion of a material would be of more significance than the time of year when barnyard animals shed their winter coats. Although both variables are related to ambient heat levels, material expansion, although an imperfect indicator, is superior because it more closely correlates with "heat", thus reducing possible confounding of the measure by other factors and increasing the internal validity of its use as a dependent variable. The closer the dependent variable is to identity with the phenomenon under investigation, the greater its reliability. The dependent variable is only perfect when it is, itself, the phenomenon. Unfortunately, the phenomenon is not always operationally useful as a manipulatable variable. Alternatively, proxy variables may introduce sufficient confounding so as to render them useless.

3.3.2.2. Selection

As described above, an objective of this study is to begin to understand, and thereby improve, the common-software medical computer system implementation process. One of the major goals is to develop a research framework to estimate the magnitudes and directions of impact which a relevant set of factors have on the implemented system's success. Therefore, the most directly applicable dependent variable is the "level of the system's success" or "success level" for brevity. This variable is theoretically perfect because it is, in fact, the phenomenon of interest.

The overwhelming majority, and possibly all, of the prior implementation research projects have implicitly or explicitly used a variant of "success" as a dependent variable. Some have simply split their sample into "successful" and "unsuccessful" systems without further discussion of rationale or validity. Others have used questionable proxy variables. This situation indicates two facts:

(1) The use of variables approximating the phenomenon, success, has nearly universal appeal; and

(2) Prior attempts to operationalize "success" as a variable have induced validity problems.

Hence, the concept of "success" is appropriate for the dependent variable but only if it can be theoretically defined and then operationalized with sufficient discrimination.

3.3.2.3. Definition

But, what is success? Is it functional hardware and software? Is it a close match between user needs and the system's functional capability? Is it the continuous operation of the system by the user?

That we may respond with a "qualified yes" to each of these questions indicates that success is an amalgam of multiple factors. Further, we may hypothesize that this may be a reason that system developers and system users have had past difficulty in agreeing on a given system's success. This serves to reinforce our human factors engineering perspective of the MCSS implementation process.

However, success is yet another case of a whole being greater than the sum of its parts. Dowling (1980) has identified systems which have been technical successes, but were considered failures by the adopters. He found others with good need/capability matches that also were considered failures. And others with some loyal users were still considered as failures. Yet the converse is true; for instance, some technically flawed systems were only partially used but were considered successes. Obviously, those who judged these systems were basing their judgments on different measures of success. This fact has only served to confound attempts to generalize implementation experience, to frustrate induction. The development of a meaningful unidimensional success measure would significantly help to resolve this problem.

As noted above, the traditional binary view of Success/Failure is erroneous and misleading. Therefore, we must abandon this view in favor of one which reflects reality with greater fidelity. Hence, we define the dependent variable to be "level of success", a theoretical continuum between two points, absolute failure and absolute success. One end point, absolute failure, is "worse" than the traditional "failure" and the other, absolute success, is "better" than traditional "success". This continuum allows us to scale a situation in which a system not only fails but also wreaks havoc on the hospital and causes other MCSSs to be eliminated as possible tools to improve the facility's efficiency and/or effectiveness, as worse than traditional failure. Similarly, an MCSS implementation which far exceeds its objectives and produces unanticipated benefits would be scaled as better than traditional success.

Our use of the words "better" and "worse" indicate that, given sufficient information, we can make comparison judgments and rank implementations as increasing (or decreasing) success levels (SL). This indicates that we can develop an ordinal success scale given a described set of "n" implementations:

SL(System Z) < SL(System P) < SL(System C)

The terms also suggest that we can take the ordinal scale one step further. Given the same set of "n" implementations, descriptions of their implementations, and some judgment criteria, we can rank them by "success level" and then grossly indicate that although the success rank order is:

SL(System Z) < SL(System P) < SL(System C)

System C is actually much more successful than System P and System P is only slightly more successful than System Z:

```
FAILURE <----|-------|----------------------|----> SUCCESS
           Sys.Z   Sys.P                  Sys.C
```

That is, we can develop an interval scale for "success level". However, our stepwise progression ends with the interval scale. We are unable to generate a ratio scale. Ratio scales require that we have some way to demonstrate how many times greater one point on the scale is than another. Since we have no logical, much less mathematical, way to show that Hospital #1's implementaion is twice as successful as Hospital #2's, we cannot develop a ratio scale. Indeed, we may argue that no one has even an intuitive sense of what "multiples of success" means.

The two keys to the development of an operational "success level" interval scale are the judgment criteria and the measure (description) as to whether or not the situation fulfills the criteria.

In the past, the judgment criteria for success has varied according to the role one had in the implementation. Many system vendors used continued payment of lease/purchase costs by the hospital. In a number of cases this also held for the hospital administrator: if the hospital was continuing payment, the system must "still" be successful. The criteria for staff members was often system use.

However, a common-software MCSS is not a research object for the general acute care hospital. Nor should it be a technological toy or status symbol. For the most part, these systems may be thought of as functional tools, the use of which improves some operational capability of the hospital. And, in fact, this view is rapidly dominating the thinking of the hospital decision makers who determine whether or not to adopt and/or retain MCSSs. Therefore, it is logical to conclude that a reasonable success judgment criteria be based on the fulfillment of adoption goals. We may define success as the (human factor) system's fulfillment of the goals the MCSS was implemented to fulfill. This explicitly recognizes that the technical success of the MCSS is inextricably coupled to the success of its implementation in a macro-system. The MCSS is but a part of the man/machine/environment system. Further, we must recognize that this definition of success is but a logical benchmark point on the success/failure (or level of success) continuum.

However, given this definition of success, how do we determine whether or not an MCSS implementation is successful; where on the success/failure continuum is the implementation outcome? What are the signposts which indicate its position? Gross positioning can be achieved by determining to what degree the objectives were achieved. Refinement, still gross, may be supplied by observed phenomena: MCSS use, disruption or smoothness of macro-system operation, perceived utility, additional benefits, added costs and other difficulties, etc. Still, all of these phenomena are judgmental. Even if we could agree on these signposts, we still judge them from our own perspective, for at best they are gross approximations. This indicates that a single frame of reference is needed. That reference frame should be supplied by those individuals who decide on and are responsible for the MCSS implementation. These individuals are the source of the judgment criteria, the implementation objectives.

Although the set of definitions we have developed is logically consistent and reasonable, our intent is not to myopically exclude its future extension and/or modification. The definitions do provide a defendable starting point and, in fact, satisfy Keen's (1977) requirements:

> (1) "The measure of success of the implementation effort depends on its intended level of adoption."
>
> (2) "An implementaion effort is successful if it meets or exceeds its intended level of adoption."

3.3.2.4. Operationalizing The "Success Level" Concept

One way that this definition may be operationalized within acceptable tolerances is by developing a Thurstone Sucessive Interval Scale which benchmarks "success" in relation to the MCSS implementation objectives. A Thurstone Scale is an interval scale derived through the use of representative judges' categorization of a series of statements along the desired unidimensional scale.

Other ways of measuring success level can be used. For example, the Delphi Method could be applied. Expert judges could be assigned to study a series of implementations and render a unified judgment as to the relative success of the observed set of implementations. Nevertheless, the method would still rely on human judgment to collapse multiple factors (dimensions) into a single dimension. The Thurstone method has the advantage that the judges are typical of the decision makers who actually decide the fate of real system implementations. This, logically, should reduce the judgment bias.

Certainly, the Thurstone method is worthy of investigation. The exploratory research described below addresses the development and execution of such a scale. A priori, though, we must recognize the existence of difficulties in applying any success level scale as described above:

(1) Lack of prior objectives or the adequate description of objectives allows the decision maker to shift his definition of goals as the implementation occurs. He may or may not realize this shift has occurred.

(2) The shift in undocumented objectives often occurs because of the massive learning which occurs during an implementation, especially for novice adopters.

(3) An a priori set of poor objectives causes the

decision maker to revise them after a learning experience. This often results in the objectives being shifted to more "socially desirable" responses.

(4) Hidden agendas which may be a part or all of the real implementation objectives may cause the publicly stated, usually socially desirable, objectives to be the wrong benchmark for success level measurement.

These are not the only potential problems with an attempt to measure success level. Nevertheless, since we do not expect a <u>perfect</u> measure, the definition provided here may still be operable within acceptable error tolerances. Only exploratory measure development and execution will resolve, or at least decrease, this uncertainty.

3.3.3. The Independent Variables

3.3.3.1. The Universe Of Implementation Factors

It is safe to assume that there are multiple factors which could contribute to the problem whenever an MCSS experiences less than planned-for success. Recent research which included a randomized survey of 40 hospitals (Dowling, 1980) found that the following factors frequently lead to less than fully successful implementations:

-Pre-existing organizational problems which the system or its implementation may or may not aggravate. The system, due to its management support and/or visibility may serve as a platform for individuals to express pre-existing dissatisfactions.

-Failure of the change process. Management, if it attempts to manage the change process (Beckhard and Harris, 1977) at all, may move into the change phase before the unfreezing phase has been successful. Or, psychological support which reinforces the adoption of new organizational norms may be either non-existent or prematurely removed before refreezing occurs.

-Insufficient resource support for the implementation effort. Manpower, time or other resources may not be made available in the manner or amount required.

-Hardware and software problems. Insufficient software and hardware verification before installation can cripple the hospital's operational capacity, endangering patient care and organizational viability, and these, in turn, may induce justifiable interference with the system.

-Confounding and magnifying the change engendered by the system with other organizational change. Often, management attempts to introduce other changes, which are irrelevant to the system's operation, in conjunction with its implementation. Extensive experiential data indicates that a system is not automatically a cure for organizational ailments and that compound changes may cause stress which is vented through system interference.

-Lack of user involvement. Allowing early user involvement has its risk. However, it usually assists unfreezing since staff members may come to perceive the system as their own. Early user involvement is also important since it is the primary mechanism for assuring that the system's functions are actually usable in a real environment.

-Neglect of staff reward structures. Frequently, the implementation process may alter the individual's reward and risk structure in such a way that he is motivated to actions that are detrimental to the system.

-Failure to meet staff expectations. Often, system advocates raise user expectations excessively in an effort to "sell" the system and gain initial cooperation. Usually, this is more detrimental than beneficial.

These factors are not unique to hospitals but are common to many industries (Beynon, 1975; Flanagan and Strauss, 1974; Gorz, 1973). However, frequent MCBIS implementation difficulties and the rate of turnover of MCSS vendors may be an indication that these implementation problems are being ignored or that they are particularly prevalent in hospitals.

Alternatively, there are usually multiple factors which contribute to a successful implementation. General industry research has revealed, but seldom validated, other factors which may bear on the implementation. Still other factors attributable to the nature of common-software, MCBISs, system vendors, non-profit industries, health care delivery facilities' organization and staffing, and so forth may also be affecting the level of success an MCSS achieves. Thus, it is possible that not all relevant factors have been identified by prior research or practice.

3.3.3.2. The Factor Array

Prior writings on implementation, while not necessarily by intent, may leave the reader with the impression that there are two sets of factors which affect implementation: one positively, the other negatively. (Positive implies aid in moving the implementation to a higher level of success; negative implies the opposite.) However, it is conceivable that there is a common subset that is the intersection of each of these factor sets.

Hence, by repartitioning the hypothetical universal set of factors, we may identify at least three subsets:

(1) the subset of factors which, if operational, may have only a negative impact on success level;

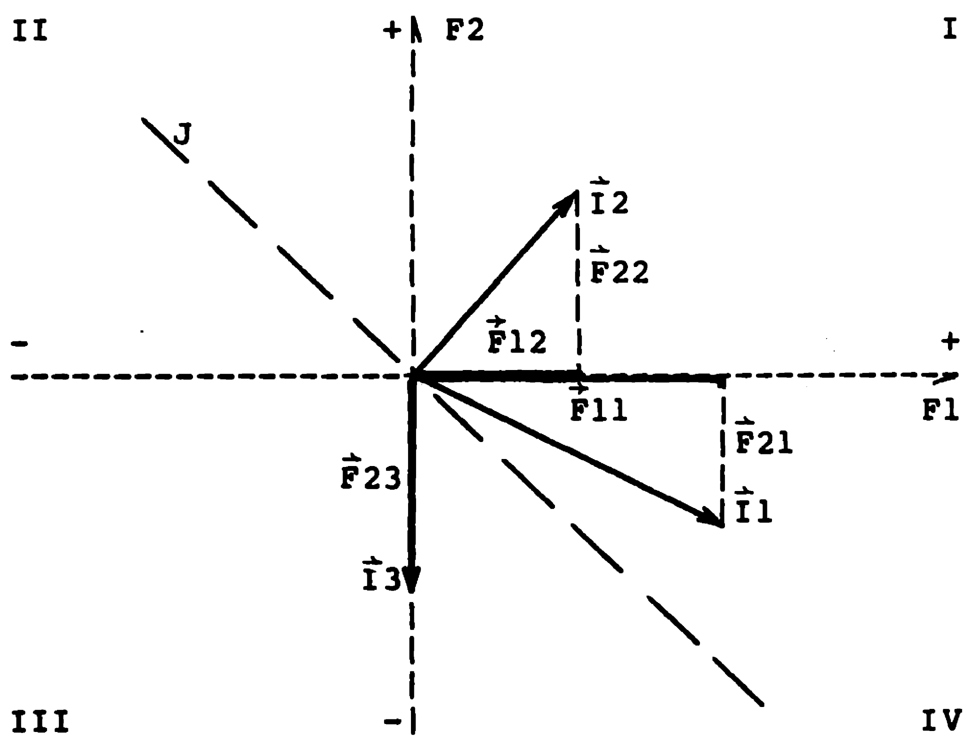
(2) the subset which, if operational, may have either a negative or positive impact; and

(3) the subset which, if operational, may have only a positive impact.

Two other attributes of factors can be discerned. First, the factor's impact may not always be operational. Perhaps a given factor may only impact success if it is not dominated by another (as described earlier) or if certain other conditions are met. Second, the factor's impact is not static. Its impact may vary according to other implementation factors or conditions.

What emerges from these conditions is the view of the factor (actually, its impact) as a vector. Each factor may have a direction (positive or negative effect) and a magnitude. Hence, we may view the implementation outcome as a resultant vector in n-space, the composite of "n" factors. The concept is illustrated in Figure 3.2. In the figure, $\vec{I}_1$ is the outcome of system #1's implementation.

Its outcome is the result of implementation factors #1 and #2. In this case, factor #1 had a positive effect on the implementation and factor #2 had a negative effect. On the other hand, Implementation #2 ($\vec{I}2$) was positively affected by both factors, although factor #1 had less of an effect than it did in implementation #1. Finally, the third system's implementation ($\vec{I}3$) has not been affected by factor #1 at all (the magnitude of the factor #1 vector here is zero), but factor #2 has had a negative impact.



Where:
- $\vec{I}n$ the resultant vector of the nth implementation.
- $\vec{F}jn$ the effect of factor j on the nth implementation.
- J the line segment where F1 = -F2.

FIGURE 3.2 IMPLEMENTATION RESULTANT VECTORS IN 2-SPACE

In other words, the factor effects on the implementations (in arbitrary units) are:

Implementation #1 ($\vec{I}1$): factor #1 ($\vec{F}11$) = +15 units
factor #2 ($\vec{F}21$) = - 7 units

Implementation #2 ($\vec{I}2$): factor #1 ($\vec{F}12$) = + 8 units
factor #2 ($\vec{F}22$) = + 9 units

Implementation #3 ($\vec{I}3$): factor #1 ($\vec{F}13$) = 0 units
factor #2 ($\vec{F}23$) = - 9 units

In general, implementation outcomes close to line segment J could be construed as neutral. Outcomes in the area where:

$$F2 > -F1$$

(e.g., quadrant I) may be considered more successful, while those in the area where:

$$F2 < -F1$$

(e.g., quadrant III) are the poorer outcomes.

This vector view of the implementation, like all models, has its benefits and drawbacks. It provides a reasonable framework for concept organization. It allows us to logically group factors into recognizable parcels. For instance, the factors $\vec{F}n$ through $\vec{F}n+g$ may represent the factors implicit in change theory, while factors $\vec{F}i$ through $\vec{F}i+j$ may be system function factors. This view forces us to recognize that none of the factors or factor packets exists in isolation. It forces us to interpret implementation processes with a view toward integration of available and useful concepts from different disciplines. This view clarifies the utility of the directed factor study approach. Since the strengths of correlation between factors and an MCSS's level of "success" (factor vectors' magnitudes and directions) have not been established, this is an obviously fruitful research direction.

Yet, it is a simplification of reality. Pragmatically, we know we will never have sample sizes sufficiently large to create factor maps in fine-grained detail. There are simply too many factors and interrelationships. Further, this view recognizes that the implementaion outcome is a function of the interrelationships of multiple factors:

$$\text{Implementation Outcome} = f\ (\vec{F}1, \vec{F}2, \ldots, \vec{F}n)$$

However, "f" represents many types of functions, none of which are currently known with any certainty.

Nevertheless, the vector view's benefits, at this stage of MCSS research, outweigh its failings as long as we never lose sight of those failings or fail to interpret results logically (rather than by undirected mathematical analysis). This view, and the direction it provides, is best used at a less fine-grained level. One very powerful simplification exists which appears to be valid according to the investigations of this research. It appears that the factor packets, as described above, cluster in recognizable syndromes. Hence, many fine grained factors may be able to be collapsed into a single macro-factor syndrome:

$$\text{Factor Syndrome \#1} = f' \; (\vec{F}11, \vec{F}12, \ldots, \vec{F}1n)$$

This would allow us to start at a reasonable level of aggregation known to be pragmatically researchable.

3.3.3.3. Factor Selection

Clearly, there are an abundance of factors and factor syndromes that are candidates for inclusion as independent variables. However, even exhaustive inclusion, were it possible, would not alleviate some of Keen's valid criticisms of the factor study (as he defines it). This is the reason for our inclusion of an MCSS implementation paradigm in this framework. The paradigm provides the frame of reference necessary to select the appropriate factors or factor syndromes for study. Turner (1971) provides this synopsis of Kuhnian insight:

> "(Kuhn) argues that science develops in a relatively nonlogical fashion from one revolution to another. Each revolution is to be distinguished by its paradigm... Against the backdrop of a preparadigmatic state of science, or of some previous paradigm, the emergent paradigm prescribes new ways of conceptualizing the structure of events... Thus, normal science is engaged in fact finding, in seeking confirmational support of the paradigm, and in the possible reformulation of the paradigm in more manageable or more elegant form. In brief, the paradigm provides the conceptual foundations for experimental work."

Hence, Keen's argument that "the paradigm indicates the relevant data" is adopted. Factor selection is not part of the research framework; it is part of the directed research effort and must be relegated to that effort.

3.4. SUMMARY

Existing research frameworks, as described by Keen (1977), have proven incapable of indicating which factors affect the success level of a system adoption with sufficient internal or external validity. Since such a factor map is of central importance in MCSS adoption descriptive research, it has become necessary to outline a framework which will enable the development of a factor map within error tolerances. In this chapter, various research concepts have been combined to yield a hybrid framework called a directed factor study.

The object of the directed factor study is to determine which factors or factor syndromes affect an MCSS adoption's level of success. The directed factor research framework views the implementation outcome as the resultant vector of an array of factor vectors. Any factor in the array may, a priori, have a direction and magnitude of impact which is positive, negative, or zero. The factor study is designed to determine for factors or factor syndromes what the vector characteristics are, their dynamics over time, under what conditions they are operative, and if their effect is likely to be altered by prescriptive interventions or if they are beyond human control. However, the framework's factor view is intended to facilitate conceptualization, not to foster only a mathematical view of the adoption process. It requires the joint use of analytic and non-analytic techniques so that an understanding of the ergonomic implications of the adoption are properly understood. This requirement diminishes the probability of causal misinterpretation.

The directed factor study relies on an MCSS adoption paradigm to indicate which factors or factor syndromes should be studied. It is based on relatively specific specification of adoption objectives, independent variables, the dependent variable (success level), and so forth, to assure that the deficiencies of other research types are overcome. Finally, it views this descriptive research effort as the foundation for prescriptive research intended to improve the probability of implementation success in future MCSS adoptions.

4. EXPLORATORY INVESTIGATION OF THE PARADIGM AND FRAMEWORK

4.1. SCOPE AND RESEARCH APPROACH

Before a future research effort can conduct a directed factor study, we must assess at an exploratory level the validity of the MCSS implementation paradigm and the appropriateness of the research framework. Here, we attempt to fulfill these two requirements.

Validation of the paradigm is based on the logical assessment of the implementation of MCSSs in eight hospitals. Essentially, the paradigm is compared with the reality of the implementations. The paradigm is considered useful if it accounts for and explains the majority of the more important events which ocurred during the implementation of the MCSSs.

Paradigm validation, itself, is part of the assessment of the framework. Key operating characteristics will be extracted from the paradigm to determine if they are operational in any of the implementations. Simultaneously, this effort will indicate if the framework's concept of factor syndromes appears to be realistic, since the operating characteristics will include certain factor aggregates. Additionally, the concepts developed for the dependent variable, success level, will be exercised. An attempt to develop an interval scale and measure for implementation success level will be made and followed with the exploratory use of the measure in the eight hospitals.

The methodology used to derive a measure of success is described in Section 4.2.1. Briefly, it is based on Thurstone's Method of Successive Intervals. The data was provided by forty hospital decision makers from eleven hospitals in the northeastern and mid-western states.

The paradigm operating characteristics used to test paradigm validity are stated in Section 4.2.2. By design, their specification is general, since this exploratory work is not intended to be the directed factor study. Rather, it is looking for broad indications of the existence, or lack of existence, of aspects of the paradigm in the implementations.

The structured case analysis of each hospital's implementation is a variant of case analysis referred to as "particularizing analysis" by Lipset, et al (1970):

> Particularizing "analysis uses general laws or regularities in order to carry out the analysis of the particular case... It uses previously known generalizations in order to make particular statements."

In this situation, the paradigm is based on the integration of pre-existing paradigms whose validity had been demonstrated by prior research. Each hospital represents a (particular) case where the paradigm's operating characteristics ("general laws" is too strong a term) are compared to the actual implementation events. If the operating characteristics are in evidence, we have an indication that the paradigm reflects reality to some degree. We fully expect that the eight cases will only grossly indicate <u>degree</u> of applicability for several reasons:

(1) Deliberately, the eight hospitals were not randomly selected.

(2) The eight implementations are all surviving systems. Most or all of their functions are actually in use. No "failed" system was analyzed.

(3) The method of analysis was not optimized to determine <u>degree</u> of paradigm impact. It was designed to determine <u>existence</u> of paradigm impact.

(4) Eight, as a sample size, may be a large number for in-depth case based analyses, but is small for statistical experimentation.

The eight hospitals were selected due to their adoption of certain MCSSs. First, four different MCSS vendors were selected. These vendors have developed systems which typically have hospital-wide effects and which are tailorable to varying degrees. One vendor has a large client base and does not modify its common software to any discernable degree. Another vendor will modify its common software to the contractual specifications of the user. The other two vendors are on the middle ground with respect to software modification. The MCSSs investigated were restricted to hybrid managerial/clinical systems (e.g., laboratory Information systems, nursing unit/ancillary service ordering systems, financial/charge systems). Secondly, a subset of hospitals which adopted one of the systems of the four vendors was generated. Two hospitals were selected for each vendor (Figure 4.1).

TYPICAL SOFTWARE COMMONALITY	VENDOR	HOSPITAL
LESS		
	#1	B and F
	#2	E and G
	#3	A and H
	#4	C and D
MORE		

FIGURE 4.1 SOFTWARE COMMONALITY VS. VENDOR

The hospitals were all private sector, non-profit, acute care facilities. They represent a variety of (bed) sizes and other attributes. The hospitals are located in the eastern, southern, and mid-western states. This geographic dispersion represents an attempt to minimize both regional idiosyncratic confounding and research costs. Although alternate sites were identified, only one was used. This was due to the primary hospital's refusal to participate in the research. The non-participating hospital's management gave no explanation, so it is not known if its reason was related to the MCSS implementation.

Case data were collected in person at the hospitals. At each hospital, five individuals who were staff members throughout the adoption were interviewed. Four of the individuals were drawn from top, middle and supervisory management of user departments. Usually, the supervisory manager was a combination clerk and clerical supervisor. The four user managers were selected for their involvement with and knowledge of the entire MCSS adoption. In some hospitals, the "top management" representative was replaced with a second middle manager since the hospital administrator did not participate in the system's adoption. The fifth person interviewed at each hospital was a nursing manager. This position was selected to represent an individual who did not participate in the adoption decision but would be in a position to have had access to the system related views and attitudes of a large portion of the hospital's staff throughout the course of the adoption. (Here, staff refers to all hospital employees and to non-employee admitting clinicians.) Occasionally, certain key individuals were no longer employed by the hospital. In these instances, the hospital would have been eliminated from participation if insufficient corporate memory existed to allow full case development. Fortunately, no hospital had to be eliminated. In one case, after 60% of the data had been collected, the hospital administrator declined personal participation. In response, an expanded interview was obtained with the second ranking manager. The reason appears to be unrelated to the MCSS adoption. Rather, the administrator is primarily an "external administrator" who has little operational involvement and only marginal knowledge of the MCSS adoption.

The interviews were directed but open ended. The data collection structure appears as Appendix #1. To determine effects of distributed power centers and influence leaders, each staff member interviewed was asked to list up to five members of the organization who were the most significant opinion leaders at the time of the adoption decision. Then they were to list, analogously, the people in the organization with the most power to effect change. After each name, they were to indicate their perception of the individual's attitude toward the adoption:

"+" => that the individual was slightly to strongly in favor of the adoption and all of the changes it engendered.

"0" => that the individual was indifferent or neutral.

"-" => that the individual was slightly to strongly against the adoption of the system and all of the changes it engendered.

Additionally, data about the user's concept of "success" and its measurement were collected following each of the case discussions. The case descriptions and their preliminary analyses are presented in Sections 4.2.3. through 4.2.10. The structure of the presentations is:

4.2.n. Hospital "X": Case and Preliminary Analysis

- 4.2.n.1. The Hospital
- 4.2.n.2. The Adpotion Decision
- 4.2.n.3. The System
- 4.2.n.4. The Implementation
- 4.2.n.5. Paradigm Fit
  - Objectives and Rational/Functional Processes
  - Adoption Processes
  - Political Process
  - Bureaucratic Process
  - Change Process
- 4.2.n.6. Success Level

4.2. TEST OF PARADIGM AND FRAMEWORK FIT

4.2.1. Development Of A Measure For SUCCESS

4.2.1.1. General Approach

Section 3.3.2., above, details the logical attributes required of a measure for an MCSS implementation's "level of success". Briefly, it indicates that an interval scale for the failure to success continuum is needed. Further, it indicates that the success level value, or score, be based on the hospital decision makers' evaluation of the total system's (in the human factors engineering sense) ability to fulfill the goals or reasons for its adoption.

As previously discussed, Thurstone's Method of Successive Intervals provides the means to develop an exploratory measure for "success level". The method's use generates an interval scale based on the judgment of a set of appropriately selected judges. These judges individually appraise the implication of a series of statements (items) and indicate their judgment by signifying where on the partitioned continuum each item belongs. A statistical method is then applied to the set of judges' item responses which develops a scale value for each item. Although the method is designed for attitude scale development, this is not inappropriate for our use. The initial adoption and the resultant vitality, indeed the survival, of an MCSS in a hospital is determined by the key hospital decision makers' judgment of multiple factors collapsed into a unidimensional outcome measure.

The reader's understanding of the theory and methodology of the Method of Successive Intervals is assumed. Since the method will not be explained here, the reader may wish to refer to Green (1954) and Edwards (1957).

4.2.1.2. Item Design And Data Collection

In this method, items (statements) are used to create benchmarks on the failure - success continuum. Each statement, as designed for our purposes, is intended to represent a possible outcome of a system's implementation. The scaling method would then develop a benchmark, a scale value, for each outcome statement.

The items were based on observed outcomes of actual MCBIS implementations. They were designed to be as general as possible while still retaining meaning to the judges. One indication that this goal was at least partially achieved is that judges frequently commented that they had observed implementation outcomes described by the statements. The items were pretested to minimize ambiguity, and the actual judges were questioned to determine if they had any difficulty in understanding the meaning of any items. Only one of forty judges indicated that he had interpretation difficulty, and then, with only one item, Item #17.

The final set of items which were judged is presented in Exhibit 4.1.

For judges to be representative, they had to be selected from the set of current hospital decision makers. To assure that the Method's assumption that judgments are distributed as a Gaussian probability density function is not violated, the number of judges was set at forty. These judges were decision makers in eleven hospitals who were holding positions in which they made or could make decisions about system adoption. These judges represented both clinical and managerial backgrounds.

Data were collected by the researcher, in person, at the judges' hospitals. Each judge was informed of a number of relevant definitions including:

> GOALS: The reason(s) the system is implemented; the functions or objectives it is

SUCCESS MEASURE ITEMS

1. The system fulfilled none of the goals we had for it.
2. The system fulfilled all of our goals and provided other benefits.
3. The system fulfilled most of our goals, but not all of them.
4. Although the system fulfilled none of our goals, computer systems will not be eliminated from future consideration of ways to solve problems.
5. The system fulfilled all of our goals but some people/departments disagree.
6. The system fulfilled few of our goals, and its operation is sporadic.
7. The system fulfilled few of our goals and caused other problems.
8. The system fulfilled our major goals but not some of the minor ones.
9. The system's costs and its failure to meet our goals assures that we will not use computer systems in the near future.
10. The system fulfilled none of our goals, but some of our people/departments wish to continue its use.
11. The system not only failed to meet our goals but caused a loss of resources and other problems.
12. The system fulfilled few of our goals but provided other benefits.
13. The system fulfilled most of our goals but some people/departments wish to discontinue its use.
14. Although the system fulfilled none of our goals, it provided other benefits.
15. The system fulfilled few of our goals and some people/departments decline to use it.
16. The system fulfilled all of our goals but some people/departments wish to discontinue its use.
17. The system fulfilled most of our goals but its operation is sporadic.
18. The system fulfilled some of our goals but not all of them.
19. The system fulfilled most of our goals but caused other problems.
20. The system fulfilled few of our goals and some people/departments wish to discontinue its use.
21. The system fulfilled most of our goals and provided other benefits.
22. On balance, the usefulness of the system is about the same as what it replaced.
23. The system fulfilled most of our goals but some people/departments have declined to use it.

EXHIBIT 4.1

intended to fulfill. Reasons or goals may be personal and/or departmental and/or organizational; stated and/or unstated.

SYSTEM: Any clinical and/or managerial computer-based information system such as clinical lab systems, admission/discharge/transfer systems, hospital information systems, financial systems, patient scheduling systems, etc.

COSTS: This includes direct expenditures (e.g., lease/purchase costs), indirect expenditures, personnel costs, organizational and personal difficulties/problems, difficulties in carrying out patient and/or management responsibilities, employee/staff dissatisfaction, etc.

These and other definitions were elaborated upon by the researcher to assure the judges' common and correct understanding.

The judges were then asked to infer what level of success each item indicated. They were to make this inference based upon their general decision making experience but not based on thoughts of a specific system with which they may have had experience. Each judge was acquainted with the following procedure:

"This procedure is based on your opinion as a decision maker. It asks you to judge the relative success/failure implied by a series of statements, each statement describing the possible outcome of a system implementation. It does not require a knowledge of or experience with computers. It is not asking for information about your hospital or your systems."

...

"The accompanying sheet contains statements which could describe the outcome of a hospital's implementation of a computer system. Each statement has a unique number.

"First, read all of the statements on the sheet.

"Second, for each statement:

(a) decide to what degree the statement reflects success/failure.

(b) write the number of the statement in the section of the above scale which corresponds to the degree of success/failure you judged.

(c) Multiple statements may be assigned to the same section. You may want to use a pencil in case you wish to revise any responses."

The judges responded by entering the item numbers in the eleven sections, or successive intervals, of the graphic in Figure 4.2.

```
EXTREME|    |    |    |    |...|    |    |    |    |EXTREME
FAILURE|____|____|____|____|   |____|____|____|____|SUCCESS
         1    2    3    4   ...  8    9   10   11
```

(NOTE: actual continuum had eleven successive intervals which were not numbered when used.)

FIGURE 4.2 SUCCESSIVE INTERVAL GRAPHIC

The responses of the forty judges appear in Table 4.1.

TABLE 4.1

JUDGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	2	11	9	3	9	3	3	10	1	5	1	7	9	4	6	10	6	8	9	4	10	4	9
2	1	11	9	3	9	2	2	9	1	2	1	4	9	3	3	10	4	3	4	3	10	1	6
3	1	11	7	3	9	3	2	5	1	4	1	4	6	3	5	9	7	5	4	4	10	5	7
4	1	11	9	2	9	2	2	9	1	2	1	4	6	2	2	9	6	6	6	2	10	4	6
5	1	11	10	1	10	2	2	10	1	2	1	2	7	2	3	9	7	6	9	2	10	3	7
6	1	11	8	2	10	2	2	10	1	2	1	4	8	2	3	10	4	6	10	2	10	3	8
7	1	10	8	1	9	1	2	9	1	1	1	1	8	1	1	10	4	3	4	2	9	6	5
8	1	11	10	2	11	2	1	10	1	2	1	3	10	2	2	11	7	8	9	2	11	5	10
9	6	11	8	6	10	4	4	9	6	7	3	8	9	7	5	8	4	5	5	5	9	7	10
10	4	10	8	7	8	2	3	7	2	8	2	8	7	4	4	7	2	8	6	6	9	2	4

Columns 1–23: ITEM NUMBER

JUDGES' ITEM RESPONSES

TABLE 4.1 (Cont.)

JUDGES' ITEM RESPONSES (Cont.)

JUDGE	ITEM NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
11	2	11	9	3	9	3	2	9	2	2	1	5	7	3	3	9	8	6	6	4	10	2	6
12	1	11	7	2	8	3	2	6	1	2	1	4	6	3	2	8	7	6	6	2	9	5	6
13	3	9	5	4	6	4	5	10	2	3	1	4	9	3	4	9	7	6	10	3	10	5	10
14	4	9	8	4	6	6	7	9	3	7	3	7	9	5	7	8	7	6	7	4	9	5	8
15	1	11	9	1	8	2	2	9	1	2	1	3	6	2	2	8	4	8	7	3	10	5	4
16	2	11	9	2	10	3	3	9	1	2	1	5	8	3	3	9	8	8	8	4	10	3	8
17	2	10	8	4	9	2	3	9	1	3	3	5	8	6	4	9	7	8	9	2	9	4	9
18	1	11	9	2	10	1	1	7	1	2	1	2	7	2	1	8	4	5	6	2	10	3	6
19	1	11	9	2	10	3	4	9	1	2	1	2	8	1	3	9	4	4	5	5	11	6	7
20	1	10	3	9	9	4	4	10	3	2	2	3	7	2	5	8	7	8	9	8	9	6	4

TABLE 4.1 (Cont.)

JUDGES' ITEM RESPONSES (Cont.)

	ITEM NUMBER																						
JUDGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
21	1	11	10	9	9	3	1	9	1	2	1	4	4	3	2	8	8	9	8	3	11	6	5
22	7	11	6	6	5	5	5	6	1	3	1	3	5	3	1	7	7	7	6	2	11	6	5
23	1	11	8	1	10	2	3	7	1	6	1	6	8	6	2	9	4	6	6	2	11	3	4
24	2	11	9	2	9	3	3	10	1	3	1	6	8	5	4	9	8	7	8	4	10	4	8
25	1	11	9	3	9	2	2	10	1	2	1	3	9	3	2	10	8	5	6	4	10	5	8
26	2	10	9	2	10	1	1	9	1	1	1	5	10	3	3	10	3	8	5	2	11	1	10
27	1	11	8	6	8	4	3	9	1	4	2	9	3	8	3	7	4	9	7	3	10	9	7
28	2	10	7	2	7	2	2	8	2	3	2	3	8	3	3	9	4	4	6	3	6	6	7
29	1	11	8	8	9	2	2	9	4	1	1	2	10	1	3	10	8	6	7	2	9	6	8
30	2	10	8	4	9	3	3	9	1	5	2	4	7	3	3	9	7	8	8	5	9	4	8

TABLE 4.1 (Cont.)

ITEM NUMBER

JUDGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
31	2	11	6	2	3	2	2	10	1	3	1	9	8	7	7	8	5	7	3	3	11	6	4
32	1	11	10	3	9	3	2	9	1	2	1	6	6	2	2	10	7	7	8	4	10	5	8
33	1	9	6	2	3	3	3	7	2	4	4	4	5	3	2	5	5	6	5	5	9	7	8
34	1	11	10	1	9	3	2	4	1	2	1	4	10	3	3	10	8	8	8	2	10	1	5
35	1	11	3	7	11	3	3	10	3	2	1	3	9	3	3	1	4	9	9	3	10	6	2
36	1	11	9	2	8	3	2	8	1	6	1	7	8	3	2	6	7	9	8	3	10	7	7
37	1	11	8	3	4	1	2	5	1	1	1	2	4	2	2	4	4	5	9	1	10	2	4
38	2	11	9	3	10	4	1	9	2	2	1	3	6	3	2	8	7	5	6	3	10	4	8
39	1	11	9	3	10	2	2	10	1	3	1	4	8	3	2	9	9	7	8	2	11	6	9
40	1	11	9	6	9	1	1	9	1	4	1	4	8	4	4	9	3	8	6	4	10	3	4

JUDGES' ITEM RESPONSES (Cont.)

4.2.1.3. Scale Development

This discussion uses Green's (1954) nomenclature and conventions. First, item histograms were plotted to gain an initial insight into response distributions (Exhibit 4.2). Any distribution which is uniform indicates that the item is ambiguous and should be eliminated. (Note that the intervals are not intended nor are assumed to be equal.) Item #17 and item #23 are of concern. Item #17 appears to be somewhat bimodal and item #23 may seem ambiguous to some judges. Exhibit 4.3 shows the standard deviations for the item responses and a histogram of the standard deviations as compared to the worst-case standard deviation for a Uniform PDF. Figure 4.3 is a plot of item standard deviations versus item numbers. Although item #17 and #23 appear borderline, the difference between their characteristics and the Uniform PDF, along with the fact that they are interesting statements, argue against their exclusion at this point.

Table 4.2 presents the frequency, cumulative frequency, and cumulative proportion calculations for the data. Tables 4.3 and 4.4 are the Pjg (observed proportion) and Xjg (unit Gaussian deviate corresponding to Pjg) matrices, respectively. Tables 4.5 and 4.6 present the matrix of column differences, including the generation of the tg's, and the matrix of (tg - Xjg), respectively.

```
HISTOGRAM   ITEM  1

MIDDLE OF   NUMBER OF
INTERVAL    OBSERVATIONS
     1.      25      *************************
     2.      10      **********
     3.       1      *
     4.       2      **
     5.       0
     6.       1      *
     7.       1      *
     8.       0
     9.       0
    10.       0
    11.       0


HISTOGRAM   ITEM  2

MIDDLE OF   NUMBER OF
INTERVAL    OBSERVATIONS
     1.       0
     2.       0
     3.       0
     4.       0
     5.       0
     6.       0
     7.       0
     8.       0
     9.       3      ***
    10.       7      *******
    11.      30      ******************************


HISTOGRAM   ITEM  3

MIDDLE OF   NUMBER OF
INTERVAL    OBSERVATIONS
     1.       0
     2.       0
     3.       2      **
     4.       0
     5.       1      *
     6.       3      ***
     7.       3      ***
     8.      11      ***********
     9.      15      ***************
    10.       5      *****
    11.       0
```

EXHIBIT 4.2

HISTOGRAM ITEM 4

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS	
1.	5	*****
2.	13	*************
3.	9	*********
4.	4	****
5.	0	
6.	4	****
7.	2	**
8.	1	*
9.	2	**
10.	0	
11.	0	

HISTOGRAM ITEM 5

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS	
1.	0	
2.	0	
3.	2	**
4.	1	*
5.	1	*
6.	2	**
7.	1	*
8.	5	*****
9.	16	****************
10.	10	**********
11.	2	**

HISTOGRAM ITEM 6

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS	
1.	5	*****
2.	14	**************
3.	14	**************
4.	5	*****
5.	1	*
6.	1	*
7.	0	
8.	0	
9.	0	
10.	0	
11.	0	

EXHIBIT 4.2 (Cont.)

HISTOGRAM ITEM 7

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS	
1.	6	******
2.	18	******************
3.	10	**********
4.	3	***
5.	2	**
6.	0	
7.	1	*
8.	0	
9.	0	
10.	0	
11.	0	

HISTOGRAM ITEM 8

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS	
1.	0	
2.	0	
3.	0	
4.	1	*
5.	2	**
6.	2	**
7.	4	****
8.	2	**
9.	18	******************
10.	11	***********
11.	0	

HISTOGRAM ITEM 9

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS	
1.	29	*****************************
2.	6	******
3.	3	***
4.	1	*
5.	0	
6.	1	*
7.	0	
8.	0	
9.	0	
10.	0	
11.	0	

EXHIBIT 4.2 (Cont.)

```
HISTOGRAM   ITEM   10

MIDDLE OF    NUMBER OF
INTERVAL     OBSERVATIONS
     1.        4      ****
     2.       18      ******************
     3.        7      *******
     4.        4      ****
     5.        2      **
     6.        2      **
     7.        2      **
     8.        1      *
     9.        0
    10.        0
    11.        0
```

```
HISTOGRAM   ITEM   11

MIDDLE OF    NUMBER OF
INTERVAL     OBSERVATIONS
     1.       31      *******************************
     2.        5      *****
     3.        3      ***
     4.        1      *
     5.        0
     6.        0
     7.        0
     8.        0
     9.        0
    10.        0
    11.        0
```

```
HISTOGRAM   ITEM   12

MIDDLE OF    NUMBER OF
INTERVAL     OBSERVATIONS
     1.        1      *
     2.        5      *****
     3.        8      ********
     4.       12      ************
     5.        4      ****
     6.        3      ***
     7.        3      ***
     8.        2      **
     9.        2      **
    10.        0
    11.        0
```

EXHIBIT 4.2 (Cont.)

HISTOGRAM ITEM 13

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS	
1.	0	
2.	0	
3.	1	*
4.	2	**
5.	2	**
6.	6	******
7.	6	******
8.	12	************
9.	7	*******
10.	4	****
11.	0	

HISTOGRAM ITEM 14

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS	
1.	3	***
2.	9	*********
3.	18	******************
4.	3	***
5.	2	**
6.	2	**
7.	2	**
8.	1	*
9.	0	
10.	0	
11.	0	

HISTOGRAM ITEM 15

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS	
1.	3	***
2.	13	*************
3.	13	*************
4.	5	*****
5.	3	***
6.	1	*
7.	2	**
8.	0	
9.	0	
10.	0	
11.	0	

EXHIBIT 4.2 (Cont.)

```
HISTOGRAM  ITEM  16

MIDDLE OF   NUMBER OF
INTERVAL    OBSERVATIONS
     1.        1     *
     2.        0
     3.        0
     4.        1     *
     5.        1     *
     6.        1     *
     7.        3     ***
     8.        9     *********
     9.       14     **************
    10.        9     *********
    11.        1     *
```

```
HISTOGRAM  ITEM  17

MIDDLE OF   NUMBER OF
INTERVAL    OBSERVATIONS
     1.        0
     2.        1     *
     3.        2     **
     4.       12     ************
     5.        2     **
     6.        2     **
     7.       13     *************
     8.        7     *******
     9.        1     *
    10.        0
    11.        0
```

```
HISTOGRAM  ITEM  18

MIDDLE OF   NUMBER OF
INTERVAL    OBSERVATIONS
     1.        0
     2.        0
     3.        2     **
     4.        2     **
     5.        6     ******
     6.       10     **********
     7.        5     *****
     8.       11     ***********
     9.        4     ****
    10.        0
    11.        0
```

EXHIBIT 4.2 (Cont.)

```
HISTOGRAM   ITEM   19

MIDDLE OF    NUMBER OF
INTERVAL     OBSERVATIONS
     1.          0
     2.          0
     3.          1     *
     4.          3     ***
     5.          4     ****
     6.         11     ***********
     7.          4     ****
     8.          8     ********
     9.          7     *******
    10.          2     **
    11.          0
```

```
HISTOGRAM   ITEM   20

MIDDLE OF    NUMBER OF
INTERVAL     OBSERVATIONS
     1.          1     *
     2.         14     **************
     3.         10     **********
     4.          9     *********
     5.          4     ****
     6.          1     *
     7.          0
     8.          1     *
     9.          0
    10.          0
    11.          0
```

```
HISTOGRAM   ITEM   21

MIDDLE OF    NUMBER OF
INTERVAL     OBSERVATIONS
     1.          0
     2.          0
     3.          0
     4.          0
     5.          0
     6.          1     *
     7.          0
     8.          0
     9.         10     **********
    10.         21     *********************
    11.          8     ********
```

EXHIBIT 4.2 (Cont.)

HISTOGRAM ITEM 22

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS	
1.	3	***
2.	3	***
3.	6	******
4.	6	******
5.	8	********
6.	10	**********
7.	3	***
8.	0	
9.	1	*
10.	0	
11.	0	

HISTOGRAM ITEM 23

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS	
1.	0	
2.	1	*
3.	0	
4.	7	*******
5.	4	****
6.	5	*****
7.	6	******
8.	10	**********
9.	3	***
10.	4	****
11.	0	

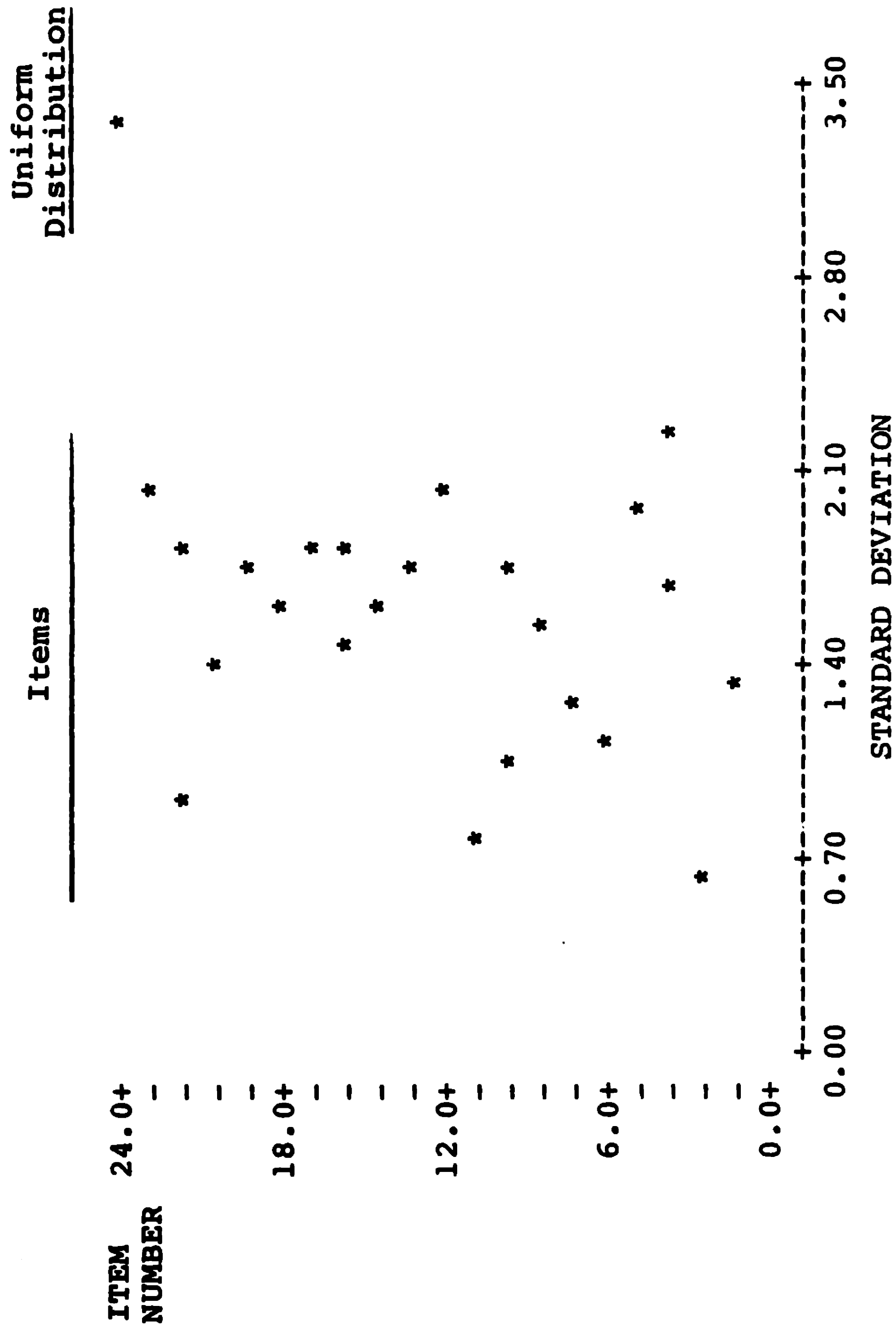
EXHIBIT 4.2 (Cont.)

ITEM	STANDARD DEVIATION
1	1.36
2	0.62
3	1.67
4	2.23
5	1.95
6	1.10
7	1.24
8	1.57
9	1.04
10	1.76
11	0.74
12	2.00
13	1.72
14	1.63
15	1.46
16	1.85
17	1.85
18	1.63
19	1.78
20	1.39
21	0.92
22	1.85
23	2.05
UNIFORM DISTB.	3.33

STAND. DEVIATION HISTOGRAM

MIDDLE OF INTERVAL	NUMBER OF OBSERVATIONS		
0.0	0		
0.3	0		
0.6	2	**	Items
0.9	2	**	
1.2	2	**	
1.5	6	******	
1.8	7	*******	
2.1	4	****	
2.4	0		
2.7	0		
3.0	0		
3.3	1	*	Uniform Distb.

EXHIBIT 4.3



ITEM NUMBER Vs. ITEM RESPONSE STANDARD DEVIATION

FIGURE 4.3

SUCCESSIVE INTERVALS

ITEM		1 <Failure	2	3	4	5	6	7	8	9	10	11 Success>
1	f	25	10	1	2	0	1	1	0	0	0	0
	cf	25	35	36	38	38	39	40	40	40	40	40
	cp	0.625	0.875	0.900	0.950	0.950	0.975	1.000	1.000	1.000	1.000	1.000
2	f	0	0	0	0	0	0	0	0	3	7	30
	cf	0	0	0	0	0	0	0	0	3	10	40
	cp	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.075	0.250	1.000
3	f	0	0	2	0	1	3	3	11	15	5	0
	cf	0	0	2	2	3	6	9	20	35	40	40
	cp	0.000	0.000	0.050	0.050	0.075	0.150	0.225	0.500	0.875	1.000	1.000
4	f	5	13	9	4	0	4	2	1	2	0	0
	cf	5	18	27	31	31	35	37	38	40	40	40
	cp	0.125	0.450	0.675	0.775	0.775	0.875	0.925	0.950	1.000	1.000	1.000

where f ≡ frequency
cf ≡ cumulative frequency
cp ≡ cumulative proportion

TABLE 4.2

SUCCESSIVE INTERVALS

ITEM		<Failure 1	2	3	4	5	6	7	8	9	10	Success> 11
5	f	0	0	2	1	1	2	1	5	16	10	2
	cf	0	0	2	3	4	6	7	12	28	38	40
	cp	0.000	0.000	0.050	0.075	0.100	0.150	0.175	0.300	0.700	0.950	1.000
6	f	5	14	14	5	1	1	0	0	0	0	0
	cf	5	19	33	38	39	40	40	40	40	40	40
	cp	0.125	0.475	0.825	0.950	0.975	1.000	1.000	1.000	1.000	1.000	1.000
7	f	6	18	10	3	2	0	1	0	0	0	0
	cf	6	24	34	37	39	39	40	40	40	40	40
	cp	0.150	0.600	0.850	0.925	0.975	0.975	1.000	1.000	1.000	1.000	1.000
8	f	0	0	0	1	2	2	4	2	18	11	0
	cf	0	0	0	1	3	5	9	3	29	40	40
	cp	0.000	0.000	0.000	0.025	0.075	0.125	0.225	0.275	0.725	1.000	1.000

where f ≡ frequency
cf ≡ cumulative frequency
cp ≡ cumulative proportion

TABLE 4.2 (Cont.)

SUCCESSIVE INTERVALS

ITEM		<Failure 1	2	3	4	5	6	7	8	9	10	Success> 11
9	f	29	6	3	1	0	1	0	0	0	0	0
	cf	29	35	38	39	39	40	40	40	40	40	40
	cp	0.725	0.875	0.950	0.975	0.975	1.000	1.000	1.000	1.000	1.000	1.000
10	f	4	18	7	4	2	2	2	1	0	0	0
	cf	4	22	29	33	35	37	39	40	40	40	40
	cp	0.100	0.550	0.725	0.825	0.875	0.925	0.975	1.000	1.000	1.000	1.000
11	f	31	5	3	1	0	0	0	0	0	0	0
	cf	31	36	39	40	40	40	40	40	40	40	40
	cp	0.775	0.900	0.975	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
12	f	1	5	8	12	4	3	3	2	2	0	0
	cf	1	6	14	26	30	33	36	38	40	40	40
	cp	0.025	0.150	0.350	0.650	0.750	0.825	0.900	0.950	1.000	1.000	1.000

where f ≡ frequency
cf ≡ cumulative frequency
cp ≡ cumulative proportion

TABLE 4.2 (Cont.)

SUCCESSIVE INTERVALS

ITEM		<Failure 1	2	3	4	5	6	7	8	9	10	Success> 11
13	f	0	0	1	2	2	6	6	12	7	4	0
	cf	0	0	1	3	5	12	17	29	36	40	40
	cp	0.000	0.000	0.025	0.075	0.125	0.275	0.425	0.725	0.900	1.000	1.000
14	f	3	9	18	3	2	2	2	1	0	0	0
	cf	3	12	30	33	35	37	39	40	40	40	40
	cp	0.075	0.300	0.750	0.825	0.875	0.925	0.975	1.000	1.000	1.000	1.000
15	f	3	13	13	5	3	1	2	0	0	0	0
	cf	3	16	29	34	37	38	40	40	40	40	40
	cp	0.075	0.400	0.725	0.850	0.925	0.950	1.000	1.000	1.000	1.000	1.000
16	f	1	0	0	1	1	1	3	9	14	9	1
	cf	1	1	1	2	3	4	7	16	30	39	40
	cp	0.025	0.025	0.025	0.050	0.075	0.100	0.175	0.400	0.750	0.975	1.000

where f ≡ frequency
cf ≡ cumulative frequency
cp ≡ cumulative proportion

TABLE 4.2 (Cont.)

TABLE 4.2 (Cont.)

		SUCCESSIVE INTERVALS										
		<Failure										Success>
ITEM		1	2	3	4	5	6	7	8	9	10	11
17	f	0	1	2	12	2	2	13	7	1	0	0
	cf	0	1	3	15	17	19	32	39	40	40	40
	cp	0.000	0.025	0.075	0.375	0.425	0.475	0.800	0.975	1.000	1.000	1.000
18	f	0	0	2	2	6	10	5	11	4	0	0
	cf	0	0	2	4	10	20	25	36	40	40	40
	cp	0.000	0.000	0.050	0.100	0.250	0.500	0.625	0.900	1.000	1.000	1.000
19	f	0	0	1	3	4	11	4	8	7	2	0
	cf	0	0	1	4	8	19	23	31	38	40	40
	cp	0.000	0.000	0.025	0.100	0.200	0.475	0.575	0.775	0.950	1.000	1.000
20	f	1	14	10	9	4	1	0	1	0	0	0
	cf	1	15	25	34	38	39	39	40	40	40	40
	cp	0.025	0.375	0.625	0.850	0.950	0.975	0.975	1.000	1.000	1.000	1.000

where f ≡ frequency
cf ≡ cumulative frequency
cp ≡ cumulative proportion

ITEM		<Failure 1	2	3	4	5	6	7	8	9	10	Success> 11
		SUCCESSIVE INTERVALS										
21	f	0	0	0	0	0	1	0	0	10	21	8
	cf	0	0	0	0	0	1	1	1	12	32	40
	cp	0.000	0.000	0.000	0.000	0.000	0.025	0.025	0.025	0.275	0.800	1.000
22	f	3	3	6	6	8	10	3	0	1	0	0
	cf	3	6	12	18	26	36	39	39	40	40	40
	cp	0.075	0.150	0.300	0.450	0.650	0.900	0.975	0.975	1.000	1.000	1.000
23	f	0	1	0	7	4	5	6	10	3	4	0
	cf	0	1	1	8	12	17	23	33	36	40	40
	cp	0.000	0.025	0.025	0.200	0.300	0.425	0.575	0.825	0.900	1.000	1.000

where f = frequency
cf = cumulative frequency
cp = cumulative proportion

TABLE 4.2 (Cont.)

INTERVAL (g)

ITEM (j)	1	2	3	4	5	6	7	8	9	10	11
1	0.625	0.875	0.900	0.950	0.950	0.975	1.000	1.000	1.000	1.000	1.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.075	0.250	1.000
3	0.000	0.000	0.050	0.050	0.075	0.150	0.225	0.500	0.875	1.000	1.000
4	0.125	0.450	0.675	0.775	0.775	0.875	0.925	0.950	1.000	1.000	1.000
5	0.000	0.000	0.050	0.075	0.100	0.150	0.175	0.300	0.700	0.950	1.000
6	0.125	0.475	0.825	0.950	0.975	1.000	1.000	1.000	1.000	1.000	1.000
7	0.150	0.600	0.850	0.925	0.975	0.975	1.000	1.000	1.000	1.000	1.000
8	0.000	0.000	0.000	0.025	0.075	0.125	0.225	0.275	0.725	1.000	1.000
9	0.725	0.875	0.950	0.975	0.975	1.000	1.000	1.000	1.000	1.000	1.000
10	0.100	0.550	0.725	0.825	0.875	0.925	0.975	1.000	1.000	1.000	1.000
11	0.775	0.900	0.975	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
12	0.025	0.150	0.350	0.650	0.750	0.825	0.900	0.950	1.000	1.000	1.000
13	0.000	0.000	0.025	0.075	0.125	0.275	0.425	0.725	0.900	1.000	1.000
14	0.075	0.300	0.750	0.825	0.875	0.925	0.975	1.000	1.000	1.000	1.000
15	0.075	0.400	0.725	0.850	0.925	0.950	1.000	1.000	1.000	1.000	1.000
16	0.025	0.025	0.025	0.050	0.075	0.100	0.175	0.400	0.750	0.975	1.000
17	0.000	0.025	0.075	0.375	0.425	0.475	0.800	0.975	1.000	1.000	1.000
18	0.000	0.000	0.050	0.100	0.250	0.500	0.625	0.900	1.000	1.000	1.000
19	0.000	0.000	0.025	0.100	0.200	0.475	0.575	0.775	0.950	1.000	1.000
20	0.025	0.375	0.625	0.850	0.950	0.975	0.975	1.000	1.000	1.000	1.000
21	0.000	0.000	0.000	0.000	0.000	0.025	0.025	0.025	0.275	0.800	1.000
22	0.075	0.150	0.300	0.450	0.650	0.900	0.975	0.975	1.000	1.000	1.000
23	0.000	0.025	0.025	0.200	0.300	0.425	0.575	0.825	0.900	1.000	1.000

MATRIX OF Pjg

TABLE 4.3

BOUNDARY (g)

ITEM (j)	1	2	3	4	5	6	7	8	9	10
1	0.32	1.15	1.28	1.64	1.64	1.96	-	-	-	-
2	-	-	-	-	-	-	-	-	-1.44	-0.67
3	-	-	-1.64	-1.64	-1.44	-1.04	-0.76	0.00	1.15	-
4	-1.15	-0.13	0.45	0.76	0.76	1.15	1.44	1.64	-	-
5	-	-	-1.64	-1.44	-1.28	-1.04	-0.93	-0.52	0.52	1.64
6	-1.15	-0.06	0.93	1.64	1.96	-	-	-	-	-
7	-1.04	0.25	1.04	1.44	1.96	1.96	-	-	-	-
8	-	-	-	-1.96	-1.44	-1.15	-0.76	-0.60	0.60	-
9	0.60	1.15	1.64	1.96	1.96	-	-	-	-	-
10	-1.28	0.13	0.60	0.93	1.15	1.44	1.96	-	-	-
11	0.76	1.28	1.96	-	-	-	-	-	-	-
12	-1.96	-1.04	-0.39	0.39	0.67	0.93	1.28	1.64	-	-
13	-	-	-1.96	-1.44	-1.15	-0.60	-0.19	0.60	1.28	-
14	-1.44	-0.52	0.67	0.93	1.15	1.44	1.96	-	-	-
15	-1.44	-0.25	0.60	1.04	1.44	1.64	-	-	-	-
16	-1.96	-1.96	-1.96	-1.64	-1.44	-1.28	-0.93	-0.25	0.67	1.96
17	-	-1.96	-1.44	-0.32	-0.19	-0.06	0.84	1.96	-	-
18	-	-	-1.64	-1.28	-0.67	0.00	0.32	1.28	-	-
19	-	-	-1.96	-1.28	-0.84	-0.06	0.20	0.76	1.64	-
20	-1.96	-0.32	0.32	1.04	1.64	1.96	1.96	-	-	-
21	-	-	-	-	-	-1.96	-1.96	-1.96	-0.60	0.84
22	-1.44	-1.04	-0.52	-0.13	0.39	1.28	1.96	1.96	-	-
23	-	-1.96	-1.96	-0.84	-0.52	-0.19	0.20	0.93	1.28	-

MATRIX OF Xjg

TABLE 4.4

COLUMN DIFFERENCES

ITEM (j)	2-1	3-2	4-3	5-4	6-5	7-6	8-7	9-8	10-9
1	0.83	0.13	0.36	0.00	0.32	-	-	-	-
2	-	-	-	-	-	-	-	-	0.77
3	-	-	0.00	0.20	0.40	0.28	0.76	1.15	-
4	1.02	0.58	0.31	0.00	0.39	0.29	0.20	-	-
5	-	-	0.20	0.16	0.24	0.11	0.41	1.04	1.12
6	1.09	0.99	0.71	0.32	-	-	-	-	-
7	1.29	0.79	0.40	0.52	0.00	-	-	-	-
8	-	-	-	0.52	0.29	0.39	0.16	1.20	-
9	0.55	0.49	0.32	0.00	-	-	-	-	-
10	1.41	0.47	0.33	0.22	0.29	0.52	-	-	-
11	0.52	0.68	-	-	-	-	-	-	-
12	0.92	0.65	0.78	0.28	0.26	0.35	0.36	-	-
13	-	-	0.52	0.29	0.55	0.41	0.79	0.68	-
14	0.92	1.19	0.26	0.22	0.29	0.52	-	-	-
15	1.19	0.85	0.44	0.40	0.20	-	-	-	-
16	0.00	0.00	0.32	0.20	0.16	0.35	0.68	0.92	1.29
17	-	0.52	1.12	0.13	0.13	0.90	1.12	-	-
18	-	-	0.36	0.61	0.67	0.32	0.96	-	-
19	-	-	0.68	0.44	0.78	0.26	0.56	0.88	-
20	1.64	0.64	0.72	0.60	0.32	0.00	-	-	-
21	-	-	-	-	-	0.00	0.00	1.36	1.44
22	0.40	0.52	0.39	0.52	0.89	0.68	0.00	-	-
23	-	0.00	1.12	0.32	0.33	0.39	0.73	0.35	-
COL. SUM	11.78	8.50	9.34	5.95	6.51	5.77	6.73	7.58	4.62
COL. MEAN	0.906	0.567	0.492	0.298	0.362	0.361	0.518	0.948	1.160

t1	t2	t3	t4	t5	t6	t7	t8	t9	t10
0.000	0.906	1.473	1.965	2.263	2.625	2.986	3.504	4.452	5.612

MATRIX OF COLUMN DIFFERENCES

TABLE 4.5

ITEM (j)	CATEGORY BOUNDARY (g) 1	2	3	4	5	6	7	8	9	10	ROW SUM	SCALE VALUE
1	-0.32	-0.24	0.19	0.33	0.62	0.67	-	-	-	-	1.25	0.21
2	-	-	-	-	-	-	-	-	5.89	6.28	12.17	6.09
3	-	-	3.11	3.61	3.70	3.66	3.75	3.50	3.30	-	24.63	3.52
4	1.15	1.04	1.02	1.20	1.50	1.48	1.55	1.86	-	-	10.80	1.35
5	-	-	3.11	3.40	3.54	3.66	3.92	4.02	3.93	3.97	29.55	3.69
6	1.15	0.97	0.54	0.33	0.30	-	-	-	-	-	3.29	0.66
7	1.04	0.66	0.43	0.53	0.30	0.67	-	-	-	-	3.63	0.61
8	-	-	-	3.92	3.70	3.78	3.75	4.10	3.85	-	23.10	3.85
9	-0.60	-0.24	-0.17	0.01	0.30	-	-	-	-	-	-0.70	-0.14
10	1.28	0.78	0.87	1.03	1.11	1.19	1.03	-	-	-	7.29	1.04
11	-0.76	-0.37	-0.49	-	-	-	-	-	-	-	-1.62	-0.54
12	1.96	1.95	1.86	1.57	1.59	1.69	1.71	1.86	-	-	14.19	1.77
13	-	-	3.43	3.40	3.41	3.22	3.18	2.90	3.17	-	22.71	3.24
14	1.44	1.43	0.80	1.03	1.11	1.19	1.03	-	-	-	8.03	1.15
15	1.44	1.16	0.87	0.92	0.82	0.99	-	-	-	-	6.20	1.03
16	1.96	2.87	3.43	3.61	3.70	3.91	3.92	3.75	3.78	3.65	34.58	3.46
17	-	2.87	2.91	2.28	2.45	2.68	2.15	1.54	-	-	16.88	2.41
18	-	-	3.11	3.24	2.93	2.63	2.67	2.22	-	-	16.80	2.80
19	-	-	3.43	3.24	3.10	2.68	2.79	2.74	2.81	-	20.79	2.97
20	1.96	1.23	1.15	0.92	0.62	0.67	1.03	-	-	-	7.58	1.08
21	-	-	-	-	-	4.59	4.95	5.46	5.05	4.77	24.82	4.96
22	1.44	1.95	1.99	2.09	1.87	1.35	1.03	1.54	-	-	13.26	1.66
23	-	2.87	3.43	2.80	2.78	2.81	2.79	2.57	3.17	-	23.22	2.90

MATRIX OF (tg - Xjg)

TABLE 4.6

Finally, the items' raw scores and final scores are listed in Table 4.7. Note that since the scale is an interval scale, a constant can be added to all scale values to allow a shift in the scale. This does not alter the scale's validity. Hence, the constant 0.54 has been added to all scale values to allow the item nearest "extreme failure" to equal zero, for convenience. This does not mean that the lowest scoring item is synonymous with absolute or even extreme failure. The items are rearranged in increasing scale value and presented in Exhibit 4.4. Figure 4.4 presents the final success level continuum scale.

The internal consistency check suggested by Edwards (1957) was performed to gain an indication of the model's (the scale's) internal consistency. Essentially, this method converts the final scale values back into a theoretical proportion matrix (Pjg'). If the absolute mean difference between the theoretical proportions (Pjg') and the actual proportions (Pjg) is small, internal consistency is indicated. Tables 4.8, 4.9, and 4.10 present the Xjg', Pjg', and | Pjg - Pjg' | matrices, respectively. The final calculation of the absolute mean deviation is shown in Table 4.10 and equals 0.033. This value is not inconsistent with values (0.02+) reported for other presumably consistent models (Edwards, 1957, p.138).

SEQUENCE NUMBER	RAW ITEM SCORE	FINAL ITEM SCORE	ITEM NUMBER
1.	-0.54	0.00	11
2.	-0.14	0.40	9
3.	0.21	0.75	1
4.	0.61	1.15	7
5.	0.66	1.20	6
6.	1.03	1.57	15
7.	1.04	1.58	10
8.	1.08	1.62	20
9.	1.15	1.69	14
10.	1.35	1.89	4
11.	1.66	2.20	22
12.	1.77	2.31	12
13.	2.41	2.95	17
14.	2.80	3.34	18
15.	2.90	3.44	23
16.	2.97	3.51	19
17.	3.24	3.78	13
18.	3.46	4.00	16
19.	3.52	4.06	3
20.	3.69	4.23	5
21.	3.85	4.39	8
22.	4.96	5.50	21
23.	6.09	6.63	2

TABLE 4.7

0.00	11.	The system not only failed to meet our goals but caused a loss of resources and other problems.
0.40	9.	The system's costs and its failure to meet our goals assures that we will not use computer systems in the near future.
0.75	1.	The system fulfilled none of the goals we had for it.
1.15	7.	The system fulfilled few of our goals and caused other problems.
1.20	6.	The system fulfilled few of our goals, and its operation is sporadic.
1.57	15.	The system fulfilled few of our goals and some people/departments decline to use it.
1.58	10.	The system fulfilled none of our goals, but some of our people/departments wish to continue its use.
1.62	20.	The system fulfilled few of our goals and some people/departments wish to discontinue its use.
1.69	14.	Although the system fulfilled none of our goals, it provided other benefits.
1.89	4.	Although the system fulfilled none of our goals, computer systems will not be eliminated from future consideration of ways to solve problems.
2.20	22.	On balance, the usefulness of the system is about the same as what it replaced.
2.31	12.	The system fulfilled few of our goals but provided other benefits.
2.95	17.	The system fulfilled most of our goals but its operation is sporadic.
3.34	18.	The system fulfilled some of our goals but not all of them.
3.44	23.	The system fulfilled most of our goals but some people/departments have declined to use it.
3.51	19.	The system fulfilled most of our goals but caused other problems.
3.78	13.	The system fulfilled most of our goals but some people/departments wish to discontinue its use.
4.00	16.	The system fulfilled all of our goals but some people/departments wish to discontinue its use.
4.06	3.	The system fulfilled most of our goals, but not all of them.
4.23	5.	The system fulfilled all of our goals but some people/departments disagree.
4.39	8.	The system fulfilled our major goals but not some of the minor ones.
5.50	21.	The system fulfilled most of our goals and provided other benefits.
6.63	2.	The system fulfilled all of our goals and provided other benefits.

SCALED ITEMS
EXHIBIT 4.4

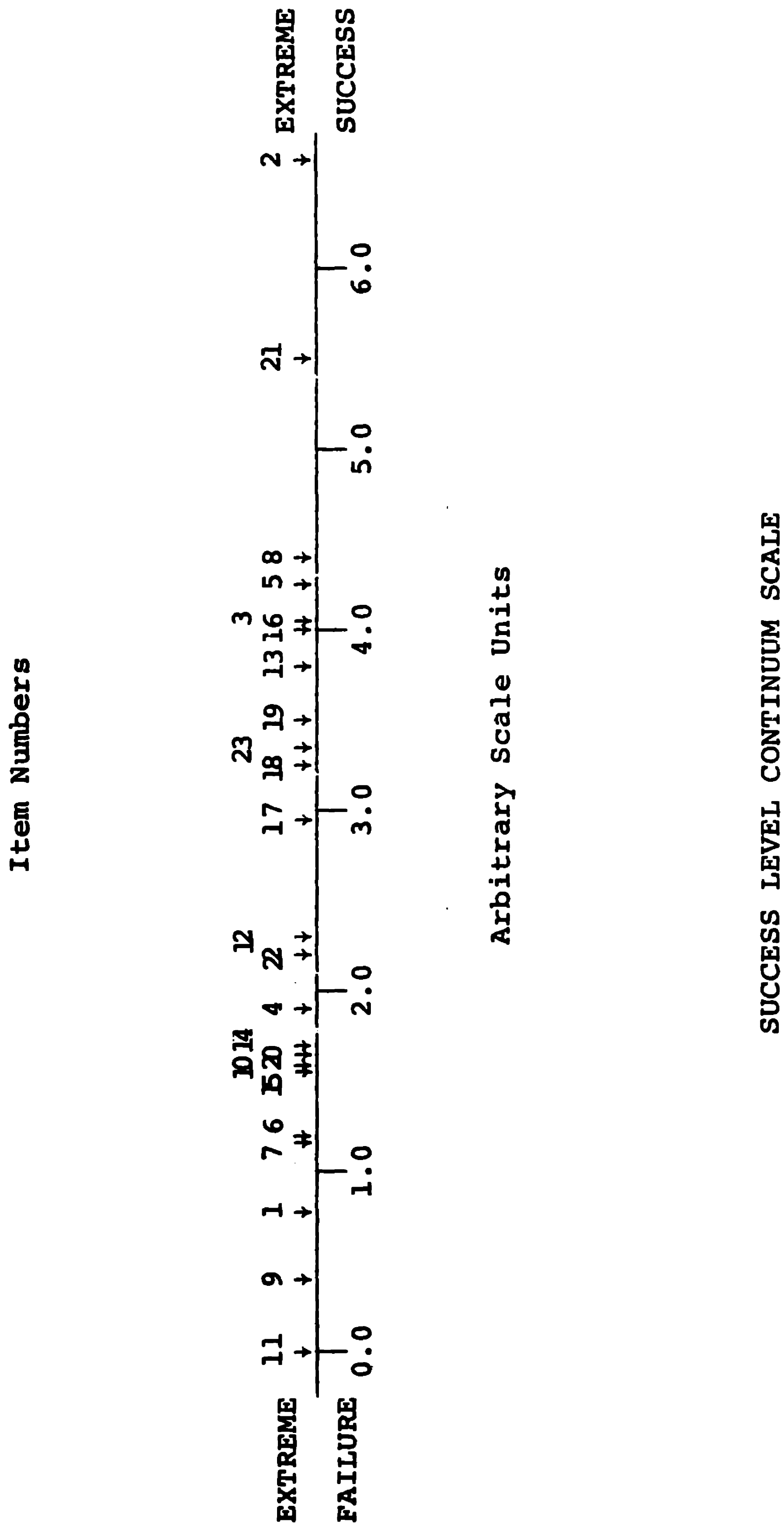

EXTREME SUCCESS
EXTREME FAILURE
Item Numbers
Arbitrary Scale Units
0.0
1.0
2.0
3.0
4.0
5.0
6.0
SUCCESS LEVEL CONTINUUM SCALE

FIGURE 4.4

INTERVAL WIDTHS (g)

ITEM (j)	& VALUE	1	2	3	4	5	6	7	8	9	10
1	0.21	-0.210	0.696	1.263	1.755	2.053	2.415	2.776	3.294	4.242	5.402
2	6.09	-6.090	-5.184	-4.617	-4.125	-3.827	-3.465	-3.104	-2.586	-1.638	-0.478
3	3.52	-3.520	-2.614	-2.047	-1.555	-1.257	-0.895	-0.534	-0.016	0.932	2.092
4	1.35	-1.350	-0.444	0.123	0.615	0.913	1.275	1.636	2.154	3.102	4.262
5	3.69	-3.690	-2.784	-2.217	-1.725	-1.427	-1.065	-0.704	-0.186	0.762	1.922
6	0.66	-0.660	0.246	0.813	1.305	1.603	1.965	2.326	2.844	3.792	4.952
7	0.61	-0.610	0.296	0.863	1.355	1.653	2.015	2.376	2.894	3.842	5.002
8	3.85	-3.850	-2.944	-2.377	-1.885	-1.587	-1.225	-0.864	-0.346	0.602	1.762
9	-0.14	0.140	1.046	1.613	2.105	2.403	2.765	3.126	3.644	4.592	5.752
10	1.04	-1.040	-0.134	0.433	0.925	1.223	1.585	1.946	2.464	3.412	4.572
11	-0.54	0.540	1.446	2.013	2.505	2.803	3.165	3.526	4.044	4.992	6.152
12	1.77	-1.770	-0.864	-0.297	0.195	0.493	0.855	1.216	1.734	2.682	3.842
13	3.24	-3.240	-2.334	-1.767	-1.275	-0.977	-0.615	-0.254	0.264	1.212	2.372
14	1.15	-1.150	-0.244	0.323	0.815	1.113	1.475	1.836	2.354	3.302	4.462
15	1.03	-1.030	-0.124	0.443	0.935	1.233	1.595	1.956	2.474	3.422	4.582
16	3.46	-3.460	-2.554	-1.987	-1.495	-1.197	-0.835	-0.474	0.044	0.992	2.152
17	2.41	-2.410	-1.504	-0.937	-0.445	-0.147	0.215	0.576	1.094	2.042	3.202
18	2.80	-2.800	-1.894	-1.327	-0.835	-0.537	-0.175	0.186	0.704	1.652	2.812
19	2.97	-2.970	-2.064	-1.497	-1.005	-0.707	-0.345	0.016	0.534	1.482	2.642
20	1.08	-1.080	-0.174	0.393	0.885	1.183	1.545	1.906	2.424	3.372	4.532
21	4.96	-4.960	-4.054	-3.487	-2.995	-2.697	-2.335	-1.974	-1.456	-0.508	0.652
22	1.66	-1.660	-0.754	-0.187	0.305	0.603	0.965	1.326	1.844	2.792	3.952
23	2.90	-2.900	-1.994	-1.427	-0.935	-0.637	-0.275	0.086	0.604	1.552	2.712

MATRIX OF Xjg' - THEORETICAL GAUSSIAN DEVIATES

TABLE 4.8

INTERVAL (g)

ITEM (j)	1	2	3	4	5	6	7	8	9	10
1	0.42	0.76	0.90	0.96	0.98	0.99	1.00	1.00	1.00	1.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.05	0.32
3	0.00	0.00	0.02	0.06	0.11	0.19	0.30	0.49	0.82	0.98
4	0.09	0.33	0.55	0.73	0.82	0.90	0.95	0.98	1.00	1.00
5	0.00	0.00	0.01	0.04	0.08	0.14	0.24	0.42	0.78	0.97
6	0.25	0.60	0.79	0.90	0.95	0.98	0.99	1.00	1.00	1.00
7	0.27	0.62	0.81	0.91	0.95	0.98	0.99	1.00	1.00	1.00
8	0.00	0.00	0.01	0.03	0.06	0.11	0.19	0.36	0.73	0.96
9	0.56	0.85	0.95	0.98	0.99	1.00	1.00	1.00	1.00	1.00
10	0.15	0.45	0.67	0.82	0.89	0.94	0.97	0.99	1.00	1.00
11	0.71	0.93	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00
12	0.04	0.19	0.38	0.58	0.69	0.81	0.89	0.96	1.00	1.00
13	0.00	0.01	0.04	0.10	0.16	0.27	0.40	0.60	0.89	0.99
14	0.13	0.41	0.63	0.79	0.87	0.93	0.97	0.99	1.00	1.00
15	0.15	0.45	0.67	0.83	0.89	0.95	0.98	0.99	1.00	1.00
16	0.00	0.00	0.02	0.07	0.12	0.20	0.32	0.52	0.84	0.98
17	0.00	0.07	0.17	0.33	0.44	0.59	0.72	0.86	0.98	1.00
18	0.00	0.03	0.09	0.20	0.29	0.43	0.58	0.76	0.95	1.00
19	0.00	0.02	0.07	0.16	0.22	0.36	0.51	0.70	0.93	1.00
20	0.14	0.43	0.65	0.81	0.88	0.94	0.97	1.00	1.00	1.00
21	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.07	0.31	0.74
22	0.05	0.23	0.42	0.62	0.73	0.83	0.91	0.97	1.00	1.00
23	0.00	0.02	0.08	0.17	0.26	0.39	0.54	0.73	0.94	1.00

MATRIX OF Pjg' - THEORETICAL CUMULATIVE PROPORTIONS

TABLE 4.9

INTERVAL (g)

ITEM (j)	1	2	3	4	5	6	7	8	9	10
1	.205	.115	.000	.010	.030	.015	.000	.000	.000	.000
2	.000	.000	.000	.000	.000	.000	.000	.010	.025	.070
3	.000	.000	.030	.010	.035	.040	.075	.010	.055	.020
4	.035	.120	.125	.045	.045	.025	.025	.030	.000	.000
5	.000	.000	.040	.035	.020	.010	.065	.120	.080	.020
6	.125	.125	.035	.050	.025	.020	.010	.000	.000	.000
7	.120	.020	.040	.015	.025	.005	.010	.000	.000	.000
8	.000	.000	.010	.005	.015	.015	.035	.085	.005	.040
9	.165	.025	.000	.005	.015	.000	.000	.000	.000	.000
10	.050	.100	.055	.005	.015	.015	.005	.010	.000	.000
11	.065	.030	.005	.010	.000	.000	.000	.000	.000	.000
12	.015	.040	.030	.070	.060	.015	.010	.010	.000	.000
13	.000	.010	.015	.025	.035	.005	.025	.125	.010	.010
14	.055	.110	.120	.035	.005	.005	.005	.010	.000	.000
15	.075	.050	.055	.020	.035	.000	.020	.010	.000	.000
16	.025	.025	.005	.020	.045	.100	.145	.120	.090	.005
17	.000	.045	.095	.045	.015	.115	.080	.115	.020	.000
18	.000	.030	.040	.100	.040	.070	.045	.140	.050	.000
19	.000	.020	.045	.060	.020	.115	.065	.075	.020	.000
20	.115	.055	.025	.040	.070	.035	.005	.000	.000	.000
21	.000	.000	.000	.000	.000	.015	.005	.045	.035	.060
22	.025	.080	.120	.170	.080	.070	.065	.005	.000	.000
23	.000	.005	.055	.030	.040	.035	.035	.095	.040	.000

MATRIX OF (| Pjg - Pjg' |)

$$\text{Absolute Mean Deviation} = \sum_{j}^{23} \sum_{g}^{10} |Pjg - Pjg'| \,/\, j*g = 7.625 \,/\, 230 = 0.033$$

TABLE 4.10

4.2.1.4. Scale Use And Scoring

In general, successive interval scales are used to determine a single individual's attitude on some issue. Our use of the scale is quite different. Although the success level scale can be used for an individual's assessment, our intent is to use it to derive a reliable, overall implementation outcome success level score. Hence, it must be administered to multiple participants to derive a single (not multiple) scale value. Multiple participants must be used (1) to reduce individual bias and (2) to gain a broad sampling from people who have different sets of knowledge about the implementation.

But, since our use of the successive interval method is novel, we must test the most reasonable ways to collapse multiple responses into a single score. The following four methods are, a priori, among the most reasonable:

(1) Method "a": calculating the median of the respondents' median responses;

(2) Method "b": calculating the median of the respondents' median of extreme responses;

(3) Method "c": calculating the mean of the respondents' median responses;

(4) Method "d": calculating the mean of the respondents' median of extreme responses.

The use of medians instead of means to calculate an individual respondent's scale value is recommended (Green, 1954) to dampen the effect of extremes. However, an alternative argument, potentially applicable here, is that those extremes may be desirable to include; hence, methods "b" and "d" will be used to allow comparison of the arguments. Collapsing multiple respondents' scores into a single summary score may be accomplished by taking the median or mean of the multiple scores. The mean could be a weighted mean. If the weights for a hospital were known, this method could prove more accurate. However, since they are currently unknown, all weights are set equal to one. At any rate, both methods will be tested.

4.2.1.5. Results

The interval "success level" scale (Table 4.11) is of sufficient consistency to allow the retention of Items #17 and #23. The scale also reflects reasonable logical consistency. A comparison of Items #10 and #15, which statistically have the same scale value, shows the confounding influence of other departments' disagreement (as to the system's utility) on the decision makers' determination of contiguous gradations of success level. Decision makers appear to consider others' opinions at the margin. Decision makers generally appear to have been able to collapse multiple factors into the scale. For instance, they attribute the failure to meet goals to poor objectives, hardware unreliability or inappropriateness, software unreliability or inappropriateness, failure of the hospital staff to cooperate in the implementation or use the system, and so forth.

The final "success level" interval scale (Table 4.11) appears to be of sufficient breadth, meaning, and internal consistency to allow its exploratory use. Therefore, the scale was employed in the development of the eight MCSS implementation cases described below. A total of forty people who were involved in the systems' implementations completed the measure by indicating which statements were generally true for their implementation. They were aware that this information was being collected for the case development. To reduce possible confounding, they were unaware, until after the completion of the measure, that they were also a part of the test of the scale. Three major points were tested:

(1) Do hospital decision makers, when actually determining the outcome of a decision to adopt or retain an MCSS, base decisions, to a large degree, upon the goals

(goals, objectives, reasons) the system is to fulfill?

(2) Does the use of the scale provide a reasonable measure of success level? Does the success level derived from the scale's use correspond to reality?

(3) Does the use of the scale provide additional insight into the dynamics of the implementation?

The results of these tests of the measure are presented in the ensuing sections.

4.2.2. Paradigm Hypotheses

The investigation of the eight MCSS implementations is intended to provide expository cases which reflect the true implementation events and user attitudes to the maximum extent possible for this data collection method. It is for this reason that the interviews were based on open-ended questions. However, to assure that the necessary data were collected, the discussions were guided or directed to provide information which would substantiate or deny the existence of various operating characteristics of the paradigm.

The operating characteristics which were examined are stated here as hypotheses, based on the supposition of the paradigm's validity.

H1: Hospital and Vendor personnel refer to each other as monolithic actors.

H2: Hospital-wide objectives exist and are rational, based on system objectives (overt and/or covert), and the limited knowledge of the staff.

H3: Individual and departmental objectives exist and are rational, based on individual objectives (overt and/or covert), and the limited knowledge of the staff.

H4: Individual, departmental and organizational objectives may be inconsistent with each other.

H5: The amount and quality of implementation planning varies directly with the MCBIS-related knowledge and experience of the adoption's key hospital participants.

H6: The median level of MCBIS-related knowledge and experience of the adoption's key hospital participants is low.

H7: Most adopters consider only a small set of potential vendors.

H8: System selection is based on objective-satisficing rather than objective-maximizing behavior (e.g., a reasonably "better" system is chosen from a small search set).

H9: The hospital's departments do not exhibit consistent monolithic actor behavior. They frequently exhibit sub-optimization behavior, a portion of which is departmental optimization.

H10: Departmental goals are usually unstated tendencies or assumptions usually consistent with the department's discipline (e.g., if hospital objectives conflict with the professional discipline's dictums, the department will attempt to conform with disciplinary dictums).

H11: Political bargaining or other action may result if the adoption causes disequilibrium in power, resource allocation, workload, etc. Through political action, departments will attempt to (at least) regain prior equilibrium.

H12: Political bargaining or other action may be used to gain departmental or organizational cooperation for the adoption process.

H13: Early adoption interest is usually manifested by managerial level individuals who have evolved positive (not necessarily accurate) mental simulations of the system's use. These individuals are usually interested in systems which affect the organizational sub-systems with which they are associated.

H14: The success of the implementation usually varies directly with the power of the system advocates, especially the "prime movers".

H15: The success of the implementation usually varies directly with the commitment of the system advocates.

H16: Any technology gatekeepers exist at the departmental level and are restricted to technology associated with their departmental functions. If a computer systems department exists, it is the computer science gatekeeper and shares the application gatekeeper role with the departmental gatekeepers, if any exist.

H17: One hospital may use another hospital as a technology gatekeeper. The primary source of information about systems is through peer contact.

H18: The trial stage may be satisfied by other hospitals' experience with the system and/or by site visits, especially those suggested or arranged by the potential vendor.

H19: The adoption phase may be seen by some staff as only a continuation of the trial stage. The adoption stage may occur before all parties are committed to the system's use.

H20: Implementation decisions are often those of bureaucratic entities rather than of central management.

H21: Departments may attempt to use pre-existing bureaucratic protocols to deal with unexperienced implementation events.

H22: Pre-existing rules may interfere with the adoption of new work processes needed to support the system.

H23: Pre-existing bureaucratic responses and rules inhibit unfreezing.

H24: Common software systems' adoptions cause a change in work processes, power relationships, reward structures, and risk structures of participants.

H25: Individual positive expectation can aid the unfreezing phase.

H26: Individual unrealistic positive expectation can inhibit the refreezing stage.

H27: Success varies directly with the active recognition and management of the change process.

H28: Success varies indirectly with the degree of change the system engenders.

H29: Success varies directly with the level of human factors engineering of the system.

While attempting to discern the existence of the characteristics of these hypotheses, we must be aware of the conditions which would lead to misinterpretation: confounding events which may lead to internal invalidity. Among the potential threats are:

History: Events not related to the implementation may confound discrimination between implementation and other effects.

Maturation: The maturation effect may have an implementation component and an artifact component. These must be partitioned or confounded inferences could result.

Reactivity: The data collection methodology may cause the respondent to give biased information (e.g., the socially acceptable response, etc.).

Selection: The hospital selection process will yield hospitals which, in a number of ways, are not representative of the universal set of hospitals. As discussed above, this research effort deliberately chose hospitals non-randomly. For most characteristics, the eight hospitals are believed to be representative. However, investigating only surviving systems will mean that some paradigm characteristics associated with systems that fail may be under-represented.

Mortality: The one hospital which chose not to participate is not expected to, but may, have induced some unknown bias of results.

Measurement: There are numerous measurement errors which could occur. This is due to the exploratory nature of the research. The hospital data analyses are subject to individual interpretation and as a control, the cases are presented in sufficient detail to allow the reader to ascertain the basis for the research conclusions.

Causality: Causal inferences may be incorrect due to data misinterpretation, spurious correlations, etc.

These problems occur to varying degrees in all research. Their potential existence should not evoke a fatalistic attitude that we will never derive a true estimate of the researched event. Rather, it should always call for intelligent interpretation of the research and its conclusions.

NOTE:

Each hospital case (Sections 4.2.3. to 4.2.10.) has the following three exhibits:

"POWER DISTRIBUTION and SYSTEM ADOPTION ATTITUDE" Those interviewed (listed across top of matrix) indicated who were the influence leaders and power people in the hospital at the time the adoption decision was made. Then, each influence or power leader's attitude toward the adoption was indicated.

"ITEM RESPONSE FREQUENCY" The items selected and the frequency of their selection by respondents during the administration of the success level measure.

"ITEM RESPONSES" Items selected by respondents (listed across top of matrix) during the administration of the success level measure.

Each hospital's exhibits appear at the end of its case.

4.2.3. Hospital "A": Case and Preliminary Analysis

4.2.3.1. The Hospital

Hospital "A" is an acute care 750 bed institution which was founded in the 1890's and has continued its service in the same location since then. It is known as a hospital which delivers good care in a small city environment. The current hospital complex is rather modern and well equipped due to two major renovation and construction projects in the early and mid-1970's. Hospital "A" is a nonprofit, nonsectarian, general medical and surgical hospital with a large outpatient service. It provides some tertiary care for the region. The hospital is accredited by the Joint Commission on Accreditation of Hospitals. It has a cancer program approved by the American College of Surgeons. It participates in Blue Cross and is certified for participation in Medicare. The hospital has approximately 2200 employees and an annual budget in excess of $51 million.

Its current patient population size is approximately 500,000, and payment mechanisms are as follows: 20% Medicare, 16% Medicaid and general relief, 14% private insurance, 5% self-pay, 35% Blue Cross, and 10% indigent and bad debts. It is affiliated with the medical and nursing schools of a nearby university; however, this affiliation does not include any management control. Additionally, it has its own nursing school and training programs in several allied health fields.

The management structure of the hospital is typical. The Administrator reports to a Board of Directors and in turn has an Associate Administrator reporting to him. Under the Associate Administrator are several functional services (e.g., the financial, personnel, medical and technical, hospital, nursing, and auxiliary services). Hypothetically, the Chief of the medical and dental staff is at the same organizational level as the Associate Administrator; however, as is somewhat typical with hospitals of its kind, he has a direct line of communication to both the Administrator and the Board of Directors. Additionally, four of the members of the medical and dental staff are members of the Board of Directors. In fact, then, the Chief of the medical and dental staff is on an equal footing with the Administrator of the hospital. The medical and dental staff includes 30 physicians who are on partial or full pay. The hospital also has approximately 80 interns and residents associated with its joint teaching program.

The Board of Directors is comprised of 24 members selected from an entity known as the Hospital "A" Society. The Society is comprised of a relatively large number of local civic and industrial leaders. Although the Board does not become involved in operational issues, it is highly involved with the planning and policy making of the institution. Its membership is characterized by very low turnover. The charter of the hospital allows a member of the Board to serve 27 consecutive years and then, after a short break, to repeat with another 27 years.

4.2.3.2. The Adpotion Decision

In 1974 a new hospital administrator arrived who had some interest in MCBISs, but little system experience. The Financial Director was new to the hospital, also. He had been hired by the Administrator and arrived to take what one other manager calls "autocratic control" of the finances of the hospital. The financial Director has also been described as the prime mover of the adoption of the system under discussion. A data processing group, which reported to finance, already existed. So, shortly after his arrival, the Administrator, Director of Finance, and data processing group convened an informal computer systems advisory group which consisted of the Administrator, the Associate Administrator for professional services, the Director of Nursing or a nursing representative, the Manager of Patient Accounts, the Director of Finance, and the Manager and his assistant from data processing. In general, members of the advisory group thought that their task was to select a system that would serve basic data collection purposes and which would augment their existing financial MCSS. This implied that they were looking essentially for a communication system with charge-capturing capability. However, the planning and the needs analysis were performed solely by the Director of Finance with little or no input from any other member of the hospital staff. As a result, various managers within the hospital have significantly different perspectives as to the objectives for the system and, in retrospect, claim that they were operating with only partial information because the Director of Finance had the only knowledge and expertise in the adoption of computer systems in the entire hospital. Further, they claim that user involvement was only a minor concern of the Director of Finance. He felt capable of specifying the needed functions and selecting a system by himself. But even with an autocratic individual responsible for automation, no decisions were made for a period of years. This inactivity had little to do with MCSSs, but was due to the fact that the hospital was intensively engaged in other activities of a higher priority. The first quarter of 1977 saw renewed interest in the adoption of a system. By this time the advisory group did not take its role very seriously and its meetings were sporadically attended. One of the managers then involved indicated that the main reasons for acquiring a new system were to improve their charge-capturing capability, to develop reliable workload information, and to establish an order entry communication system which would link the nursing units with ancillary services. Of particular interest was the adoption of a pharmacy subsystem.

Various members of the advisory group and other members of the hospital continued an informal, personal scan of available services. Although four systems were reviewed, apparently only the successful vendor was given serious consideration. It is alleged that the Financial Director convinced the members that this vendor was the only appropriate one. One staff member has indicated that this course of events was dictated by the Financial Director's personal friendship with the corporate officer of the successful vendor.

Regardless, by late 1977 a contract was initiated between the hospital and the vendor. This was executed by the Financial Director without the approval of the Board of Directors. The Board reacted to this action with significant displeasure. They felt that they should have been consulted on a contract of this nature. By early 1978, the Board decided to fire the hospital administrator. The removal of the administrator was based on several reasons; however, it is alleged that the MCSS contract was "the straw that broke the camel's back". Although the Financial Director resigned his position, it should be noted that he did have the consent of the computer system advisory group before he initiated the contract with the user. Members of that group report that they felt that the vendor did, in fact, provide the basic system for which they were looking and that the vendor gave strong assurances that it would be able to fulfill the contract, although this implementation would be the largest that the vendor had ever experienced.

4.2.3.3. The System

The adopted system is comprised of proprietary software prepared by the vendor and loaded on minicomputers supplied by a well-known hardware vendor. The system serves the following main functions. First, it is a one-way communication system from the nursing units to the ancillary departments. Ancillary services are requested through this communication system, and charges accrue as a result of these transactions. This is front-ended by the admission, discharge and transfer system. The system also does outpatient scheduling and has a function which generates patient care level information for the nursing units. This patient care information is used to derive a desirable staffing pattern for the nursing units. The charge information and the patient demographic information generated by the system serves as batch input to another vendor-provided common software financial package. This other system was adopted in the 1973-1974 timeframe.

The system runs on two minicomputers; one is reserved for inpatient operations and the other handles outpatient operations. The system has 110 CRTs which are distributed throughout the nursing units, admissions and discharge office, the various ancillary services, and the data processing center. It has 20 printer terminals, 1 line printer, and 4 disk drives. The system is operationally available for 21.5 hours for inpatient service and 18 hours per day for outpatient service. The remaining time is scheduled downtime for preventative maintenance and for batch processing which generates the input for the financial system. Aside from the batch interface with the financial system, no other interface exists.

4.2.3.4. The Implementation

Hospital "A" has experienced a protracted implementation period, with initial planning supposedly performed by the Financial Director. Although discussion of system adoption had generated some specific expectations within numerous members of the staff, the contract which the Financial Director signed was the vendor's standard contract. It made no specific, detailed references to the capabilities of software which were to be provided. Most of the implementation activities were agreed upon verbally with no contractual provisions. Nevertheless, the contract did call for a pharmacy subsystem and an accounts receivable system. Neither of these functional capabilities has been delivered to the hospital (as of this date). Part of this problem is that an accounts receivable software batch process has been delivered, as well as the capability for the pharmacy (as for any ancillary department) to receive the request information from the nursing units. However, neither of these capabilities were those described by hospital members as the capabilities they understood would be delivered. Hospital staff members indicated that a full accounts receivable package and a pharmacy information subsystem would be part of the delivered software.

The vendor had assured the hospital that the first subsystem, the admissions, discharge and transfer system (ADT), would be installed three months after the contract was signed. However, the vendor did not fulfill this promise. The ADT subsystem was unavailable for installation until one half year after the contract was signed. The ADT, outpatient, and inpatient subsystems' users only learned of the implementation in announcement sessions shortly before the ADT system was implemented. This allowed only two weeks for vendor-provided training. However, many of the individuals in these service sections were aware of the implementation long before. They had been introduced to the vendor's first field engineer who interacted with them in a needs analysis mode. That is, he went into various sections asking what capabilities were needed and wanted, and gave almost universal assurance that the desired capabilities would be provided. Unfortunately, this served only to greatly increase unrealistic and unfulfillable staff expectations.

When general training did begin, little implementation planning had been carried out. As a result, the training sessions were oriented toward the explanation of basic system capabilities and there was little discussion as to what those capabilities implied for the way the hospital staff members would be doing their work or interacting with the system. No one had considered, to any significant degree, the necessary alteration of the hospital's work processes to allow for constructive use of the MCSS. Fortunately, the ADT system was quite limited in its capabilities, successfully handling fairly well-defined procedures. As a result, the limited training given to ADT personnel was sufficiently effective to allow them to alter their work processes and integrate the system. In this respect the ADT subsystem's implementation was relatively painless and effective. The anxiety demonstrated by some of the workers in A&D dissipated very rapidly, as they found the system would neither replace them nor disastrously alter their work life. Still there were some early problems with the ADT system. The hospital had difficulties with several application software bugs and, since the ADT system generated a census, there were some operational problems in keeping the census up to date. The ADT module had been implemented by direct cutover, rather than parallel processing.

The outpatient subsystem, the next subsystem to be implemented, followed the ADT system by seven months. Based on the relative success of implementing the ADT system with no planning and little training, the same logic (including facility-wide direct cutover) was applied to the implementation of the outpatient system. This proved nearly disastrous. Unlike the ADT system, the outpatient system was defined by several on-line functions of one minute real-time characteristics. While the ADT system gave the users a matter of hours to recover from an outage or verify entered data, the outpatient system users quite often had only sixty seconds before the source of the information, the patient, was no longer available for further information or data correction. Further, the outpatient system was to generate demand billing. Therefore, the information had to be available and correct by the time the patient left the hospital.

The outpatient system's implementation was characterized by significant software bugs, staff inability to use the system, and massive deflation of user expectations. Training was considered generally insufficient and was limited to discussion of the system's characteristics, rather than the characteristics of the use of the system in the real environment. It became immediately obvious that the outpatient subsystem's implementation was going to be extremely difficult. The field engineer who had been involved with the hospital to date was replaced by a new field engineer, not because of the original's inability, but because the vendor had changed its service districts, shifting Hospital "A" into a different region. The vendor's new field engineer had no experience with the hospital or its problems prior to his arrival. Field engineers, at that point, were characterized by the hospital staff as being ineffective and indifferent to the hospital's needs. One manager stated that the field engineers would not extend themselves to improve the hospital staff's understanding of the system or its appropriate use. The only documentation of the relationship is in the form of software complaints issued by the hospital, some of which yet to be acted upon (two years after implementation). At this point, the lack of planning for the implementation was evident. There was no capability within the hospital to expand the training beyond the nature of what the system vendor was providing. Also, there was no significant or sufficient in-house human factors or systems engineering effort to adjust and improve the organization's operating capacity once the system had been installed.

Although the inpatient subsystem was to be installed two months after the outpatient system, the continuing failures of the outpatient system forced the hospital administrative staff to refuse inpatient system installation until the vendor corrected the existing outpatient software difficulties. The hospital forced a delay of more than two months before the vendor could get the software problems under control. System fixes ran true-to-form. As the vendor installed some corrections, other bugs were caused or revealed. One hospital manager indicated that they were finding bugs "weekly". Another manager claimed that the field engineers were ineffective, that they attempted action without understanding the problem. He said that he had to explain "a problem three times before he (the field engineer) would get it right".

It was at this point that the Administrator was fired and the Financial Director resigned. One manager who was employed at that time commented that many individuals within the hospital were "disgusted" with the system and felt that the Financial Director was deserting them after leading them into a difficult situation. General hospital reaction to the system was increasingly negative. Many people were not previously aware of the extent of the effect of the system on the hospital's activities and were unpleasantly surprised to find that its frequent failure impaired operational capabilities throughout the hospital. In addition to the real negative effects, the system began to suffer from bad press. Individuals in the inpatient wards or nursing units who realized the next system module would affect them were looking to their counterparts in the outpatient sections to determine the system's effects and saw only negative reaction. This led to an uncooperative "show me" attitude.

When hospital management finally allowed the vendor to proceed with the inpatient module implementation, many of those involved with the module were fearful that the system would make their working conditions significantly worse and that they would not be able to cope with the system. Still, there was a set of individuals who were instrumental in improving the implementation of the inpatient module over that which the outpatient system had experienced. The data processing staff, although inundated with work since the beginning of the implementation, was able to generate the interest of some staff members in developing an in-house training package. A nursing coordinator was designated to help, and among them, they generated training packages which were used to train over 800 people in a two-week period before the inpatient subsystem went live. This group's enthusiasm and dedication to resolving the crisis seemed to sway a number of individuals into giving the system a chance to prove itself. As a result, more people were involved in the inpatient module's implementation planning and in useful training than with the previous module. Hence, the inpatient module's implementation was far more successful than that of the outpatient module. Still, there were serious problems for some departments. For example, one cost of increased information transfer reliability was a massive, unanticipated increase in paperwork in the clinical laboratory. The lab's inability to cope with the problem decreased its responsiveness to its clinical responsibilities. The MCSS's effect on Central Service was "traumatic". They had "to beg for training", and the printer which generated their work orders was so slow, their response time for requests became "much worse" than for the manual system.

As indicated earlier, the accounts receivable and pharmacy modules, which were to be implementated after the inpatient module, have never been implemented. The vendor had been developing a sophisticated pharmacy module which was unavailable when the hospital was ready to implement such a module. The accounts receivable module was never implemented because the DP and other hospital staff had assumed that the system was meant merely to interface with the pre-existing MCSS rather than replace it. As it turned out, the objective to fully replace the pre-existing MCSS was the uncommunicated objective of the Financial Director. When he left the hospital the impetus to implement the new AR system was gone. Hence, the system remains configured basically with the three packages discussed above. Its current status is that outstanding software bugs identified two years ago have yet to be resolved. Shortly after the inpatient module became active, the vendor, once again, redistricted. As a result Hospital "A" was shifted to yet another service representative. Therefore, the vendor's education process had to start afresh. As might be inferred from the fact that the vendor was undergoing massive territorial changes, it was also undergoing major internal reorganization which diverted its attention from contract compliance. In fairness to the vendor, it should be noted that since its reorganization was completed, it has renewed its effort to resolve Hospital "A"'s outstanding software problems. Belatedly, many of the problems have been resolved and work is underway to correct the residual problems.

4.2.3.5. Paradigm Fit

Objectives and Rational/Functional Processes

Due to the prolonged implementation of this sytem, it is difficult to discern what the true implementation objectives were. In part, this is because peoples' understanding of those objectives change over time. In part, it is because some of the key characters involved in the decision to implement the system are no longer employed by the hospital. Nevertheless, one key staff member felt that he had a relatively clear understanding of the hospital level objectives for the system. These included:

(1) The system was to capture charge data with high reliability.

(2) The system was to capture workload data.

(3) The system was to be a communication system through which nursing units could directly order ancillary services.

The objectives and certain qualifications were used to discern which systems were or were not acceptable for adoption. These qualifications included the following. The system must:

(a) be easy to use;

(b) be sufficiently flexible to allow interfacing with other systems at a later date;

(c) be a sufficiently modifiable skeleton for the hospital's unique software requirements;

(d) allow result reporting at a later date;

(e) be affordable; and

(f) be an MCSS that was currently successful at another hospital.

The objective which was later stated, that of adopting a pharmacy subsystem, appeared to have been a departmental objective, the result of political bargaining to gain the acceptance of various ancillary departments. Another departmental objective was that the Financial Director wanted a system which would ultimately replace the pre-existing accounts receivable and financial MCSS. Apparently this last objective was a hidden agenda item due to the fact that the hospital did not want to alienate the previous vendor in case continued support would be necessary.

In attempting to ascertain the objectives, various staff members were contacted. Discussions with them indicated that there was not a clear understanding of the true objectives of the system. As a result, people have formed inferred opinions based upon what they would expect reasonable goals to be for such a system. This demonstrates the staff members' inclination to derive rational explanations for organizational phenomenon. The existence of the accounts receivable subsystem objective, the pharmacy subsystem objective, and the other criteria indicate that there were several sets or strata of objectives, one of which existed at the hospital level, others of which existed at the departmental level. That departmental objectives are not shared goals and therefore are not truly hospital level objectives is supported by the following facts. The Pharmacy Director had no interest in replacing the accounts receivable package and the Financial Director was entirely indifferent to the adoption of the pharmacy system.

All of these objectives are rational at either the departmental or organizational levels. Thus, even those who were not heavily involved with the adoption felt they understood the reasons for the adoption. This fact aided the rally to improve the inpatient subsystem's implementation. Further, that a system beset with functional problems (some hardware and many software problems) survived may have been facilitated by the fact that no one rated as powerful or influential (Exhibit 4.5) was averse to the MCSS's adoption. Additionally, the Financial Director, the adoption's "prime mover", was considered to be the second most powerful and influential individual at the hospital.

Adoption Processes

The earliest interest in the adoption of an MCBIS for the hospital seems to have been generated by the new hospital administrator. It was he who hired the Financial Director who was known to have interest in bringing aboard or improving computer-based systems in the hospital. It was the Financial Director who assumed the key responsibility for selecting and implementing a system. From all indications there were two technological gatekeepers in the hospital at that time, the Financial Director and the Data Processing Director. As in many other hospitals, they shared the gatekeeper function by partitioning it into the technical part and the functional part. The DP Manager allowed the Financial Director to specify the functional nature of the system and the Financial Director, in turn, left the technical issues to the DP Director. In their roles as gatekeepers, other individuals looked to them for leadership and knowledge with respect to the adoption of a computer system. While these two individuals served as information gatekeepers within the organization, neither one was completely cognizant of the state of the art of vendor-provided systems. Therefore, each screened his environment for relevant data. Through an attempt to reconstruct the processes by which they gained information about systems, it appears that their major methodology was one of peer contact. Over time, peer contact provided basic background information as to who had investigated what systems, who had adopted what systems, and what the general impressions and general levels of success appeared to be. Once a search was deliberately undertaken to identify potential systems, peers also served as a network from which similar current information was retrieved. This screening process also served as a test stage process, since peers would be contacted to determine their experiences with systems. Information was gained not only of the nature of systems but also of their performance in a particular health setting. The other form of test which is seen in most hospitals also occurred in this one. Individuals, once a system was identified, made site visits to see the system in operation and thereby confirmed the functionality of the system, even if they did not completely understand the nature of those functions. This methodology effectively fulfilled the adoption criteria of implementing a system which was "successful". Success in this case was never benchmarked or measured, it merely meant that the system had been implemented in another organization and that, when visited, the other organization had not complained unduly of system inadequacies.

Political Process

Considering the size and composition of the computer system advisory group, Hospital "A" experienced relatively little political interaction. It appears that the pharmacy was the only major department which entered into political negotiation for the optimization of their particular department. This is seen in the departmental objective of implementing a fairly sophisticated pharmacy information system in spite of the fact that the Financial Director and other key people (i.e., powerful people) did not consider a pharmacy system to be among their major objectives. Therefore, the political paradigm was seen to be in effect in this situation. However, its effects are somewhat dampened primarily because of the "dogmatic" and "authoritarian" nature of the prime mover for the system adoption, the Financial Director. It appears that the Financial Director was operating from a significant power base both as perceived by other members of the hospital staff and in fact. This was due to his close association with the Administrator who had hired him as well as his control of financial vitality of other departments.

Bureaucratic Process

Adherence to rules and procedures to the detriment of the system's adoption was in evidence in the early days of the implementation of each of the modules. Individuals were reticent to alter established work procedures and response protocols. This syndrome was exacerbated by the fact that little systems planning had been performed to give them reasonable new rules and procedures to which it would be reasonable to adhere.

Even when general clinical staff favorably anticipated the sytem's arrival, nursing unit clerks viewed the system's implementation with some apprehension. Although this may be due in part to reluctance to change, it was also because their primary work involved adherence to strictly-enforced rules and the system would corrupt those rules by which they were judged successful.

Aside from the adherence to rules and processes on the part of the individuals, the only other major consideration which the bureaucratic process holds for Hospital "A"'s implementation was one of the reticence to break the contractual agreement between the hospital and the vendor. Although key managers claim that there was ample evidence that the vendor did not perform in accordance with the contract, they were people who considered their own adherence to an agreement to be of some importance. Further, the efforts required by their organization to breach the contract involved significant bureaucratic inertia to maintain the status quo, that is, to continue the process instead of changing courses once again. The claim that this bureaucratic momentum still exists is moot. Several of the key managers stated that they would like to replace the system immediately.

Change Process

Hospital "A" is a case in which unfreezing was not accomplished. The first two subsystem implementations (the ADT and outpatient systems) were virtually unplanned and came as somewhat of a surprise to some of the individuals who had to interface with the system. Training was considered insufficient to prepare people to accept the change, to actually be able to function in a changed environment. There had been little or no effort made to destabilize the existing manual system. Most individuals felt that it seemed to work well enough to be left in place. They did not feel that a new system was needed. They were never fully informed as to why the system was being implemented, or that it may have been needed for another department, if not for theirs. Therefore, when the chaos of the outpatient subsystem reached its peak, many individuals felt no need to continue the chaos if the previous manual system was available. Essentially the only unfreezing attempt that could be perceived is the dogmatic demand by the Financial Director that the system be adopted. This generated a state of resolution in the other participants which may be paraphrased as:

> No matter what I say or how I feel, the powers that be want the system; therefore it, rather than the manual system will survive. Thus, no matter how I feel about the system or its capabilities I have no option but to continue in the attempt to use the system or sever my relationship with the hospital as an employee.

This attitude toward the system served among some members to make them resolute about following the letter of the instructions to use the system, if not the spirit. When this happens, those individuals are likely to be able to perceive ways in which to employ the system more productively or be able to see procedural process changes which would improve their capability to perform their functions. However, as often happens with this mindset, there is no impetus, internal or external, to carry out those ideas or implement the improvements perceived. This is not true of all the individuals at Hospital "A". Many individuals had enthusiastically looked forward to the implementation of the system. Among the reasons for this attitude were the technological imperatives described previously and a sense that the system was something progressive which would increase their internal sense of prestige and the prestige in which they were held by the surrounding medical community. As a result, Hospital "A" had a mixture of people who provided internal unfreezing as well as those who never fully unfroze.

The change process in the first two subsystems came very rapidly and the refreezing process was not actively managed. The main refreezing mechanism was a general understanding that the manual system would never return. However, social supports for a well-functioning system were not possible with the implementation of the system due to the fact that even those individuals who wanted the system to be adopted were facing a situation which did not warrant their enthusiasm. Therefore the system itself and the vendor's perceived lack of cooperation did nothing to refreeze positive attitudes or the change. The social setting, which was one of some upheaval, apprehension, and "disgust", in a way can be viewed as cognitive dissonance to any sense of positive reinforcement for the change. The change, in fact, represented unfreezing for the new system at the very time it should have been refreezing; that is, the hardware and software problems caused a significant increase in the costs of the system to individuals. Problems had to be overcome; system malfunctions had to be manually resolved. These efforts caused additional workloads for both those who favored the system and those who did not. Finally, the system's adoption is not yet complete as a result of long-standing software failures. Essentially, this has kept the change phase open. Closure could not be reached before the resolution of the system's problems occurs.

4.2.3.6. Success Level

Based on all of the hospital staff's comments and objectives and on functional considerations, the implementation may be considered to be of marginal success.

During attempts to ascertain perceptions of system success, various individuals expressed the opinion that, if they had the decision to make today, the system would not be adopted. Some went further; there are those in the hospital who would like to break the seven-year contract as soon as possible. One key manager indicated that he felt that the vendor never intended to fulfill the promises it used to close the contract. He feels that the vendor knew it did not have the technical capability to fulfill the promises, and he stated that the hospital was "hood-winked". On several occasions during the implementations, the owners of the vendor corporation were contacted and personally had to appear at the hospital. In all cases it was claimed that they had stated that they would fix all of the problems and that the hospital need not worry. One hospital manager stated that it was his impression that the corporate officers never had any intention to "come through" on their commitment.

One may infer from these comments that hospital managers felt the system was a failure; however, this is not the case. In speaking to the managers each one felt that the system was moderately successful. They felt that the system fulfilled most of its implementation objectives but was not as successful as they were led to believe or had expected it to be. Nevertheless, they feel that even though they describe it as moderately successful, it was not worth the investment.

The seemingly contradictory beliefs about success level are reflected in the outcome of the administration of the success level scale (Exhibits 4.6 and 4.7). The results indicate the following summary:

> There is staff disagreement about the system's fulfillment of its adoption objectives. Thus, there is probably disagreement about objectives.

All agree that not all goals were fulfilled. Some people feel that most were not fulfilled. The hardware/software system's operation is sporadic; functional problems have been encountered. Use of the system has caused operational problems and some people wish to discontinue the system. However, the system has generated some additional benefits for a few departments. The system is only as useful as its predecessor manual system.

This description fits the case fairly well.

The people interviewed had no problem completing the success level measure. Most indicated that the benchmark for success should be whether or not the system did what it was purchased to do. The others (2) had difficulty in defining success. They developed a summary attitude, but were unsure as to how it developed or whether it was fair. One individual, a member of the DP staff, said that managers' objectives were unreliable since hospital managers seldom understood either MCBISs or objectives.

	ASST ADM MED/TECH SVC	CONTROL	DIR CENTRAL SVC	NURSING REP	NURSING COORD DP	SUPV DP
External Management						
CHAIRMAN, BD OF DIRECTORS	I +					
CHMN, FINANCE COMMITTEE	I +					
Top Management						
HOSPITAL ADMINISTRATOR	I P +	P +	I P 0	I P +	I P 0	
Non-Line Clinicians						
CHIEF OF MEDICAL STAFF	I 0	P 0			I P 0	
AN INTERNIST	I 0					
Middle Management						
ASSOCIATE ADMINISTRATOR	P +		I 0			P +
ASST ADM, MED & TECH SVCs	P +	I +				P +
ASST ADM, HOSPITAL SERVICES	P +					
DIRECTOR, FINANCE #	P +	I P +	I P 0	P +		I P +
DIRECTOR, NURSING		I +	I +	I P +	P +	
DIRECTOR, PERSONNEL		P 0				
MANAGER, CLINICAL LAB					I +	
MANAGER, PATIENT ACCT & ADM						P +
DIRECTOR, CENTRAL SERVICES					P +	
ASST DIRECTOR, NURSING				I 0		
COORD, PRIMARY CARE NURSING					I 0	
Supervisory Management						
NURSING SUPERVISOR, EVENING				I 0		
NURSING SUPERVISOR, NIGHT				I 0		

NOTE: I => Influence (Opinion Leadership)
P => Power

+ => Pro-Adoption Attitude
0 => Indifferent, Neutral
- => Anti-Adoption Attitude

POWER DISTRIBUTION and SYSTEM ADOPTION ATTITUDE HOSPITAL A

EXHIBIT 4.5

SELECTION FREQUENCY	SCALE VALUE	ITEM NUMBER	
**	1.15	7.	The system fulfilled few of our goals and caused other problems.
*	1.20	6.	The system fulfilled few of our goals, and its operation is sporadic.
*	1.57	15.	The system fulfilled few of our goals and some people/departments decline to use it.
*	1.62	20.	The system fulfilled few of our goals and some people/departments wish to discontinue its use.
***	2.20	22.	On balance, the usefulness of the system is about the same as what it replaced.
**	2.31	12.	The system fulfilled few of our goals but provided other benefits.
**	2.95	17.	The system fulfilled most of our goals but its operation is sporadic.
****	3.34	18.	The system fulfilled some of our goals but not all of them.
*	3.51	19.	The system fulfilled most of our goals but caused other problems.
*	3.78	13.	The system fulfilled most of our goals but some people/departments wish to discontinue its use.
***	4.06	3.	The system fulfilled most of our goals, but not all of them.
**	4.39	8.	The system fulfilled our major goals but not some of the minor ones.

NUMBER OF RESPONDENTS = 6

ITEM RESPONSE FREQUENCY HOSPITAL A

EXHIBIT 4.6

HOSPITAL A

ITEM RESPONSES

ITEM SCORE	ITEM NUMBER	ASST ADM MED/TECH SVC	CONTROL	SUPV DP	NURSING COORD DP	DIR CENTRAL SVC	NURSING REP
Failure		<-stronger	-----	early	advocacy	--------	weaker->
0.00	11						
0.40	9						
0.75	1						
1.15	7	+				+	
1.20	6	+					
1.57	15					+	
1.58	10						
1.62	20	+					
1.69	14						
1.89	4						
2.20	22	+	+			+	
2.31	12	+				+	
2.95	17			+	+		
3.34	18	+	+	+	+		
3.44	23						
3.51	19				+		
3.78	13						+
4.00	16						
4.06	3			+	+		+
4.23	5						
4.39	8				+		+
5.50	21						
6.63	2						
Success							
MEDIAN		1.91	2.77	3.34	3.51	1.89	4.06
MEDIAN OF EXTREMES		2.25	2.77	3.51	3.67	1.73	4.09

MEDIAN of: COLUMN MEDIANS: 3.06 COLUMN EXTREMES: 3.14

MEAN of: COLUMN MEDIANS: 2.91 COLUMN EXTREMES: 3.00

VARIANCE of: COLUMN MEDIANS: 0.65 COLUMN EXTREMES: 0.69

EXHIBIT 4.7

4.2.4. Hospital "B": Case and Preliminary Analysis

4.2.4.1. The Hospital

Hospital "B" is a 150 year old institution which provides primary through tertiary care in a major metropolitan area. The hospital is somewhat atypical in that it has a certain group of surgical specialties which give it a tertiary care perspective. Still, approximately 60% of its service is provided at a primary care level. The hospital has approximately 200 beds which are housed in two older buildings and a large, modern superstructure which encloses them. Hospital management was unable to estimate its patient population, but it is estimated at approximately 400,000 people when the appeal of its surgical specialties is considered. The hospital is accredited by the Joint Commission for Accreditation of Hospitals and has a medical school affiliation whose residency is approved by the American Medical Association. The hospital is a member of the Council of Teaching Hospitals of the Association of the American Medical Colleges and is certified for participation in Blue Cross and Medicare. The hospital has approximately 900 employees and an annual budget in excess of $23 million.

The organizational chart of the hospital is relatively typical. There is a Board of Directors which is primarily involved in policy and planning. The Board of Directors, which numbers 15, is elected from the Board of Corporators which consists of 70 individuals. There is built-in turnover to prevent Board stagnation. The Board has a number of standing committees which meet at approximately one-month intervals to review the planning and policy processes and provide general guidance for the control of the organization. In particular, the Board has provided expert information about contracts. Reporting to the Board is the hospital's General Director (of managerial background), who has four associate administrators reporting to him. Even though the chiefs of services and the medical staff technically report to the General Director they, in fact, have several lines of communication directly to the Board of Directors. One of the mechanisms for medical staff involvement in the Board's actions is that three service chiefs attend all Board meetings as representatives of the medical staff. Additionally, the initial charter of the hospital provides that the state's Governor is allowed to make an appointment to the Board. He has named one of the house physicians as a member of the Board. Management of the hospital was stable until the time of the system adoption decision. The General Director had been in place for nearly 25 years. Although four associate directors report to the General Director, the Associate Administrator for operations is generally considered to be the second in command of hospital operations. The individual who is currently in that position arrived at the hospital immediately prior to the decision to adopt the MCSS. There are both standing committees and joint managerial committees within the hospital and within the Board. In general, chiefs of services, managers, and the Board of Directors are jointly involved in almost all budget activities. They comprise a very active budget management committee which has unusually detailed information about financial requirements. This is due to the fact that hospital charges are broken down by the individual elements of services rendered, so that the quality and detail of information for the budgetary and cost control process is unusually specific. In fact, the services rendered are broken down both by diagnosis and by the care level actually required by the individual patient.

4.2.4.2. The Adoption Decision

By the mid-1970's Hospital "B" had in place its own data processing (DP) group which consisted of approximately 15 systems analysts, programmers, and computer operators. This group had developed five systems which served the following functions: payroll, general accounting, inventory control, cost reporting, fund raising, and patient accounting. These systems were running on an in-house IBM 360 Model 25. Little progress was made in the development and enhancement of the in-house software systems after approximately 1975. Operational problems in the design of the systems were exacerbated by the fact that the various patient accounting functions of the hospital (i.e., emergency, outpatient, inpatient, etc.) were located in separate application modules with no interface. This had the operational impact of segregating data collection, billing, and accounting activities so that each sector of the hospital had its own set of procedures. Essentially, this in-house staff seemed to have served the needs of the hospital until about 1975, the point at which modifications needed to be made to the software to keep it compatible with the hospital's evolving managerial processes. This, as it turned out, was very difficult to do since the original systems were very poorly documented and since some of the original software developers were no longer employed by the hospital. Gradually (over the next three years) the DP staff came to be seen by hospital staff members as being the keepers of an outmoded and unresponsive dinosaur. Various requests to modify the system were unable to be fulfilled because the 360 had reached processing saturation and would support no new applications.

At this time management of the hospital kept the computer-based systems at an arm's length. They recognized that they did not understand computer technology or operations, and chose to ignore rather than confront the problems. They did, however, continuously promise to upgrade the inadequate hardware configuration of the hospital. Without this promise a number of the hospital's programmers would have quit. Still, it became apparent over time that the hospital management was not acting to replace the hardware configuration and was not providing the environment in which good programmers could develop good systems. This had the effect of causing attrition of some of the better software people. As a result, the DP Manager was left with what may be considered a second-string DP team, and he came to be seen by management and hospital staff as being incapable of effective leadership. It is not known now whether the DP manager attempted to force any issues with regard to the acquisition of new systems, but it appears that he did not, and was somewhat complacent with the status quo.

As new systems failed to evolve, upper-management began to believe that the DP staff was ineffective. This eventually led them to fire the DP Manager. Later, hospital management realized that it had acted hastily since it now had a DP department which was entirely leaderless. Hospital management unsuccessfully attempted to search for a new DP manager, finding to its dismay that it was not willing to provide a salary commensurate with the experience it required. One hospital employee summed up the "sorry state of DP" and the hospital's inability to attract a new DP manager by listing the following problems:

(1) primitive equipment;

(2) no upward mobility for a new DP manager;

(3) programming staff ineffectiveness; and

(4) high staff turnover.

In the early spring of 1978, a new Associate Administrator for operations was hired. This individual had previous experience with both shared and custodial service MCBISs as an administrative user. Although the Associate Administrator had many duties when he first reported to the hospital, he noticed several system-related problems. The five separate billing systems resulted in a duplication of input effort and an uncertain level of reliability in the hospital's billing operations. The in-house DP staff was seen as incapable of integrating the separate billing systems or providing any other new systems to the hospital. Since the in-house staff had been unable to respond to several hospital needs, a scheduling system had been implemented on a computer system based in Toronto, Canada.

A competing view was held by a number of supervisory managers and clerical staff. They had worked closely with the existing DP staff and had a perspective different from that of top management. The DP group was believed to consist of "good" people. Lower-level operations personnel felt that "things were improving" with regard to the MCBISs developed by the in-house DP group; however, they sensed that the DP staff was extremely frustrated with hardware which was incapable of supporting major revision or new system development. Some of the better members of the DP staff became discouraged and "massive turnover in DP" ensued. Some DP people raised the issue to upper-level management and, in fact, new hardware was ordered and scheduled to arrive when the Assistant Administrator for finance placed a hold on its delivery. There is no information as to why this occurred; however, the action "upset" the DP staff and caused the remaining key people to start resigning "from the top down". They recognized that the hospital would probably be shifting away from in-house systems, first on the outpatient system level and then through the rest of the existing systems.

By this point the hospital had created a small task force to look into the computer-related problems. This task force consisted of individuals from the outpatient section, admissions, fiscal service, accounting, and data processing. They had come to the conclusion that the scheduling system had to be completely rewritten and were talking about the possibilities of improving the in-house staff. Apparently the task force solicited bids to provide outside software support to the in-house staff, but after receiving bids ceased any further action. The new Associate Administrator noticed what he called a "decision vacuum". He felt that the management of the hospital and the task force were not asking the right questions and were caught up in the trivia of fixing an unworkable situation. He was aware of other hospitals' DP people who had problems developing usable systems. He also knew that various shared systems users had experienced difficulties. Still, he felt that the initial question should be whether or not the hospital should perform system development activities in-house at all. But the hospital needed help in managing the DP group while this question was being answered. So, the new Associate Administrator hired a consultant from a custodial service vendor with which he had previous experience. This consultant had several duties. First, he had to gain control of the DP effort and try to stabilize ongoing production processes. Next, he had to attempt to discern the nature of the problems within the hospital. Finally, he had to determine a set of feasible alternatives to resolve these problems. Additionally, the consultant was to evaluate the hospital's present 360-based system, as well as the capabilities of the present staff. In hiring the consultant the new Associate Administrator had begun to work closely with the Associate Administrator for finance. Essentially, these two became the prime movers for the adoption of the system which was eventually implemented. These Associate Administrators decided that they had the following options: to upgrade the present system and in-house staff; to move to a shared service (with potentially more than one vendor); to move to a facilities management (custodial) service; to use an in-house staff to buy externally-generated software.

By this time, the hospital had experienced several years of ineffective support from its computer systems. Criticism of management and DP group inaction was rampant. The two Associate Administrators felt that immediate action was needed not only to solve the problem but also to stem non-constructive criticism. They decided that the present in-house staff was incapable of developing a sufficiently complex capability which would move the hospital rapidly out of its present predicament. Based on their budget, they saw no prospect of hiring a quality DP manager, so they gave up that search. Next, through peer contacts, literature, vendor information and previous experience they eliminated shared systems from further consideration. They felt that the shared systems did not meet the hospital's operational needs. They were too inflexible to support its unique requirements. The administrators briefly looked at the idea of bringing aboard outside software to be maintained by the in-house group; however, this would also require the upgrading of their present hardware, a task which they felt incapable of doing satisfactorily. Facilities management was the residual option. This conclusion was reached by the end of 1978 and the answer left another problem: where to find a facilities management organization.

The new Associate Administrator was the only manager who had any experience with facilities management, and he was aware of only one vendor. He believed that the vendor was generally competent and sufficiently service oriented to warrant investigation. Therefore, he proposed that the hospital enter into a contractual agreement for the vendor to provide all hardware, software, operations personnel, and maintenance for a replacement system. He intended that the vendor's common software systems be modified and/or augmented so that they would have a one-to-one mapping with his desired capabilities and existing systems. The vendor responded positively.

After a cursory review of three or four other MCSS vendors, the vendor initially contacted was selected. Hospital management cited the following reasons for choosing the facilities manager. This vendor provided the capability for tailored software support. It already knew the unique scheduling system since its consultant had been on site for almost three-quarters of a year. It agreed to submerge the accrued cost of the consultant in the contract. One of the key administrators had had prior positive experience with the vendor. Hospital administrators could secure the attention of the vendor's top management and "not get stuck with lower people". The vendor allowed the programmers, rather than marketing people, to talk directly to the users. Hospital management perceived that the vendor had a strong service ethic and was sincerely interested in doing an excellent job. Finally, although costs were not deeply considered, the resultant vendor's contract bid was "very competitive". It was felt that the successful vendor's initial bid was higher than the others but hospital management was convinced that the others were attempting to "low-ball" the hospital. However, one key manager suggested that the dominant reason to go with facilities management and the successful vendor was that it was the "quickest way to boot strap" the hospital. The facilities management group would immediately provide new hardware, programming, and a completely new support staff - things which the hospital desparately needed.

4.2.4.3. The System

The system adopted by the hospital is a common software custodial system with unique software modifications. The system is comprised of in-house hardware primarily supporting batch operations. The actual system configuration includes an IBM System 3 Model 15 with printer diskette, two tape drives, and a card reader and punch which handles the hospital's batch financial application. Additionally, an IBM System 34 with two small printers, six CRTs, and a diskette drive supports inpatient operations, scheduling and the collection of operating room, diagnosis, admission, and demographic data on an online basis. These online activities are limited to data collection, rather than process support. The system is programmed, maintained, and operated by the custodial service and the hardware vendor. Some portions of the software were modified and others are entirely unique. The hospital has experienced few, if any, difficulties with the hardware configuration but has had significant difficulties with the applicability of the original common-software to its operations, as well as software bugs in both the common software and the unique modifications.

4.2.4.4. The Implementation

The contract called for the replacement of the hospital's existing systems with the same or higher level of functional capability. Specifically, the functions required were the following: an integrated billing system; an accounts receivable system; a flexible management reporting system; a personnel system (including payroll); an outpatient registration system, a revised centralized scheduling system; and, a "charitable donation" management system. The hospital had the contract reviewed by the Chairman of its Board of Directors. The Chairman, in turn, had the contract checked by his company's Vice President for information systems. Finally, the contract was reviewed by the hospital's staff attorneys and General Director. It is interesting to note that each of these groups brought a different perspective to the contract review. The information systems V.P. at the Chairman's corporation looked into several functional issues which the hospital had failed to consider. Alternatively, the hospital's General Director made note of the fact that the scheduling system was previously the possession of the hospital and that the hospital should retain proprietary rights over the software. As a result of these reviews, the hospital believed that the contract would serve the its needs.

Sixty days after the General Director and Chairman of the Board approved the contract, hardware installation was completed. Meanwhile, a "whole cast of characters" was convening to develop conversion plans and staff communication mechanisms, and the DP staff was "smoothly" resigning. One manager commented that the old DP people were no loss. However, several of them were hired by the vendor to provide continuity of operations and a corporate memory of hospital systems.

4.2.4. Hospital "B"

Before the actual conversion began, a formal conversion committee was established. Comprised of users and managers, it attempted to continue the planning for the implementation. The same committee existed after the conversion started but no longer planned for future activities, even though some systems had yet to be implemented. Instead, it attempted to resolve operational problems. Initially, positive anticipation was the general reaction among the hospital staff. It was felt that the hospital had been "such a mess" for so long that any change was welcome, not only because of improvements but because it represented the end of an unhappy situation. The first modules implemented were payroll, accounting, inventory, and cost reporting. Essentially, their conversions were smooth. Following these, the fund raising or "charitable donation" management and patient accounting systems were implemented. It was at this point in the implementation that problems started and began escalating. It represented the first time that five different sets of users, whose functions were logically similar, began to work together. (Recall that the patient accounting module replaced five separate billing systems.)

Soon after, hospital staff members began to complain that the system was not meeting their expectations. User training had been somewhat sporadic, although hospital and vendor interest in the training was high. Still, vendor personnel used a "different vocabulary" than members of the hospital staff. The vendor, it was claimed, oriented training to the nature of the system and its technical functions, omitting the linkage of the system to the hospital's operations. All of the software modules were delivered late. Hospital staff claimed that the software was insufficiently tested due to contract time pressures, and that the system was unusable until corrections could be patched in. As a result, the initial experience with the modules was characterized by lack of function. Various members of the hospital staff began to be "disappointed". Just then, a major MCSS vendor, who had numerous client hospitals Hospital "B"'s vicinity, went out of business. Hospital management believed that the vendor decreased operational suppport for their hospital in an attempt to court and secure new business with hospitals previously affiliated with the defunct vendor. As a result, the hospital felt that the vendor was giving insufficient training and software correction support. Promised user manuals failed to materialize so that training, aside from interactions with vendor's staff, was impossible. Continuous software problems were encountered; when one bug was fixed, several others emerged. Worker discontent became a problem, especially in the billing sections. User experience was explained as follows. At first they thought they would get a particular function. Then the vendor would respond that that function was not supported by the system. Thereafter, the user would claim that they expected to be able to use the function and were now unsupported by the vendor. Essentially, expectaticns and communication were badly handled, especially considering the experience levels of vendor and hospital staffs.

Still it is claimed that the vendor's staff handled themselves professionally. The hospital felt it had legal recourse to abort the contract or force the vendor to a higher level of support. However, they acquired new sophistication through the adoption process and realized that they had created unrealistic time schedules which no vendor could be expected to uphold. Futher, they felt that although there was a significant lack of coordination and testing of the software, some of the communication problems were the fault of the hospital. Finally, the vendor's reporting package did not prove useful for the hospital. However, various managers within the hospital felt they were to blame since they never performed sufficient planning for information reports to allow a priori identification of the mismatch. Problems with the billing system were not only those of software but of massive input error.

Part of the billing problem was that the five user groups had never worked together before and had no desire to start. One of the vendor's staff members attempted to analyze part of the billing problem. He found that although three billing sections were located on the same floor and could communicate by line of sight, they still failed to coordinate billing procedures. To overcome these problems, a system analyst redesigned the input form so that all three of these groups could use the same form in sequence. However, hospital personnel refused to comply and eventually the vendor gave up any attempt to improve the situation. To this day, each of these billing entities has refused to adopt the techniques supported by the system and are, in fact, still using the billing techniques which pre-dated the system. During the attempt to adopt the system, several individuals within some of these sections became "disgusted" and quit their jobs. Some other sections were promised that the new system would decrease their paperwork. Experience contradicted this, and in some areas increased paperwork and processing loads ensued.

Part of the problem was that to meet implementation schedules, the vendor brought up its pre-existing, unaltered common software. As a result, the software was modified in iterations in a live environment. This decreased the user's confidence in the vendor, since this process was perceived as illogical and as only patching problems. At times the situation degenerated into personality conflicts between hospital and vendor personnel which, even now, have caused decreased credibility on both sides. In a number of cases mid-level managers opted out of cooperation, and problems had a tendency to fester before surfacing. Because of this, by the time a problem was identified, major conflicts were inevitable. When the outpatient system was converted ten months after the initial conversion, these problems were still occurring. At this point, however, the outpatient people had heard numerous negative comments about the vendor and entered the process with skepticism. The conversion teams had long since become useless and were discontinued. They had become a "battleground--not a forum"; hence, the last formal mechanism for raising problems before they became disastrous was lost.

During this period of common software revision, the vendor had to rely on user judgments. In many cases the users had built expectations which were cumulative across experience; that is, as the user had seen numerous computer-based systems over the years he had a tendency to aggregate all of their capabilities within his expectations. In this respect, the contract called for one system while the user was thinking of quite another system. This, plus the communication problem, led to many comments such as "we told them five times and they still don't understand what we need". Thus, one year into the conversion the implementation was "grinding along", but was not very supportive of hospital operations. Hence, the hospital felt it was necessary to formalize problem reporting to the vendor. They instituted a procedure whereby all problems were to be recorded in writing so that problems could be identified by any member of the community, preventing the development of "bad feelings" of the hospital staff for the vendor. Further, early documentation allowed the hospital to identify and track problems which were previously slipping through the cracks. Although the hospital felt this effort was only 50 percent effective, it did seem to represent a turning point for the implementation. In general, hospital management continued their reserved optimism that sooner or later the problems would be worked out. Their attitude was one of attempting to understand the situation and work through it to a successful implementation, rather than one of retribution, as has been seen in other hospitals.

By now the hospital had attempted implementation of the unified billing system, but had problems. The conversion of the scheduling system was better; however, it proved to be costly, late, and complex. It was felt that the outpatient registration system was also too complex for inexperienced users. Hospital staff contended that the human factor's engineering to assure ease of use was not evident. Two years after implementation the state of the conversion remains unchanged. Some modules are successfully functioning; other modules are functioning in spite of the lack of cooperation of the users. There seems to be a subset of users which is happy with the vendor, while there are a greater number of people who feel the system is inappropriate and who miss the "good old days" when the hospital had its own in-house staff. One supervisory manager indicated that the vendor's staff members were responsive and trying to do a good job. But he felt that the hospital's "own people were better", that they were working for and identified with the hospital's goals. They were helpful to non-DP staff members and, in general, if given proper support by top management could have produced a better system than has been delivered by the vendor. It is a distinct possibility that some of the problems which existed at low levels after the new systems were installed were, in fact, attributable to the low-level managers' resentment that their associates in the DP staff had been forced to resign.

4.2.4.5. Paradigm Fit

Objectives and Rational/Functional Processes

The major hospital goals for the system were:

(1) To replace functions previously run on the in-house IBM System 360;

(2) To end the current inability to improve system capabilities to match hospital needs;

(3) To overcome the "problem" of having, paying for, and managing an in-house DP staff.

Superficially, these seem to be hospital-wide goals. There was majority agreement that the pre-existing system was unsatisfactory, that the pre-existing staff was "dead wood", and that the hospital's needs were changing faster than the 360 software systems could be modified. It is difficult to document whether or not subsystem (departmental and individual) goals were also in evidence. However, some indication exists that the goal of resolving the in-house DP staffing problems existed only at the level of certain associate administrators. Additionally, it is clear from the implementation that numerous users had objectives for the system which were privately held on an individual departmental level. They expected to receive certain processing capabilities with the conversion, and these goals were never made known until those capabilities were found to be unsatisfied.

Adoption Processes

Essentially, this implementation followed the adoption model. There appeared to be no remaining gatekeepers within the DP department; they had all quit. As a result, any remaining potential gatekeepers were deemed of insufficient quality or knowledge to be trusted by of the hospital staff. However, when the new Associate Administrator for operations was hired, he immediately assumed a gatekeeper role. This is reflected in the fact that he was soon entrusted with the search process. His previous experience with the facilities management vendor became the main source of intelligence and determined the adoption decision. In this respect he also served as an influence leader, as did the other prime mover for the system, the Associate Administrator for finance. However, other influence leaders existed (Exhibit 4.8). Early on, when the move to the facilities management vendor was generally seen as a positive step, the various influence leaders in departments were not distinguishable. However, some soon were noticeable. Certain influence leaders, who later became disgruntled with the system, were effective in disenchanting their peer contacts within their departments. This is one of the prime reasons that the billing subsections failed to adopt new processes which would support the use of the single, integrated billing system.

Political Process

The political paradigm was evident long before the new system was selected. Although the DP department was the guardian of the hospital's information, its most vital asset, it was politically weak. Everyone admitted that new hardware was required but DP had to submit its budget in competition with medical and surgical departments. Invaribly its power in the political process of budgeting was insufficient; it was never successful. This was one of the frustrations which led to several systems analysts quitting.

The political processes during the adoption decision and the initial conversion were not obvious. However, the political power structure and the optimization at department level may be seen by observing which modules received enhancement and which were direct conversions, in spite of the fact that they also needed enhancements. The ultimate evidence of the effect of the political paradigm came after difficulties were encountered with the system. In several instances the vendor's software support group urged upper-level management to assist in gaining the cooperation of lower-level management (where "upper" and "lower" were defined by the vendor's view of the organization through its organizational chart). However, this hospital, like others, had distributed power bases and one of the top administrators simply refused to attempt to goad other departments into cooperation. He told one vendor representative that he could not do so because the vendor did not realize that the department he was attempting to force to cooperate was quite powerful. The administrator then told the vendor: "No, I'm not going to try to force nursing to cooperate. If they don't want to do it, there's no way I'm going to be able to make them." As a result, the key administrator chose to abrogate management responsibility in deference to political reality.

Bureaucratic Process

The existence of bureaucratic rules and procedures in the hospital is obvious. They led to significant difficulties in the vendor's attempt to get various hospital departments to accept the common software as an initial operating capability. (It may be remembered that common software was to be implemented and then modified, giving the hospital rapid access to a new technology while ultimately providing a refined and unique capability.) Still, the common software system was a sufficiently different operating methodology so that numerous departments refused to alter their procedures to make it work. Once again, this hospital's adoption processes were hampered by a combination of political and bureaucratic factors. The previously discussed fact that hospital administration refused to intervene in the political arena to gain cooperation for the system's adoption was also tied to the existence of bureaucratic procedures. Whenever a user was challenged to adopt new methodology, these procedures were cited as the main reasons the user could not adopt that methodology. This behavior continues two years after initial implementation in several departments, such as some of the billing sections.

Change Process

Perhaps the most significant factor in the implementation process is that the refreezing process was never accomplished. Essentially, unfreezing had progressed without significant intervention by the vendor or the hospital management. The DP staff was perceived for a long time to be weak and ineffective. So, most of the hospital staff members viewed the impending implementation as a very positive event, one which indicated that the hospital was once again becoming progressive and was not stagnating. But during this unfreezing, staff expectations rose in ways which were not controlled. In some instances vendor staff promised certain operating capabilities which were never delivered. This is obvious since several major modules have yet to be delivered. Also, as mentioned above, staff expectations exploded through the additive prior experiences of the staff members. Once the change occurred, refreezing was hampered. In addition to the fact that expectations were unfulfilled and, perhaps, unfulfillable (i.e., unrealistic), the operational difficulties with the software and communication problems with the vendor raised a significant level of cognitive dissonance with respect to the system. Cognitions occurred which did not reinforce the change and assured that mutually reinforcing social acceptance would not take place. Quite simply, unfreezing has yet to occur; in fact, some top managers feel that there is so much cognitive dissonance between expectations for the system and actual system fulfillment of those expectations that they are worried that a current unfreezing is taking place. In this respect, the ensuing change would be one to abort use of the system entirely and return to some manual methodology. This fear was so great that, at first, hospital management determined that it did not want to participate in this research.

4.2.4.6. Success Level

None of the individuals interviewed referred to the system as an unqualified success. Exhibits 4.9 and 4.10

present the success measure responses. The measure's responses generate the following synopsis of the implementation:

> The system fulfilled many adoption goals but people disagree as to the relative importance of these goals. All agree that some goals are unfulfilled. Various people or departments have declined to use the system and others wish to discontinue its use. Although the system has produced some additional benefits, its operation is sporadic and it has caused other problems.

Those interviewed partitioned their determination of success to reflect specific functional capabilities. When one manager was asked if he would repeat the process by making the same decision, he indicated that he would not; that he would give much stronger consideration and expend much greater effort in an attempt to keep the software support in-house. This is reflected in the fact that the hospital is currently attempting to hire a DP manager. The first task for this individual will be to represent the hospital's needs to the vendor's staff. However, the contract provides for a buyout option for the software, and key managers are seriously considering the reemployment of an in-house staff, at least for maintenance and minor system upgrading (even if they maintain a relationship with the vendor to provide major software changes).

In essence, all of the individuals interviewed indicated that the primary means of measuring success must be the benchmark of whether or not the system fulfilled the goals of that individual. In many cases that individual did reflect hospital-wide goals; in some cases they did not. Specifically, one manager's unstated goal of forcing the hospital into action was deemed very successful. A second individual, unstated goal was to improve the hospital's general understanding of the control and importance of the DP function. This he considers to have been very succesful. Third, he considers one of the functional goals of the hospital (i.e., of implementing a modified scheduling system) to have been very successful. However, he rates the billing system as only a moderate success, and the other systems which had operational problems as failures. He added a fourth category, that of disaster, which he applies to the outpatient system. Essentially it should be noted that almost all individuals agreed that major contracted deliverables have never been delivered. Major missing components include the outpatient registration system and the personnel system. (Only the payroll portion of the personnel system is currently available.) Determination of success by one manager was modified by the fact that the hospital has refused to pay for undelivered items. As a result, the individual feels he can benchmark the delivered software as being somewhat successful, while rating the undelivered systems as failures. However, he indicates that had the hospital fulfilled its obligation of payment, he would rate the vendor as being a failure. Several managers alluded to the fact that their belief on level of success would change over time. In particular, one manager noted that the system is so close to being good that he considers its future very bright. Hence, today he would rate its level of success lower than he would or hopes to be able to rate it in the future.

	ASSOC DIR ADMIN	ASSOC DIR FINANCE	ASST ADMIN SPECIAL STUDIES	ASST ADMIN FINANCE	MGR ACCTG RECORDS
External Management					
CHAIRMAN, BOARD OF DIRECTORS	I P +	P +	I P +	P +	
PRESIDENT, BOARD OF DIRECTORS		P +		P +	
Top Management					
GENERAL DIRECTOR	P +	I P +	I P +	I P +	P 0
Middle Management					
ASSOC DIRECTOR, ADMINISTRATION		I P +		I P +	I P +
ASSOC DIRECTOR, FINANCE	I P +	I P +		I P +	I P +
ASSOC CHIEF, A MEDICAL SERVICE	I P 0				
ASSOC CHIEF, A SURGICAL SERVICE	I 0		I P 0		
ASST ADMINISTRATOR, SPECIAL STUDIES		I +	I +	I +	
DIRECTOR, NURSING			I +	I +	
DEPT HEAD, SCHED, MED REC, PHARM					I P +
MANAGER, ACCOUNTING					I 0
ADMINISTRATOR, OUT PATIENT SERVICES					I 0

NOTE: I => Influence (Opinion Leadership)
P => Power

+ => Pro-Adoption Attitude
0 => Indifferent, Neutral
- => Anti-Adoption Attitude

POWER DISTRIBUTION and SYSTEM ADOPTION ATTITUDE HOSPITAL B

SELECTION FREQUENCY	SCALE VALUE	ITEM NUMBER	
*	1.57	15.	The system fulfilled few of our goals and some people/departments decline to use it.
**	2.20	22.	On balance, the usefulness of the system is about the same as what it replaced.
*	2.31	12.	The system fulfilled few of our goals but provided other benefits.
*	2.95	17.	The system fulfilled most of our goals but its operation is sporadic.
****	3.34	18.	The system fulfilled some of our goals but not all of them.
*	3.44	23.	The system fulfilled most of our goals but some people/departments have declined to use it.
**	3.51	19.	The system fulfilled most of our goals but caused other problems.
*	3.78	13.	The system fulfilled most of our goals but some people/departments wish to discontinue its use.
**	4.06	3.	The system fulfilled most of our goals, but not all of them.
*	4.39	8.	The system fulfilled our major goals but not some of the minor ones.
**	5.50	21.	The system fulfilled most of our goals and provided other benefits.

NUMBER OF RESPONDENTS = 5

ITEM RESPONSE FREQUENCY HOSPITAL B

EXHIBIT 4.9

HOSPITAL B

ITEM RESPONSES

ITEM SCORE	ITEM NUMBER	ASSOC DIR ADMIN	ASSOC DIR FINANCE	ASST ADMIN SPECIAL STUDIES	ASST ADMIN FINANCE	MGR ACCTG RECORDS
Failure		<-stronger	----early	advocacy	-------	weaker->
0.00	11					
0.40	9					
0.75	1					
1.15	7					
1.20	6					
1.57	15					+
1.58	10					
1.62	20					
1.69	14					
1.89	4					
2.20	22			+		+
2.31	12			+		
2.95	17	+				
3.34	18	+	+	+	+	
3.44	23					+
3.51	19	+				+
3.78	13					+
4.00	16					
4.06	3	+				+
4.23	5					
4.39	8					+
5.50	21	+				+
6.63	2					
Success						
MEDIAN		3.51	3.34	2.31	3.34	3.65
MEDIAN OF EXTREMES		4.23	3.34	2.77	3.34	3.54

MEDIAN of: COLUMN MEDIANS: 3.34 COLUMN EXTREMES: 3.34

MEAN of: COLUMN MEDIANS: 3.23 COLUMN EXTREMES: 3.44

VARIANCE of: COLUMN MEDIANS: 0.23 COLUMN EXTREMES: 0.22

EXHIBIT 4.10

4.2.5. Hospital "C": Case and Preliminary Analysis

4.2.5.1. The Hospital

Hospital "C", founded in the early 1900's, is a 300-bed acute care, general medical and surgical hospital located in an industrial suburb of a major city. The hospital is accredited by the Joint Commission for Accreditation of Hospitals and is certified for participation in the Blue Cross and Medicare/Medicaid programs. The hospital is a private, nonprofit, nonsectarian facility which has existed at its present location since the mid-1920's. Although part of the hospital dates to the mid-1920's, much of the hospital is of modern architecture with major construction going on in the 1970's and more to follow. The hospital has no significant training programs. It has 4.5 full-time equivalent physicians, 3.5 of which are allocated to the 24-bed mental health facility. The other is the director of the mental health facility. Its active medical staff numbers approximately 150, with an additional 100 physicians who are currently inactive. The population the hospital serves is approximately 100,000, with financing for care being provided by the typical array of mechanisms. In particular, 50 percent of the care is covered by Medicare, 15 percent by Medicaid, 25 percent by Blue Cross, 5 percent is self-paid, 3 percent is other insurance, and 2 percent is bad debt. The hospital employs approximately 800 individuals, and has an operating budget in excess of $16 million.

Hospital "C" has a rather traditional organizational chart. The Administrator reports to the Board of Directors, and has reporting to him the Chief of the Medical Staff and the directors of several divisions which include nursing, physical services, employee relations, and community relations. Additionally, the Associate Administrator reports to him; the Associate Administrator, in turn, has numerous subsections for which he is responsible. As with most hospitals of its kind, the Chief of the Medical Staff has an indirect but effective reporting relationship with the Board of Directors. The Board of Directors at Hospital "C" is an 8-10 member group elected from the approximately 150 members of the Board of Incorporators. While the Incorporators meet semi-annually and are remotely involved in planning, the Board of Directors meets monthly in subcommittees and is involved in planning and general oversight of tactical and operational decisions. Hospital management has referred to the Board of Directors as a "hands off" board which prefers an oversight role to one of direct involvement. The hospital's Administrator is seen as an "outside" administrator, whose major functions involve external relationships. Essentially, the hospital Administrator's lack of involvement in the hospital's operations has distributed his power unequally among seven assistant administrators and directors. As a result, the Assistant Administrator for finance became dominant in the internal operations of the hospital. This fact generated a certain amount of dissatisfaction among the other directors and assistant administrators who felt that the financial managers had undue control over their operational entities.

4.2.5.2. The Adoption Decision

In the late 1960's, Hospital "C" began its involvement with MCBISs. At that time the hospital was one of the prime movers in the development of a nonprofit hospital association based shared service system. This system eventually provided most of the services of adopted (subject) system. Using the hospital association's system, the Hospital "C" had billing and accounts payable systems in operation as early as 1969. Over the years the shared service added on other functions and capabilities, and as these became available, Hospital "C" adopted them. This symbiotic relationship lasted approximately nine years, but then in 1977 the hospital's Assistant Administrator for finance began to be concerned about the shared service's lack of response to new user requirements. The Assistant Administrator for finance was about to begin a search for potential replacements when its accounting firm (one of the big eight accounting firms) issued an assessment of the hospital's needs and suggested that the hospital continue to use the existing system. But within six months of this report, that existing system went out of business.

In the fall of 1978, the hospital association's shared system announced that it would provide service for three more months and then terminate operation. It had agreed to turn its users' files over to a large shared service vendor and informed its members hospitals that that vendor could provide service to them if so desired. Since the old shared service system was primarily oriented to financial systems, the Assistant Administrator for finance of Hospital "C" assumed the responsibility of initiating a search for a replacement system. He was, in fact, "turned off" by the way the hospital association and vendor had handled the situation. He felt that it represented unprofessional pressure to adopt the vendor which had entered into the arrangement with the hospital association. Yet the Assistant Administrator for finance realized that he would have little bargaining power as a small hospital among the twenty some odd hospitals which were then scurrying to find another form of computer-based support for their operations. To resolve this and provide the hospital with some bargaining power, he and key individuals of six other hospitals banded together to form a committee whose needs and goals were essentially similar. This committee intended to contract jointly for a service which would be agreed upon by all members. The primary objective of this group was to provide replacement services; however, it investigated only a few vendors. Among these were two of the country's largest, as well as a regional facilities management organization. The logic for this was that they wished to assure that the firms they were dealing with were "blue chip firms". They felt that by dealing with this class of vendors (the "class" was one of perception), the hospitals would not get "stung".

The facilities management vendor, who was rapidly deleted from further consideration since the members of the committee felt that it represented too great a change in their procedures to be coped with in the current crisis setting. The committee hired a "computer expert" who specialized in health care delivery systems and who was known to all the committee members. This consultant drew up a list comparing the functions of the two competing shared service vendors and contrasted these with the services previously provided by the hospital association's shared service. Indications exist that the committee members felt that the two systems were sufficiently compatible with their needs to warrant further consideration. Both were considered good vendors; however, upon further investigation various members found aspects of one or the other with which they were not completely comfortable. The Assistant Administrator for finance at Hospital "C", for instance, found that one of the vendors could not provide an alpha name list of bad debts, a function which was deemed very important to this committee member. As negotiations between the committee and the two vendors continued, the financial members of the committee felt that they had problems. One of the vendors (the unsuccessful vendor) had developed a marketing strategy whereby they were dealing with administrators and not with financial people. Further, this vendor's personnel available for negotiation were not considered key members of their staff. If a negotiation point required approval, the negotiators could not approve the point, it would have to be passed to upper levels of vendor management for a decision. This caused unnecessary delays.

The individuals who comprised the committee began to become impatient with these delays, realizing that only fifty days were available to complete a conversion to a new system. Further, Hospital "C"'s Assistant Administrator for finance indicated that the unsuccessful vendor's key personnel were uncooperative. They clearly wanted the business, but they were "impertinent". The final decision came at a point of crisis. The successful vendor had made a bid based on continuous negotiation by vendor representatives who were authorized to make decisions. The unsuccessful vendor suddenly realized that it was about to lose the business of these seven hospitals and asked for a final meeting with key members of the committee. It was only at this last meeting that decision makers of the vendor's corporation were flown in to deal directly with the committee. At this point one of the vendor's chief representatives told the committee members that their business was very important to the vendor and that the vendor was willing to significantly underprice the competition. However, the committee had already decided to reject the unsuccessful vendor. In fact, it was felt that since the unsuccessful vendor had not even provided proper negotiating resources, it would not provide efficient operational resources. As a result, the committee rejected the unsuccessful vendor's low bid and accepted the higher bid of the other vendor.

4.2.5.3. The System

The system that Hospital "C" implemented was a shared service system. The system supports the following functions: patient accounting and billing, including third party billing; census; accounts payable; general ledger; payroll; property accounting; and inventory control. The system's hardware is located at the vendor's home site and only peripheral equipment is located within the hospital.

User equipment includes a Four-Phase data concentrator; 8 CRTs, which are used as the main form of data entry; and a 300 line per minute printer. The CRTs are located in the work sites responsible for the functions the system supports. The shared service is provided by one of the high-volume vendors.

4.2.5.4. The Implementation

Once Hospital "C" had made the decision to adopt the new shared service system, its staff had less than fifty days to fully convert and implement the new system. The primary task was to convert the various files needed to support the new system. Unfortunately, the vendor's resources were stretched incredibly thin. At the same time it was carrying on normal business activities, these new seven hospitals had to be implemented. The vendor brought in support personnel from outside the region; however, even these additional people were insufficient to assure a smooth transition. As preparation for the conversion continued, hospital personnel began to realize that this was not a simple conversion to another form of system, but rather a massive conversion to different file structures, different item names, and different procedures. They began to sense that the change was greater than they were prepared to deal with. Shortly before the system was to become operational, vendor representatives provided a training experience which was considered insufficient in both quality and quantity. Many of the vendor's training personnel were themselves still in training and were not fully aware of the nature of the system or the typical impact the system had in an adopting hospital. As a result, the vendor representatives did not have the answers the hospital personnel were seeking and provided no information as to the impacts of the new system on the old work processes. Although the system was made available for interactive training, hospital staff said that vendor representatives were never available to help them. As a result, most of the hospital employees claim that the live system training was relatively ineffective. They spent more time trying to decipher user manuals than in actually learning how to use the system. However, those employees were the lucky ones. Another group of employees were never sent to classes because they were needed in the critical task of data conversion. As a result, some of the most important employees were never formally trained to use the system.

At this point a number of employees began to be somewhat disgruntled with the change process. Several key employees who had worked in the area of data preparation for the old system heard that the old system was to go out of business and were rather happy with the prospect of something "better" replacing it. Their complaint with the previous system was that they "saw everything go in and nothing come back". They were looking forward to a "challenge" and had the potential to be strong system advocates. However, the decision to go with the system vendor was announced to them and they became disturbed that they were not part of the decision process. They were not alone in feeling disturbed. Apparently the feeling pervaded most of the first level managers of the financial division. It was about this time that "mass confusion" began. Many individuals were not involved in the conversion until data preparation began. In the data processing section (actually a data preparation section) the supervisor was trained to use the system and was expected to train his employees; however, this person was never able to effectively train the others. His approach was "this is what you do", rather than telling them what to do, why it needed to be done, and how it affected the hospital's operations. As a result, a number of individuals claimed that they gained no understanding of the system. They only acquired a rote response to certain stimuli.

There was another set of employees which was not enthusiastic to see the new system implemented. These individuals felt that they "knew the old system", were happy with its processing capabilities, and did not fully understand the reason for the crash conversion to a new system. Their claims in this respect conflicted with upper level management who claimed that the reasons for the conversion were discussed openly in an effort to allow workers and lower level supervisors to understand the emergency situation that the hospital faced. It appears that both groups are partly correct in their contentions. The horizontal and vertical communication within the hospital were so poor that the reasons for the implementation were never conveyed to all members of the staff.

Mass confusion began two to three weeks before the cutover. At this point there was a general feeling that there was insufficient time to complete the conversion of data and to complete training to allow productive use of the system. Some individuals were working 60-75 hours per week to accomplish the conversion. By the beginning of 1979, when the conversion actually occurred, morale was very low. The early excitement deteriorated into "chaos", "tension", and "confusion". Deadlines were set and often not met. Instructions were given but were ambiguous to those who tried to carry them out. And some individuals began to resent being overworked. This led to a general resentment of the new system, especially in two sections, billing and payroll. These two sections were primarily staffed by older employees who were quite satisfied with the pre-existing system, and the resentment led to several resignations. In total, the hospital lost 8 people who were unwilling to "put up with the system". During January, even system advocates were disappointed. Their disappointment centered on the unfulfilled expectations generated by vendor promises that the system would decrease paperwork, when actually paperwork was increased. In some departments, individuals who resented the system still tried to make the conversion successful, but in the same departments a number of individuals did not try at all. In January these individuals "totally resented" the system. They did not attempt to carry out their transactions correctly, since not even their supervisors knew if they were making mistakes.

The individuals outside the financial arena at first believed that the new system would provide improved non-financial operational support. Some of these expectations were met; however, disappointment set in since functions which were smooth under the old system, such as payroll, were claimed to be worse under the new system. But as the implementation continued, improved capability was realized; for example, cost information for nursing units began to be relied upon and was felt to be very helpful in unit management. Additionally, census and ADT information was able to be used in the nursing unit. This was the first time that CBIS support in these areas had been provided. Nursing unit staff were not involved in the decision to adopt the new system, but they were included in "dog and pony shows", and the vendor did approach them to determine if there were any functions the system could provide for them. This ultimately proved to be unfortunate, since the vendor representative promised to implement a user-designed patient data sheet, and failed to do so. Additionally, a number of head nurses were "angry", since the system forced them to adopt changes in their patient processing procedures. Further, due to the system's report generation methods and hospital's update procedures, a number of deceased patients were listed in good health. This led to a general lack of confidence in the system's output reports. Dissatisfaction with the new system was ultimately documented by the end user, the patient. Numerous patients complained of repeat billings when the fee had in fact been paid, and of receiving first bills which were late and accompanied by dunning notices.

The first year of operation of the new system was described by one member of management as a "disaster". However, the hospital began to use the system productively. One employee explained, "It was something which had to be done - we didn't have any choice - people didn't realize its impact until it came". The second year of the system's use was one of "reconstruction". It was recognized that the general level of sophistication of the new system was much higher than that of the preceding system. Different procedures were required, especially with respect to the general ledger. In this respect, problems were encountered. The general ledger was updated daily, but at the end of the month the system provided no consolidated general ledger. Management staff had to construct one using the daily reports. Further, it is recognized that the hospital staff members were learning a completely new system, although the same functions were being served. The new system required many more input forms than the old system to do the same work. It required more codes of a more complex nature. But key people in the organization continued to support its operation. As a result, new procedures gradually evolved and were integrated into the normal work flow. Individuals who were very disgruntled with the new system sought employment elsewhere or retired. Current management described problems with three individuals as being related to their age; however, the problems may have been associated with the individual's long-term integration of previously understood work procedures. One hospital manager described the patient account manager as "62 going on 100" and the controller as being from "the old school". He stated that these individuals never supported the integration of the new system. The "DP lady" who was 67 years old did try, with some degree of success, to aid in the adoption of the system. Therefore, the correlation of problems with age may be deemed fallacious. Regardless, the patient accounts manager did not support the system, and as a result "receivables went out of control". Essentially, the receivables went from 55 days to 80 days and this led hospital management to "replace the patient accounts manager". Following this action, the controller resigned and the DP lady retired. Replacement of these three key individuals allowed the infusion of enthusiasm by individuals who saw problems which they wished to overcome. In essence, they were responding to an "exciting challenge". Upon analysis, one of the problems with the first year's operation of the system was that massive numbers of simple mechanical mistakes were made. Once individuals got used to the system and the code structures, these mechanical mistakes decreased in number and allowed much more productive use of the system. The payroll system, a "total shambles", led to a crisis when W-2 forms proved to be completely erroneous. This seems to have been a catalyst for payroll personnel who tried to resolve the problem and in so doing became their own leaders. That is, massive involvement with the system led them to learn it and to be able to feel more at ease with it, thereby producing a cascade of positive reactions to the system which they, for the first time, began to understand. As the patient accounting system problems were slowly resolved by new leadership, another stumbling block was breached. The promised tape-to-tape third party billing capability was finally available one year after its scheduled arrival.

However, the new patient account manager, in attempting to resolve the problem, initiated the second level of resistance. This manager autocratically attempted to force the use of the system. The manager was resented by a number of individuals who became disinterested in cooperating because of him. This patient accounts manager was never fully accepted by the staff and soon resigned his position. Throughout it all, patient account personnel never really understood why the past methods developed to interact with the old computer-based system were no longer valid with the new computer-based system. As a result, the third patient accounts manager had a massive reeducation effort which, once completed, proved successful.

Throughout the entire process, the hardware availability of the system was sufficient to support the hospital's operation. This is not to say that occasional failures did not occur; however, they were not operationally significant. Software was essentially validated by the vendor long before the hospital attempted to use it. Therefore, the software which was provided to the user through the shared service functioned correctly. Certain modifications were never delivered or were delivered late. Hence, the available software worked, yet certain functions were not supported. At the end of the second year of this prolonged implementation process, certain software deliverables were still not in place. However, the system was being productively used, even though certain departments still resented the implementation events as well as the system.

4.2.5.5. Paradigm Fit

Objectives and Rational/Functional Processes

The primary goals for the system were:

(1) to provide a state-of-the-art financial system;

(2) to provide an inpatient census and cost system; and

(3) to form the nucleus for functions which could be added later.

The first goal was more than a function to function replacement of the system going out of business. The second goal was a departmental request granted for political reasons. The third goal was a requirement for flexibility and interfaceability.

The hospital's goals for the system were never formally stated nor conveyed to other staff members. Its major goal (#1) was developed by the Assistant Administrator for finance. Hence, by definition, a departmental goal became the organization's goal. His ability to control the hosptial's goals is consistent with his level of power (Exhibit 4.11). Still, other goals existed. For instance, as has been mentioned above, the nursing division had a separate goal of being provided increased cost and patient control capability. In this sense, the nursing division desired to see the finance division's goal realized since its own cost information would be thereby assured. However, the inverse was not true. The financial division was not really interested in whether or not patient processing support was available to the nursing units. It, in fact, has never investigated the lack of the promised patient data sheet subsystem.

Adoption Processes

Although the adoption process was forced upon the hospital, the hospital's experience generally fits the adoption paradigm. The hospital did not automatically sign a contract with the vendor that the hospital association representative suggested. Instead, they attempted to screen their environment for alternatives. The degree to which they accomplished this was minimal; they only observed four vendors and discarded one immediately. However, they did attempt to match their perception of functional needs to the capabilities of the system and contacted peers to determine whether or not the system would pass their tests as to perceived capabilities. This testing also served the function of assuring that the vendor had a reputation for success and provision of appropriate support.

The prime mover for the adoption of the new system was the financial director. Since the system was primarily a financial common software system, he automatically became the organization's gatekeeper. Differentiating his roles as leader and gatekeeper is difficult. However, it is clear that other staff members did go to him for information as a gatekeeper rather than as a controller. The role of influence leaders was evident but minimal; they obviously had no impact on the decision to implement the new system. Nevertheless, they did impact the perception of the system's success or capability to ultimately achieve success. In this respect, certain influence leaders who were either for or against the system did have a minor impact on the perceptions of their peers and created either pockets of dissatisfaction or pockets of hope within the subdepartments of the nursing and financial divisions.

Political Process

The political situation was primarily in evidence through negative actions. It was generally felt that the hospital had no choice but to implement a new system. Therefore, a sense of finality or fatalism was evident in those individuals who were not anticipating arrival of the new system with pleasure. As a result, some departments withheld support in an effort to optimize their department's situation. In some cases their goals included the removal of the system and the reversion to a status quo. This goal was known to be impossible but was emotionally desired nonetheless. In some cases a political intervention was used to secure the support of certain departments for the system. This may be noticed by the fact that the nursing units were approached on a different basis than the financial units. Essentially, the nursing units were asked what they would like to have in the system to support their operations. Although key components of their desires were never fulfilled, they, nevertheless, were brought into agreement and cooperation by the promise of capabilities which would uniquely support their environment. Still, the political paradigm's effects in this implementation were not great.

Bureaucratic Process

The adherence to pre-existing rules and structures seems to have been a distinct problem with the implementation of the system. Since training was poor to nonexistent, reasons for and knowledge of the changed procedures was not communicated to those who would perform the work. This fact is clear, since several system users continued their old work practices, even after the new system had been installed for many months. There existed increased dissatisfaction with the system because it forced a change in the procedures which had become ingrained. However, the bureaucratic paradigm is in evidence at a much higher level in this implementation. Since the system was adopted in a crisis situation, the hospital's existing rules and procedures were the single most important facet of the system selection. As discussed above, the primary goal of the system selection decision was to secure a system that would fit the pre-existing work structures within the financial service. The systems which represented a significant departure (i.e., one shared service system and the facilities management system) were immediately rejected.

Change Process

The interrelation of the various paradigms is evident in this hospital. The bureaucratic structures which management attempted to preserve through the selection of the new system were linked to the inability of individuals to integrate massive change, in this case, change from the rules and procedures with which they were accustomed. So, in a sense, the selection of the system to maximize a fit with existing rules and procedures was analagous to the selection of a system which reduced the level of change required in a system conversion.

Statements by end users support the concept that part of the difficulties experienced in the first year of implementation were related to the fact that individuals were not prepared for change. Although some individuals were dissatisfied with the old system and were unilaterally unfrozen, dissatisfaction with the new system during the coversion process created sufficient internal cognitive dissonance so that unfreezing was negated. In other individuals no unfreezing occurred prior to the change. These individuals had not received training, had not been informed as to the reasons for the conversion, and had not been informed of the change to their work life that the system engendered. Given the circumstances of the required rapidity for change, very little planning for new work processes occurred. Most planning was directed at efforts to complete data conversion; therefore, individuals may have been motivated to prepare changes while not being prepared tc accept the major change, the integration of the new system. Those individuals who received training and who received information as to the reasons for adoption of the new system were insufficiently motivated to accept the change. The training was haphazard, of poor quality, and of insufficient duration. The individuals who were attempting to train hospital personnel were themselves not completely knowledgeable as to the nature of the system. They attempted to explain the system from the viewpoint of a system developer. They understood how to explain a transaction, which was to them defined as the imperative and a string of arguments, while the group attempting to learn perceived the transaction as a human interaction of which the imperative was but a small part.

Due to the failure to successfully unfreeze the hospital staff, the period of change was painfully prolonged. Even when some individuals were motivated to accept the change, others were not, and this had the result that refreezing mechanisms in the form of social supports to accept the change were frequently missing. Clearly, the failure of the change process was a major factor leading to the removal or retirement of the individuals mentioned above. Once these individuals were replaced, there was a better environment to support the change process. However, in the patient accounts section this environment did not improve because of the autocratic nature of the new manager. Instead, as discussed above, a second level of resistance occurred which was not broken down until the third manager was employed.

In summation, unfreezing, change, and refreezing is still occurring two years after the implementation began. With some individuals unfreezing has yet to be successful. This phenomenon directly correlates with the individual's and department's level of system support.

4.2.5.6. Success Level

The application of the success measure (Exhibits 4.12 and 4.13) resulted in the following synopsis:

> The system fulfilled most adoption goals; but all agree that not all goals have been achieved. The system caused additional problems; and some wish its use discontinued. A few additional benefits were realized.

This synopsis reflects the reality of the situation fairly well.

As would be expected, perception as to the system's level of success varied by department. A nursing representative expressed the opinion that the system was slightly successful, since she assumed it was carrying out functions needed by finance, but indicated that nursing's goals for the system had not been fulfilled. Other individuals rated the system as a success to varying degrees according to the difficulties they had encountered in its implementation. The Assistant Administrator for finance indicated that this system was a "moderate success". He acknowledged that the system's implementation had been extremely difficult, that the system did not fulfill all of his goals, and that the conversion process was an experience he would rather not repeat. However, he also noted that the perception of success varied over time and that earlier in the implementation more people would have indicated the system to be a failure.

	HOSP ADMIN	ASST ADMIN FINANCE	NURSING REP	ASST TO PATIENT ACCT MGR	DATA ENTRY OPER
External Management					
PRESIDENT, (BD OF DIR) EXEC COMM		P 0	P +	P +	P 0
Top Management					
HOSPITAL ADMINISTRATOR		I P -	I P +	P +	P 0
Non-Line Clinicians					
CHIEF, MEDICAL STAFF		P 0		P 0	
Middle Management					
ASSOCIATE ADMINISTRATOR		I P 0	I P +	P +	
ASST ADMINISTRATOR, FINANCE		I P +	I P +	P +	P +
DIRECTOR, PATIENT SERVICES			I P +		
DIRECTOR, NURSING				I 0	
DIRECTOR, FACILITIES MANAGEMENT			I +		
DIRECTOR, SOCIAL SERVICES				I 0	
Supervisory Management					
SUPERVISOR, BILLING				I -	I +
SUPERVISOR, DATA PROCESSING **				I -	I 0
SUPERVISOR, PAYROLL					I -
Workers					
MENTAL HEALTH UNIT WORKER					P 0
ADMITTING SECRETARY, NIGHT					I -

NOTE: I => Influence (Opinion Leadership) + => Pro-Adoption Attitude
P => Power 0 => Indifferent, Neutral
** => I/O Processing - => Anti-Adoption Attitude

POWER DISTRIBUTION and SYSTEM ADOPTION ATTITUDE HOSPTIAL C

EXHIBIT 4.11

SELECTION FREQUENCY	SCALE VALUE	ITEM NUMBER	
*	1.62	20.	The system fulfilled few of our goals and some people/departments wish to discontinue its use.
**	3.34	18.	The system fulfilled some of our goals but not all of them.
***	3.51	19.	The system fulfilled most of our goals but caused other problems.
**	3.78	13.	The system fulfilled most of our goals but some people/departments wish to discontinue its use.
***	4.06	3.	The system fulfilled most of our goals, but not all of them.
**	4.39	8.	The system fulfilled our major goals but not some of the minor ones.
**	5.50	21.	The system fulfilled most of our goals and provided other benefits.

NUMBER OF RESPONDENTS = 4
NOTE: The single response for Item #20 reflects an individual group's goals.

ITEM RESPONSE FREQUENCY HOSPITAL C

EXHIBIT 4.12

HOSPITAL C

ITEM RESPONSES

ITEM SCORE	ITEM NUMBER	ASST ADMIN FINANCE	ASST TO PATIENT ACCT MGR	HOSP ADMIN	DATA ENTRY OPER	NURSING REP
Failure		<--stronger----early advocacy-------weaker->				
0.00	11					
0.40	9					
0.75	1					
1.15	7					
1.20	6					
1.57	15					
1.58	10					
1.62	20		+ *			
1.69	14					
1.89	4					
2.20	22					
2.31	12					
2.95	17					
3.34	18	+				+
3.44	23					
3.51	19	+	+			+
3.78	13		+		+	
4.00	16					
4.06	3	+	+			+
4.23	5					
4.39	8	+	+			
5.50	21	+			+	
6.63	2					
Success						
MEDIAN		4.06	3.92		4.64	3.51
MEDIAN OF EXTREMES		4.42	3.01		4.64	3.70

MEDIAN of: COLUMN MEDIANS: 3.99 COLUMN EXTREMES: 4.06

MEAN of: COLUMN MEDIANS: 4.03 COLUMN EXTREMES: 3.94

VARIANCE of: COLUMN MEDIANS: 0.16 COLUMN EXTREMES: 0.41

EXHIBIT 4.13

4.2.6. Hospital "D": Case and Preliminary Analysis

4.2.6.1. The Hospital

Hospital "D" was founded in the 1890's in a city which has since become a suburban appendage to a large metropolitan complex. The current facility was built in the 1940's and was expanded in the 1950's and late 1970's. The most recent expansion brought the bed count to 161 beds. It has an annual operating budget in excess of $9 million and has 360 full-time equivalent employees. Hospital "D" currently competes with three other local hospitals. All four hospitals are general medical and surgical, nonprofit, nonsectarian community hospitals. None of them have tertiary care capabilities. Most relatively complex cases are immediately referred to the tertiary care hospitals in the nearby city without intermediary evaluations at the community hospitals. Hospital "D" has an active outpatient department, but has suspended its inpatient maternity care. Otherwise, Hospital "D" fulfills its role as a community hospital and provides the usual ancillary services to its patients.

In the last few years, Hospital "D" has had approximately 175 physicians on its medical staff. Only one physician is a paid hospital staff member; he is the pathologist. All other medical services are provided through service contracts with various small group practices. Hospital "D"'s patient population has been estimated to be 49,000 people. This is a very gross approximation due to the overlapping territories of the four competing hospital. Its patients' charges are reimbursed as follows: 48% by Medicare, 24% by Blue Cross, 12% by commercial insurance, 12% by Medicaid, and the remainder is self-paid and bad debt.

Traditionally, Hospital "D" has been dominated by its Board of Directors to a degree atypical of similar institutions. The Board's involvement is not reflected in the hospital's rather typical organizational chart. On the chart, the usual array of associate administrators and the medical staff report to the Administrator. In turn, the Administrator reports to the Board. However, the medical staff, as usual, has a dotted line connecting them directly back to the Board of Directors. Although membership on the Board is a unpaid, it is taken very seriously by Board members.

One Board position which was consistently involved in the hospital's day-to-day operations was that of the Treasurer. The Board, in fact, viewed the Treasurer, rather than the Administrator, as the top manager of the hospital. He had a strong influence on the Board and he directly controlled the activity of the Director of finance. Usually, in fact, he ignored the existence of the hospital's Administrator. This rather atypical situation evolved because the top hospital management had not regarded the financial affairs of the hospital as very important; instead, it was oriented toward the hospital's day-to-day operations. The Treasurer disapproved of this lack of financial involvement by the hospital administrative staff, but chose to fill the vacuum himself. His assumption of this responsibility was accepted by the Board of Directors who allowed him to control of the hospital's finances. One other attribute of the Board of Directors is significant; the Board had consistently refused to allow participation by the medical staff in its decisions.

The role of the Board of Directors has been modified in the past half dozen years, however. Approximately six years ago, the hospital's Administrator (described above) retired and was replaced by a relatively young administrator. The new Administrator was determined to increase his control of the organization so that it would be commensurate with his responsibilities. Since then, the Board of Directors' power has decreased in inverse proportion to the Administrator's absorption of control. Concurrently, the nature and composition of the Board began to change. Board membership turnover resulted in a younger group of extremely competent professionals and executives being named to the Board. The new Board members believed that their primary role was to assist in planning, oversight, and management consultation in specific, agreed upon problem areas. The fifteen Board members are still more active in the management of the hospital than most other community hospital boards; however, they have extracted themselves from its day-to-day operations.

4.2.6.2. The Adoption Decision

In the early 1970's, Hospital "D"'s financial systems were entirely manual. The Board of Directors reserved all financial decisions unto themselves. In fact, the Treasurer completely bypassed the Administrator and directly regulated the Controller's activities. At one point, the Treasurer was monitoring all bad debts and personally attempted to collect them in the community. The Board was negotiating all contracts, and the Administrator was only informed when his signature was needed.

In 1971, the Treasurer decided that the financial information available through the existing manual system was insufficient for proper control. At his suggestion the Board hired a consultant to select a computer-based system which would provide the necessary management information to the Board. The consultant investigated hospital operations but made no contact with the Administrator whatsoever. Without consulting any administrative departments within the hospital, he recommended a semi-mechanized system which the Board approved and procured. Implementation of this semi-mechanized system was handled entirely by the consultant and the consultant's personnel. They directly altered the hospital's work procedures in almost all departments without consulting any hospital managers. This led to what was described as "complete pandemonium". The hospital management was naturally quite annoyed that they had no say in the selection or implementation of the system. Hospital workers who were required to prepare the data for the system also reacted adversely. Essentially, they failed to accept the semi-mechanized system; and difficulties with its implementation continued until the day of its removal. Employees resented the fact that they had no say in the change of procedures; they had been comfortable with their old procedures and felt that the new system was more of a detriment than an enhancement. It was during this implementation, which lasted four years, that the Administrator decided to leave the hospital.

Upon his arrival, the new administrator noted that the hospital's financial information was so poor that its auditors took ten months to complete an audit. In a report to management, the auditors specifically addressed the difficulties the hospital was having in carrying out basic transactions associated with securing revenues which resulted from patient encounters. In general, transaction control was so poor that its audit trail was impossible to follow and resulted in information meaningless for management's use in planning and control. When the current Administrator arrived, there were no budgets being developed in the hospital, and the trial balance was only being done at the end of the fiscal year. The Administrator had no valid financial information with which to work. He had to postpone at least one annual meeting in an attempt to get a trial balance so that he would have some financial information to report to the Board. Still, he had no status on account ages, the receivables level, or current expenditures.

It would be unfair to blame the semi-mechanized system for the collapse of the financial system in Hospital "D". The Board of Directors' consultant attempted to implement this system in a manual environment which was characterized by secrecy. The old financial system had been run by the hospital's Controller under the direction of the Treasurer, as noted above. However, the Controller kept no documentation of his accounting systems. All personnel who provided accounting support to him were told to do specific tasks, but were never informed of that task's role in the development of financial information for the hospital, nor in the linkages between various accounting functions. The situation was analagous to the computer programmer who develops a program and refuses to develop its documentation. Essentially, the financial system, while manual, worked, but no one besides the Controller knew how it worked. When a semi-mechanized system was implemented, the Controller did not lend his support to the system. As a result, no one in the hospital knew how to integrate the system into its operating procedure, and the failure of the semi-mechanized system was assured.

The new Administrator attempted to deal with this situation by advising the Board that the semi-mechanized system was entirely inadequate and that the whole financial system of the hospital must be revised if the hospital was to remain solvent. The Board agreed and again hired the same consultant to look into the problem. The consultant reported back to the Board that the semi-mechanized system which he had previously recommended could do anything the Administrator needed done. He recommended continued attempts to integrate the system into the hospital's normal procedures.

The Administrator could not accept this decision. He noted at that point that there were 20,000 active outstanding accounts, and that transaction processing and patient billing were a "nightmare". The Administrator agreed with the accounting firm's assessment that the semi-mechanized system was about to fail and noted the severe strain on the hospital's cash flow. The Administrator recognized that he would have to counter the consultant's influence with the Board if he were to get it to recognize the seriousness of the financial situation. In addressing the Board at an annual meeting, he asked the Board how much they were paying the consultant. No one on the Board knew; however, they estimated it to be approximately $5,000 per year. When the Administrator advised them that the consultant was being paid an average of $35,000 per year, they were shocked. The Board then authorized the Administrator to assume control of the hospital's finances (under the Treasurer's guidance) and to do whatever he thought was necessary to prevent the imminent collapse of the hospital's financial structure. This included authorization to procure an MCSS. It was under these circumstances that the hospital's Controller decided to retire, taking with him any corporate understanding of the hospital's financial systems.

The Administrator recognized that he did not know how to select or implement a system, so he began his search by contacting peers at similar hospitals. He found that most other hospitals used contacts with other peers or consultants to select candidate systems. The Administrator, as the result of his search, identified a system which he recommended to the Board of Directors.

However, the Treasurer would not accept the Administrator's recommendation and decided to reopen the search and select a system himself. The Administrator warned the Treasurer that if he were to select a system the Administrator would not be responsible for its success. Still, the Treasurer decided to continue his investigation of potential systems and after a year decided on the system the hospital was to adopt. His choice was immediately approved by the Board. So, the Administrator was forced to comply with the decision of the Board and took action to implement its decision. He therefore announced to other hospital managers that the MCSS was to be installed.

The announcement was met with unexpected resistance. This resistance stemmed from the fact that the original semi-automated system was never successfully implemented and had generated continuing "nightmares" for the operating departments of the hospital. Various hospital employees felt that another implementation would simply mean more problems and they were unwilling to commit themselves to the adoption of a new system.

However, a potential implementation crisis was averted when the system vendor suddenly announced that it was going out of business. But, this resulted in further chaos within the hospital. As a result, the Treasurer lost credibility with the Board of Directors. It was at this point when the Administrator decided to take control of the whole project, not only of the search. He informed the Board of Directors that either he would assume control of the project, in which case he would be held responsible for its outcome, or they would be responsible for the financial disaster which he documented in the minutes of the Board meeting. The Board had no recourse, since it was returned to ground zero, than to turn the decision over to the Administrator. So, the Board agreed and removed the Treasurer from his position.

The Administrator immediately reopend the search for an MCSS. He was not alone in his search; there were several other hospitals in the same situation. They were the ones previously using the system whose vendor went out of business. Several of these hospitals, including Hospital "D", banded together to achieve a better negotiating stance with any potential vendors. They agreed to a common, gross functional description and proceded to investigate four different systems. Only two of the systems appeared to satisfy all of the hospitals' needs; and the two vendors were invited to present their systems to the hospital group. This process resulted in the ultimate selection of the vendor which appeared to be more sensitive to the hospitals' plight, which agreed to provide the same services as the system it was replacing, and which appeared to be capable of providing implementation support to all of the hospitals simultaneously. One administrator noted that the successful vendor got the contract because, in negotiations, its people could commit to an agreement, while the other vendor's staff had to have all agreements approved by their superiors. He said that one of the unsuccessful vendor's key negotiators was "on a yacht in Biscayne Bay", when he should have been at the major negotiating meeting. The hospital group felt that since the unsuccessful vendor was insufficiently interested in providing decision makers in the negotiating process, then they could not be relied upon to successfully implement the system.

The Administrator decided to adopt the system selected by the group and proceeded with elementary contract negotiations. However, he was able to hire the current Director of finance before initiating a contract. He allowed the new Director of finance to review the system's applicability to the hospital's needs, and turned over the adoption responsibility to the new financial officer. He felt that this responsibility could be safely delegated, since his recent interactions with the Board assured that the Director of finance would have almost a year of noninterference by the Board in which to adopt this system. The new Director of finance decided it was more important to alleviate the current financial disaster than to spend more time optimizing the decisions as to which system to adopt. Therefore, he concurred with the Administrator's choice of MCSSs.

4.2.6.3. The System

The system Hospital "D" chose to adopt was essentially a shared service system which provided the following functions: accounts receivable, patient billing, general ledger, patient census, accounts payable, and payroll. This system requires the use of certain in-house equipment which includes one printing terminal, one disk reader, and two key-to-disk data entry devices. The CPU is located at the vendor's site.

As it was used within Hospital "D", approximately 30 people interacted with the system on a routine basis, and of these, 90% limited their interaction to data preparation and entry. The system required that system-specific procedures be carried out in the various accounting departments; but other areas, such as the nursing units, required minimum modification of their work procedures to satisfy the data requirements of the system. The major change generated in the nursing units was the modification of existing census forms and charge slips.

4.2.6.4. The Implementation

Hospital "D"'s implementation of the financial MCSS, like that of the preceding system, was non-participative and beyond the control of most users. The vendor made a significant attempt to provide implementation support to the hospital; however, hospital users characterized implementation training as insufficient to develop confidence or understanding in the user. The vendor's trainers were, in fact, felt to be insufficiently familiar with the operating characteristics of the system to be suitable as trainers. An analysis of this situation reveals that the vendor's trainers were aware of the global characteristics of the system but were insufficiently experienced in applying the system's capabilities to specific user sites. As a result, the vendor's staff talked in generalities relative to system functions, while users were attempting to speak in terms of concrete applications to specific instances. Hence, there was a complete mismatch in communication between the vendor's trainers and the users. Certain users perceived this communication failure as disinterest on the part of the vendor. Others felt that if the vendor's staff did not understand the system, the system in fact may be too complicated for the users to understand. Still, the users made a strong attempt to learn how to use the system, since for the first time in two decades they were guided by a

Director of finance who helped them understand the intra-relationships of the financial system and its impact on hospital operations. Other users felt that this was no advantage. They were not familiar with the new Director of finance, but had spent numerous years working on the manual financial system. This situation resulted in a number of users wishing to revert to the old manual system and being very hesitant to adopt any new technology.

Regardless of many users' failure to understand the need to change from an ailing mechanical system to an MCSS, the hospital had to rapidly proceed with the implementation. The financial condition of the hospital was extremely serious: it was felt that the hospital would have to start liquidating its capital assets to survive the year. Continued implementation training or further attempts to convince a reluctant staff that a computer-based system was necessary was a luxury the Director of finance could no longer afford. The implementation lasted approximately nine months. The system was implemented by stepwise adoption of functions. The first function implemented was payroll and the next function became operational three months later.

During this time the hospital hired a new Controller. The two new financial staff members were able to generate the energy necessary to adopt the new functions in the various departments. Still they were facing an uphill fight, since numerous clerks and subdepartment heads continued to resist the change. Major resistance to the system centered in three areas: data processing (DP, actually data preparation), patient accounting, and accounting. The key to the difficulties in getting DP's cooperation was the DP supervisor's uncertainty as to whether or not she could master the new technology. She admitted that the implementation of the previously existing semi-mechanized system was so difficult and painful that she lost all enthusiasm for conversion to yet another technology. Her group's participation in the MCSS's implementation rose dramatically and in direct proportion to its understanding of the nature, capabilities, and processing idiosyncracies of the new system. Today they are considered strong system supporters. Like the DP group, the patient accounting section felt that the semi-mechanized system's implementation was a very bad experience and wished to prevent a similar experience in the future. Therefore, its people did not engage themselves in system implementation activities, but essentially were prodded and forced into cooperation against their will. There is still resentment within this group, and it still is not committed to the system's use. Nursing, the third group, has refused to use the MCSS's census system. The previous census system was labor-intensive and its replacement system represented a significant enhancement by reducing a nursing unit's workload in maintaining patient census and condition data. However, the census coordinator has never trusted mechanized systems, contending that the computer system could be in error at any point in time. Hence, she refuses to use it and still maintains a manual census.

Regardless of isolated problems, the system is functional throughout the financial sections of the hospital.

4.2.6.5. Paradigm Fit

Objectives and Rational/Functional Processes

The hospital's goals for the system were the following:

(1) To solve the problems which were the result of the implementation of the semi-mechanized system;

(2) To support timely billing to enable the hospital to achieve its financial recovery;

(3) To deal with the high volume of standard transactions which the hospital was generating; and

(4) To provide improved financial and control information to the hospital management and to the Board of Directors.

In attempting to determine if there were any subdepartmental or individual goals different from the three hospital goals, it was learned that the new Director of finance wanted the system to assist in the education of hospital managers and staff members in the area of financial control and financial planning. He wished them to understand the need to convert to a more efficient financial system so that he would be able to regain control of the in-house financial system. He considered these desires to be major, covert, departmental and individual goals.

Hospital "D"'s adoption of the financial system verifies the existence of hospital implementation goals and reflects that key hospital staff members judge success in light of those hospital goals. In addition to the financial Director's individual goals, some other support was found for the existence of the three strata or goals.

Objectively, all of the goals for which the system was implemented have been, or are in the process of being, fulfilled. Although the hospital will never recover some bad debts, many of which are the result of significantly late billings, the hospitals' receivables are now below the national average. The financial officers are receiving valid and timely information on which to base decisions, and the system is capable of sustaining an increased transaction workload.

Some dysfunction has been observed. DP personnel contend that system down time coincides with periods of the day when they have a high volume of transactions to process. In reality, the hardware outages appear to be limited to two to three hours duration once every four to six weeks. Since input is batched, it is difficult to discern how such outages could be seen as other than minor inconveniences.

Hospital "D"'s adoption of the computer-based information system is somewhat atypical, in that it adopted the system under extreme duress and had little time for implementation planning or testing to determine the system's applicability to their needs. In this situation, one might suspect that the MCSS adoption decision would be made by someone in power and without significant participation. This is true in Hospital"D"'s adoption. Exhibit 4.14 demonstrates that the chief opinion leader and power in the hospital at the time of the system's selection was the individual who selected the system, that is, the Administrator.

Adoption Processes

There is no evidence that a gatekeeper existed within the organization; in fact the evidence indicates that the hospital had no technology gatekeeper at that time. However, the adoption process does fit the adoption paradigm in other ways. One of the key criteria for selecting a system was that it be in successful operation at other facilities whose operating characteristics were similar to Hospital "D"s'. The system's "test" was carried out by the Administrator and his staff via peer review of adopted systems. This test, however, was not universally acceptable; it satisfied the Administrator and the Director of finance; but the Board of Directors was never convinced of the applicability of the system, nor were the various operating departments within the hospital. Some departments definitely matched the paradigm's indication that some groups see the actual implementation of the system as a mere test and not an actual commitment to the system's use.

Political Proceses

Hospital "D"'s MCSS adoption offers very strong evidence for the political paradigm. It is clearly evident in the relationships extant among the financial services, the Administrator's office, and members of the Board of Directors. What is different about this system's implementation is the degree of involvement of the Board of Directors. It is useful to consider the Board of Directors as another operating agent of the hospital, since it was so integrally involved with that hospital's operations. If you look at the Board in this perspective, then their involvement and the interactions which resulted from their involvement show strong evidence of the existence and impact of the political paradigm.

The political bargaining has been described in the case, so it will not be repeated here. However, the political (power) struggle between the administrator and the Treasurer is an obvious example. This process also affected others. When the old Controller realized that he was losing control of his turf, he chose to quit, one of the ultimate political actions. There were other political processes, such as negotiations between finance and nursing for system support, which are not as obvious but nevertheless evident.

Bureaucratic Process

This implementation superficially neither supports nor rejects the bureaucratic paradigm. It was noted, however, that one of the reasons why the change process was particularly difficult was that individuals were used to the rules and regulations and other bureaucratic trappings of the previous systems and were unwilling to depart from those bureaucratic structures. However, this fact is integrally tied into the failure of the change process, thus supporting the existence of the change paradigm and the interrelationship of the paradigm elements. It does not differentiate between the individual's inability to accept the change (and his blaming this on the bureaucratic structure) or the actual effect of the bureaucratic structure itself.

Change Process

The change process' effects are obvious. It was strong for some individuals who chose to resign rather than accept change (e.g., the Controller). It was also exhibited in the early use of the system. Many users did not even fairly consider the MCSS because they had endured the negative effects of a prior change (i.e., the adoption of the semi-mechanized accounting system). When unfreezing mechanisms, such as promised improvements in their work setting, were tried, they were ineffective. No one believed them. Too much prior cognitive dissonance remained. Hence, unfreezing of a majority of users was not possible until the system became operational. Then, it established its own level of credibility and some unfreezing began.

4.2.6.6. Success Level

The financial system is generally seen to have been a success in Hospital "D". However, the perception of the degree of success varies across departments (Exhibits 4.15 and 4.16). The application of the success measure yields the following synopsis of of the implementation's outcome.

> Most agree that the system fulfilled its major goals. It generated other benefits. However, a department (nursing) has refused to use it. Others believe it has caused some problems and wish to discontinue its use.

This view reflects the reality of the situation.

Most staff who were interviewed believe the system to be a moderate to major success. The financial Director believes that it has been a major success simply because it allowed the financial staff to retain knowledge of the system's use, thus depriving the Board of its ability to interfere. Further, he considers the adoption to be a managerial advance because it started to make all managers aware of their role in the hospital's vitality. Similarly, most staff claimed that their view of success was based on their understanding of the system's ability to fulfill its goals (as they understood those goals).

	EXEC DIR	DIR FINANCE	CONTROL	ASST DIR NURSING	DP** COORD
External Management					
PRESIDENT, BOARD OF DIRECTORS	I P +		P +		P +
TREASURER, BOARD OF DIRECTORS	P +	I P +	I P +		
A MEMBER, BOARD OF DIRECTORS	I P +				
Top Management					
EXECUTIVE DIRECTOR	I +	I P +	I P +	I P +	P +
Non-Line Clinicians					
CHIEF, MEDICAL & SURGICAL SERVICES		P 0			
Middle Management					
DIRECTOR, FISCAL SERVICE		I +	I P +		
DIRECTOR, PERSONNEL		I P +	I P +	I +	I 0
DIRECTOR, NURSING		P -	I -	I P 0	
CONTROLLER	I +				
Supervisory Management					
SUPERVISOR & COORD, DATA PROCESS **					I +
Workers					
SECRETARY TO FISCAL SVC DIRECTOR		I 0			

NOTE: I => Influence (Opinion Leadership)
P => Power
** => I/O Processing

\+ => Pro-Adoption Attitude
0 => Indifferent, Neutral
\- => Anti-Adoption Attitude

POWER DISTRIBUTION and SYSTEM ADOPTION ATTITUDE HOSPITAL D

EXHIBIT 4.14

SELECTION FREQUENCY	SCALE VALUE	ITEM NUMBER	
**	3.34	18.	The system fulfilled some of our goals but not all of them.
***	3.44	23.	The system fulfilled most of our goals but some people/departments have declined to use it.
**	3.51	19.	The system fulfilled most of our goals but caused other problems.
**	3.78	13.	The system fulfilled most of our goals but some people/departments wish to discontinue its use.
****	4.06	3.	The system fulfilled most of our goals, but not all of them.
*	4.23	5.	The system fulfilled all of our goals but some people/departments disagree.
***	4.39	8.	The system fulfilled our major goals but not some of the minor ones.
****	5.50	21.	The system fulfilled most of our goals and provided other benefits.
*	6.63	2.	The system fulfilled all of our goals and provided other benefits.

NUMBER OF RESPONDENTS = 5

ITEM RESPONSE FREQUENCY HOSPITAL D

EXHIBIT 4.15

HOSPITAL D

ITEM RESPONSES

ITEM SCORE	ITEM NUMBER	DIR FINANCE	EXEC DIR	CONTROL	ASST DIR NURSING	DP** COORD
Failure		<-stronger----early		advocacy-------		weaker->
0.00	11					
0.40	9					
0.75	1					
1.15	7					
1.20	6					
1.57	15					
1.58	10					
1.62	20					
1.69	14					
1.89	4					
2.20	22					
2.31	12					
2.95	17					
3.34	18				+	+
3.44	23		+		+	+
3.51	19	+	+			
3.78	13	+			+	
4.00	16					
4.06	3	+	+	+		+
4.23	5		+			
4.39	8	+		+		+
5.50	21	+	+	+		+
6.63	2				+	
Success						
MEDIAN		4.06	4.06	4.39	3.61	4.06
MEDIAN OF EXTREMES		4.51	4.47	4.78	3.56	4.42

MEDIAN of: COLUMN MEDIANS: 4.06 COLUMN EXTREMES: 4.47

MEAN of: COLUMN MEDIANS: 4.04 COLUMN EXTREMES: 4.35

VARIANCE of: COLUMN MEDIANS: 0.06 COLUMN EXTREMES: 0.17

EXHIBIT 4.16

4.2.7. Hospital "E": Case and Preliminary Analysis

4.2.7.1. The Hospital

Hospital "E" is a 500 bed institution located in a major city. It was originally founded in the late 1860's as a public health hospital. It remained in the hands of the public health service until acquired by its current parent organization in 1967. Now a private, nonsectarian facility, it is housed in a modern complex which was built between 1971 and 1974. The hospital has been accredited by the Joint Commission on Accreditation of Hospitals. Its cancer program has been approved by the American College of Surgeons, and its residency is approved by the American Medical Association. Further, it is certified for participation in Blue Cross and Medicare. It serves a market segment of approximately 300,000 people, essentially drawing from the confines of its urban environment. About 20% of its care is paid for by commercial insurance; approximately 60% is covered by federal programs such as Medicare and Medicaid; and 20% is private pay, care for the indigent, and bad debts. The facility serves as a teaching hospital and therefore provides a number of tertiary care services. However, it has an extremely large outpatient complex, and primary and secondary care provision is a major part of its activity. Thus, it is a short-term, acute care facility having just under 2,000 individuals on its payroll and an annual expenditure in excess of $53 million. Occupancy runs at approximately 82%. Although the hospital is one of many quality institutions in its city, it enjoys strong ties with the local population.

Since Hospital "E" is associated with a university complex, its management structure is somewhat affected by the management structure and policies of the university. Although separate from the medical center, the Hospital Director reports to the Vice President for Health Affairs of the university. Additionally, numerous medical and surgical services have as their chiefs the chairmen of their analagous medical school departments. Further, there is a medical and dental staff organization whose president has a link to the oversight committee at the level of the university's Vice President for Health Affairs. It is obvious that Hospital "E" has strong domination by individuals trained as health care providers/researchers.

4.2.7.2. The Adoption Decision

Hospital "E" had been involved with MCBISs for most of the last decade. However, in the mid-1970's the system's adoption process was controlled by three individuals: the Hospital Director, the Director of Finance, and the DP

Director. These three, called the "triumvirate" by some of the people in the institution, had noticed that the clinical laboratory offered an interesting possibility for computerization. It dealt in high volume, repetitive transactions that were information-intensive. It was their aim at that point to develop a total hospital information system, subsystem by subsystem. They already had in place a large-scale computer system which, among other things, handled finances and also had CRTs in all of the nursing units. They felt that by automating the laboratory they would be able to start moving into the area of clinical support. Nevertheless, the first efforts at automation in the laboratory, or at least implementing some kind of system support, were somewhat tentative attempts to get the financial charging processes under control. In the mid-1970's the laboratory was charging for approximately $2.5 million worth of laboratory tests per year. The triumvirate, at first, attempted to introduce an optical scanner for charge capturing into the laboratory subunits. However, after a sufficient period of time, it was found that the optical scanner reject rate was too high to provide a reliable alternative to the manual charging system; and it was removed. Their next attempt was to install CRTs from the main system in the laboratory so that charges could be added in real time as the test requests were presented at the laboratory. In the first year of CRT entry, the charges captured jumped from $2.5 million to over $3.5 million. It was felt that most of this increase was not due to increased volume but rather due to the capture of charges which the manual system previously would have lost. This CRT methodology continued until 1978 at which point charge capture had jumped to $8 million per year.

With this increase in data entry activity, the laboratory became dissatisfied with the main hospital system because of its slow response time. In addition, data processing personnel were concerned about the response time degrading the operations of other real time users. The triumvirate informed the Clinical Laboratory (CL) Director that his organization would be the next unit in the hospital that they would attempt to automate. Essentially he was told of this decision rather than being a participant in it. By the time the CL Director was informed of the decision to adopt a laboratory information system, the triumvirate had already initiated a search for potential systems. One of the early systems which reinforced the triumvirate's decision to proceed with laboratory automation was a system developed in another university and adopted by a major vendor as its field developed clinical laboratory information system (LIS). After several site visits this system was rejected for several reasons. The system was too CPU-intensive on a fairly large machine and would therefore not be amenable to loading onto Hospital "E"'s mainframe. Further, it did not provide some of the internal processing support that the triumvirate thought would be useful for the laboratory. Once the CL Director was informed of the decision to adopt an LIS, he entered the decision-making process and began his own search for a system.

Although the system search lasted a full two years, very few systems were identified and tested even at an elementary level. In total, not more than six systems were seriously considered. Two of the systems were rejected before the decision process was completed because their vendors had gone out of business. Another one was dropped because it was far too expensive. The remaining systems were then checked at several levels. First, an attempt was made to determine whether or not they were in successful use at other hospitals. Next, the systems were observed to determine whether they grossly matched Hospital "E"'s lab processing methods. After that, an attempt was made to determine the reliability of the vendor's products, the stability of the vendor's organization, the compatability of the vendor's hardware with the hospital's existing mainframe, the availability of field support for the software and hardware and, finally, a gross estimate of the cost/benefits ratio.

It is interesting to note that throughout the search process the triumvirate and the CL Director were attempting to optimize different things. The CL Director was looking for a system which was a stand-alone turn-key laboratory system, in the "logical application group" sense. On the other hand, the triumvirate was looking not only for an LIS, but for one which could be integrated as a decentralized node of the current mainframe system. Further, the triumvirate was looking for a system which could be expanded in the future and interfaced with other nodes of a total hospital information system. They wanted a system whose tests could be ordered in the nursing units and in other service departments. Test requests would then be processed by the hospital's mainframe, packeted, and shipped as transaction batches to the LIS. The LIS would then process the test requests and eventually return test results to the nursing units through the hospital's mainframe. That this was one of the objectives of the triumvirate was not known to the CL Director until after the adoption process was complete. The CL Director interpreted the triumvirate's reaction to possible systems as a somewhat unnecessary and myopic desire to purchase hardware from the same vendor who installed the mainframe hardware. It is not known whether the triumvirate unsuccessfully attempted to make the clinical CL Director aware of its objectives, or if the triumvirate was retaining system adoption discretion unto itself and was deliberately not informing the CL Director.

Nevertheless, the CL Director did become an ally of the adoption. He reviewed several systems which were visited not only by the triumvirate and him but also by numerous staff members, including the President of the Medical and Dental Staff, the Medical Director, the Hospital Director, and the University Vice President for Health Affairs, and other key personnel. Today all parties claim that the successful vendor was their choice; however, there is some evidence that the successful vendor's selection was a negotiated process. The CL Director stated that he allowed the triumvirate their wish in adopting a system based on hardware manufactured by their mainframe vendor, while they, in turn, had to allow him certain leeway in functional software specification. At any rate, once the decision was made all four members of the selection group backed the decision for their own reasons.

4.2.7.3. The System

The system adopted by the hospital is a fairly typical laboratory information system. Its main functions include patient registration (within the laboratory), ordering laboratory tests, scheduling tests, setting up the internal work flow, result entry (either manually or through direct auto-analyzer to system interfaces), result appendage to the patient's file, and ultimately the reporting of test results through two laboratory line printers. The sub-laboratories which are supported by the system are chemistry, hematology, and serology. In particular, blood bank, pathology and microbiology are not supported by the system. The exception to the manual reporting process is that two CRTs with slave printers are located in the emergency room, and results are generated there upon request.

The system uses proprietary software and runs on a single in-house IBM series 1 system. The system is configured with two disk drives, one tape drive, two line printers, 12 CRTs (two with slave printers), one label printer, and four printing terminals. The CRTs, except for the two located in the emergency room, are used within the clinical laboratory at various work stations. The system is interfaced with an SMA 12, an SMA 6, a Coulter Senior, a Coulter S Plus, and a Lark Differential Counter. However, problems have been encountered with the interfaces to both Coulter machines. The interface with the Senior had been functioning properly but after five months of use it mysteriously started to provide the system with erroneous data. The interface with the Colter S Plus has not been working since its delivery. It is unclear whether the problem lies with the Colter, the interface, or the LIS's software; however, all of the other interfaces seem to be working properly and have provided significant improvements and the capability of the laboratory to process an increasing volume of test requests. The failures of the Colter interfaces have been overcome temporarily by treating both instruments as though the interfaces do not exist.. Laboratory technicians therefore enter test results manually for each of the tests on the two systems' batteries.

4.2.7.4. The Implementation

Planning for the system's implementation was almost nonexistent. That planning which was accomplished was done by the Director of Data Processing (DP) in the area of technical support for the system. One of the negotiated points was that the minicomputer serving the laboratory would be located in the laboratory. Therefore the DP Director centered his efforts on providing technical assistance to the laboratory in the area of implementation. However, the DP Director stated that if he had to repeat the adoption, he would retain control of the hardware because laboratory staff failed to supply it with a proper operating environment. In these statements, the DP Director provided some contradiction which demonstrates that the support he had given the laboratory was either insufficient or not complied with. Indication exists that the former situation is more likely.

Planning by clinical laboratory personnel was restricted to the effort of the CL Director. This, in part, is because the CL Director felt there was no one else within the clinical laboratory who was sufficiently capable of planning for the system's installation. He stated that there were two people whom he could "trust" in the adoption process, but at the time of installation both had just terminated their employment at the hospital (for reasons which had nothing to do with the system's adoption). The clinical laboratory staff only found out about the system's implementation six to seven weeks before it went live. They were not consulted to any significant degree as to how the system should be integrated into their work processes or how their work processes would be affected by the system. As a result, there was a strong feeling of resentment against the CL Director's handling of the implementation process. If the CL Director had had prior implementation experience, perhaps he would have been capable of implementation planning; however, this was not the case. His only planning was for the mandatory conversion tasks (e.g., the system's dictionary development). Apparently no thought was given to system integration into the laboratory, user training, or user cooperation.

Essentially the first four months of active use of the sytem continued in the same vein. The CL Director retained all decision making and expected the laboratory personnel to use the system productively even though its implementation altered the basic mechanisms for carrying out the functions of the laboratory. He made no provisions for consulting the staff or integrating its ideas into solutions for system problems. This had the effect of alienating most of the clinical laboratory staff. Two populations evolved. The first population consisted of those who supported an LIS adoption because of their prior hands-on experience with them at other hospitals. Their behavior consisted of support for the concept, disagreement with the way the implementation was handled, but encouragement of their peers that sooner or later the problems would be worked out. The second group consisted of those laboratory workers who had no experience with an LIS. Since they were not consulted about the system's functions or impacts, they resented the implementation, did not feel that they were responsible for it, and therefore had a "show me" attitude. They felt that if the system worked while not upsetting their prior work style, the system would be fine. However they were not prepared to extend themselves in any way to help insure the successful adoption of the system.

Once the system was brought up, it was tested to some degree. Although the computer system was not used for actual laboratory support, its mock use was parallel with the ongoing manual process. It was during this time that people got most of their training and came to a gross understanding of how the system would affect them. They were able to use the system with fake patient data and learn by trial and error. This experience represented 90% of the training they received before the system went live. Once the CL Director was convinced that the system was acceptable, that is, three weeks after the actual installation, the manual system was dropped entirely and those functional sections of the laboratory which were supported by the system began its full use. However, most of the users of the system were still not fully trained. Even when the parallel processing was occurring and hands-on experience with the system was allowed, many of them, if not most of them, refused to take advantage of the overtime pay provisions to remain and continue training after their daily work had been completed.

The initial operation of the system has been described as a "disaster", even though the same software set was being successfully used at other hospitals. The clinical laboratory staff was completely unprepared to deal with the live system. Problems were minimized, in fact, because the system did not require non-laboratory personnel to change their work methodology. However, even using the same manual systems outside the lab as had previously existed, laboratory personnel managed to lose over 50% of the test results of the first few days' operation. When nursing units attempted to get results, they were invariably told that the test request had never arrived at the lab, that the specimen had never arrived at the lab, that the test request had been lost within the laboratory, that the specimen had been lost within the laboratory, that a test was accomplished but the results had been lost, or that the test results were considered invalid. Obviously, this had a massive impact on the hospital's operation. Not only were physicians unable to base decisions on information they expected to have available, but also the administrative side of the hospital was affected in that 50% of the revenue generated by the hospital during this time period was lost.

Since no one had considered how the system was to be used or how it would affect their operation before the system went live, they were trying to make real time adjustments in their work processes. After the first couple of weeks gross procedures had been reestablished and the loss rate of information was cut down dramatically. Nevertheless, it still averaged 15%. Further, even when the test results did arrive at the nursing unit, ward clerks did not know how to process the cumulative result reports generated by the system. These reports were designed to replace all prior reports associated with the outpatient episode, but quite often physicians would make notes on the old reports. As a result, the nursing staff was afraid to remove the old reports which were to be discarded upon the arrival of the new cumulative reports. Thus, most patients had multiple copies of cumulative reports with practitioner notes scattered throughout them. Physicians did not know that these were not separate reports and had to spend time searching through them to retrieve notes and to figure out which results were most recent. Neither the nursing nor physician staffs were made aware of the proccessing changes which the system brought about. Therefore, they were quite intolerant when operational difficulties were encountered. The physicians would become angry with the nurses, who in turn would become aggravated with the clinical laboratory staff, who in turn considered a "class action suit" against the CL Director. It is not known on what grounds they considered this suit; however, it does testify to their dissatisfaction with their working conditions and the way the implementation was handled. After the first few weeks, the physicians became entirely intolerant with the system and demanded to know why the system was adopted and, since it had generated so many problems, why the manual system was not reinstated. Essentially they were never answered, but the members who comprised the triumvirate and the CL Director had no intention of returning to manual operations and continued to plod ahead with makeshift alterations in their manual procedures. To make matters worse, the system implementation did not alter human nature and when laboratory technicians made mistakes, they were seen by the CL Director as being inexcusable. In several instances he openly admonished clinical laboratory personnel for being stupid, when, in fact, their mistakes were attributable to innocent mistakes or attempts to improvise new work proceedures. Needless to say, clinical laboratory personnel began to resent the CL Director for his insensitivity, as well as his inability to manage the laboratory.

In spite of all these early problems in the system's adoption, there was a critical mass of laboratory technicians who aided the clinical CL Director in developing new processes which eventually led to the system's successful use. With increased success the laboratory personnel experienced a decreasing number of complaints by clinical personnel and had time to respond to their primary task of processing laboratory tests. The system did provide some clerical benefits to the clinical laboratory staff and the nursing unit clerks, once the system's procedural difficulties were eliminated. Over time, the sytem became sufficiently integrated such that most personnel within the clinical laboratory preferred to keep it rather than return to manual processing. It is interesting to note that the CL Director bases his assessment that the system is a moderate success not on its capabilities, but on the fact that complaints against the system have decreased. Throughout the implementation, however, the system's use was made more difficult by frequent system failures. The system software has always performed relatively flawlessly; however, the hardware has experienced a number of problems. At times the minicomputer would fail unexpectedly and would require the implementation of rather labor-intensive recovery procedures. Since its implementation, the system's tape drive, which transfers charges to the hospital's mainframe, has been sporadically inoperative. Further, as noted earlier, two of the auto-analyser interfaces have repeatedly failed. To recover from these failures the staff has had to manually transfer information into the system, significantly increasing the time allocated to the system per unit test. The only other hardware difficulty that the laboratory has experienced has been repeated failure of its line printers. On frequent occasions it had to re-route line printer output onto the prinitng terminals.

4.2.7.5. Paradigm Fit

Objectives and Rational/Functional Processes

The composite goals for the MCSS were:

1) To decrease the incidence of lost test requests and lost specimens;

2) To decrease the incidence of lost results;

3) To decrease the incidence of lost charges;

4) To provide greater control over the test processing procedures within the laboratory; and

5) To provide a clinical laboratory node for an eventual hospital information system.

The hospital's adoption goals vary according to the staff member's position within the organization. However, the composite set reflects the goals of the powerful and influential actors (Exhibit 4.17). As mentioned earlier, the "triumvirate" saw the system's adoption as part of their goals to develop a total hospital information system (goal #5). The CL Director did not share this goal. It should be noted that although the CL Director stated some adoption goals in terms of negatives ("to decrease..."), he attributed the problems which generated this loss of information integrity to factors outside of the clinical laboratory, to chronic hospital problems. One of the biggest problems to the laboratory is that physicians or nursing staffs which transcribe doctors' orders onto test requests generate requests with insufficient demographic data, incomplete patient information, or illegible patient information and test request information for the laboratory to process a specimen even if it is drawn.

The triumvirate was less aware of the fact that the laboratory's ability to handle information and process it correctly is heavily dependent upon the provision of correct information to the laboratory. Therefore, the triumvirate saw the system as helping the laboratory's internal procedures, while the laboratory saw the system as a mechanism to improve the quality of information generated in the nursing units, not in the laboratory. Further, clinical laboratory technicians and nursing unit personnel were essentially unaware of the system's goals.

Clearly, the goals reflect the fact that there existed departmental and individual as well as organizational goals for the system. This fits quite well with the paradigm's forecast.

Adoption Processes

Once the decision was made to adopt a system, the DP manager appeared to have been looked upon as the gatekeeper of information about clinical laboratory systems, although he knew very little of the operation of clinical laboratories. However, in investigating his methodology to gain information about systems, it appears that he not only exercised a peer contact network but also relied on the CL Director as the gatekeeper for information about clinical laboratory systems. In this case, the CL Director had no more information about laboratory systems than did the DP manager, so he in turn relied on his peer contacts at other hospitals. For all of the personnel involved in the search activity, peer contacts were the primary mechanism for gaining information.

The next major source of information was vendor contacts. In this case, those involved indicate that vendors noticed that they were exercising peer contacts to gain information about systems and that the hospital was in the early phases of an adoption. The vendors therefore initiated contact with various staff members within the hospital to try to explain their systems.

Political Process

In this implementation, political activity was relatively obvious. It centered in the early adoption stages of system selection. As mentioned above, various systems were under consideration for adoption. Some were eliminated rather easily (e.g., the two vendors who went out of business before the decision was made). However, the residual offerings in some ways met the triumvirate's goals more than the CL Director's objectives, and for others the inverse case was true. Therefore, both sets of individuals describe a political bargaining process whereby the primary goals of each group were met. However, it is clear from both sides that unless their political goals were met, they would not have conceded to the other group's selection.

In another sense, the very adoption of a system was a political action as seen from the point of view of the CL Director. In this case a system was to be adopted for a clinical function, but the decision was made by managers outside the laboratory. The mechanisms used to gain the CL Director's support for this decision appear to have been a process of political bargaining, although neither side would discuss the contents of this bargaining.

Bureaucratic Process

The bureaucratic structures regulating the work processes in the hospital appear to have had some effect on the early adoption of the system. As mentioned earlier, little or no planning was done to alter perceptions of these rules and, in fact, alter the rules themselves. Therefore, when the system was adopted and did not conform to the prior rules of behavior or rules of processing, the old rules were continued, and met with failure when dealing with the new system. Had sufficient planning been accomplished and new protocol been developed, it is expected that the detrimental impact of the existing bureaucratic processes could have been significantly reduced.

Change Process

In this implementation very little unfreezing occurred. The staff was thrown very rapidly into the change phase, which can be construed to have begun when they were instructed to start training on the system and before it went live with real patient data. There had been no attempt to create dissatisfaction with the prior system. In fact, the computer-based system was implemented at a point when the perceptions of the manual system were at an all-time high. It can be seen that this is related to nursing staff and physician reaction to wish to return to the pre-existing manual system. Further, even after the change there was little effort or recognition of the importance of refreezing, even when clinical laboratory personnel attempted to successfully adapt to the system's processing requirements. If they had made a minor mistake, the CL Director focussed all of the attention on the mistake and none of it on the positive attempt to use the system. Finally, there was no internal laboratory social support for the adoption of the system. The vast majority of individuals had a "show me" attitude toward the system and resented the way the CL Director "forced" the system on them.

4.2.7.6. Success Level

In general, the personnel within the hospital classified the system as a moderate success in spite of the early implementation "nightmare". The use of the success measure gives a synopsis of the adoption (Exhibits 4.18 and 4.19):

> There is significant disagreement on whether the adoption goals were fulfilled by the MCSS. (This is related to a lack of understanding of the

goals.) Those who feel that the major goals were fulfilled recognize the existance of the disagreement. Similarly, people believe that the system generated many additional benefits but some problems. Finally, the system's hardware or software operation has been sporadic.

This synopsis seems to be valid.

Various members of the hospital staff indicated that they would have labeled it a failure had the measure been taken earlier in the implementation phase. This offers support for the concept that the implementation may be perceived at a different level of success depending upon the point in time at which the success level was measured.

Finally, all of those interviewed collapsed their reasons for judging success iinto goal accomplishment. One individual could not verbalize this, but she was doing it nevertheless.

	DIR FINANCE	DIR CLIN LAB	DIR DP	PATIENT SVC MGR	CHEM SUPV
External Management					
VICE PRES, UNIV HEALTH AFFAIRS	I P +	I P +	P +	P +	
VICE PRES, UNIV BUSINESS & FISCAL	I P 0				
Top Management					
HOSPITAL DIRECTOR	I P +	P +	I P +	I P +	I P 0
MEDICAL DIRECTOR	I P +	P 0	I +	I P +	I P +
Non-Line Clinicians					
PRESIDENT, MEDICAL & DENTAL STAFF		I P 0	I 0	I P +	
Middle Management					
CHAIRMAN, MEDICAL DEPARTMENT		I 0		I +	I P 0
CHAIRMAN, PATHOLOGY DEPARTMENT		I 0			
CHAIRMAN, PSYCHIATRIC DEPARTMENT		I +			
DIRECTOR, FINANCIAL SERVICE	I P +	P +	I P +	P +	I P +
DIRECTOR, DATA PROCESSING			I +		
DIRECTOR, NURSING					I P 0
Other					
CHIEF MEDICAL RESIDENT				I +	

NOTE: I => Influence (Opinion Leadership) + => Pro-Adoption Attitude
P => Power 0 => Indifferent, Neutral
- => Anti-Adoption Attitude

POWER DISTRIBUTION and SYSTEM ADOPTION ATTITUDE HOSPITAL E

EXHIBIT 4.17

SELECTION FREQUENCY	SCALE VALUE	ITEM NUMBER	
*	1.20	6.	The system fulfilled few of our goals, and its operation is sporadic.
*	2.31	12.	The system fulfilled few of our goals but provided other benefits.
**	3.34	18.	The system fulfilled some of our goals but not all of them.
*	3.51	19.	The system fulfilled most of our goals but caused other problems.
*	3.78	13.	The system fulfilled most of our goals but some people/departments wish to discontinue its use.
**	4.06	3.	The system fulfilled most of our goals, but not all of them.
*	4.23	5.	The system fulfilled all of our goals but some people/departments disagree.
***	4.39	8.	The system fulfilled our major goals but not some of the minor ones.
***	5.50	21.	The system fulfilled most of our goals and provided other benefits.
*	6.63	2.	The system fulfilled all of our goals and provided other benefits.

NUMBER OF RESPONDENTS = 5

ITEM RESPONSE FREQUENCY   HOSPITAL E

EXHIBIT 4.18

HOSPITAL E

ITEM RESPONSES

ITEM SCORE	ITEM NUMBER	DIR FINANCE	DIR DP	DIR CLIN LAB	CHEM SUPV	PATIENT SVC MGR
Failure		<-stronger	----early	advocacy	-------weaker->	
0.00	11					
0.40	9					
0.75	1					
1.15	7					
1.20	6					+
1.57	15					
1.58	10					
1.62	20					
1.69	14					
1.89	4					
2.20	22					
2.31	12					+
2.95	17					
3.34	18		+			+
3.44	23					
3.51	19				+	
3.78	13			+		
4.00	16					
4.06	3		+	+		
4.23	5	+				
4.39	8		+	+		+
5.50	21		+	+	+	
6.63	2	+				
Success						
MEDIAN		5.43	4.23	4.23	4.50	2.83
MEDIAN OF EXTREMES		5.43	4.42	4.64	4.50	2.80

MEDIAN of: COLUMN MEDIANS: 4.23 COLUMN EXTREMES: 4.50

MEAN of: COLUMN MEDIANS: 4.24 COLUMN EXTREMES: 4.36

VARIANCE of: COLUMN MEDIANS: 0.69 COLUMN EXTREMES: 0.74

EXHIBIT 4.19

4.2.8. Hospital "F": Case and Preliminary Analysis

4.2.8.1. The Hospital

Hospital "F" is a 330-bed nonprofit, nonsectarian, acute care hospital. Founded in 1880 it has been at the same location since then, providing general medical and surgical care to its suburban community. The current hospital is comprised of a main building erected in the early 1930's, expanded by major construction in the early 1970's. It has two medical office buildings which were built in the mid-1960's and the mid-1970's. The hospital is associated with a school of medicine and provides residencies and internships for 27 physicians. It also cooperates with a nearby university in providing training in certain administrative and ancillary care areas (AMA approved). It is accredited by the Joint Commission on Accreditation of Hospitals and certified for participation in Medicare and Blue Cross. The hospital has an operating budget in access of $26 million, and has approximately 1,100 employees. Its patient population size is approximately 150,000. Care payment is provided by a number of sources: 45% comes from Medicare, 30% from Blue Cross, 5% from Medicaid, 5% is self-paid, 10% is commercial insurance, and 5% is all other, including bad debts.

Hospital "F"'s organizational chart is typical for a general medical and surgical hospital. The hospital Administrator has the usual retinue of assistant administrators reporting to him. These include the Nursing Director, the Financial Director, and those directors responsible for operational groups and ancillary departments. The hospital is served by 450 active referral physicians. There are a number of services which are contracted, such as pathology; and other physicians, such as EKG and EEG readers, serve on a fee-for-service basis. Other physicians listed in the organizational chart serve as paid honorary heads of departments. However, the medical staff has a strong, extra-organizational linkage directly to the Board of Directors. There exists a joint trustee and staff committee which oversees many of the policy and managerial issues within the facility. Additionally, physicians are involved with the various administrators in joint study committees on particular topics. Various administrators feel that this joint study committee structure "carries a lot of weight", works fairly well, and effectively deals with the problems for which the committee is formed. Apparently, the Board of Directors does not involve itself to any great degree in the operations of the hospital; rather, it occupies itself with policy development and procedural oversight.

4.2.8.2. The Adoption Decision

The hospital's involvement with the use of MCBISs dates to the very early 1970's. By 1977, three separate shared service systems were in operation within the hospital. The first was a system which handled payroll, billing, and accounts payable; however, it was recognized that certain accounting functions were needed which were not supported by this system. As a result, a general ledger shared system was adopted. Following this the hospital leased a shared inventory control system.

Even though all three systems were managed by the finance department of the hospital, control over these systems was difficult to maintain. Management, as it learned more of the use of these systems, realized that an integrated system would be much more useful. The main financial MCSS seemed to be appropriate for the hospital. However, increasing problems were encountered as the hospital's operations changed. As the hospital evolved in its knowledge of systems and its understanding of their applicability, the hospital found it hard to influence the first shared system vendor to modify existing packages or start developing other applications. To get the vendor interested in system modifications, the hospital had to contact 30 other hospitals that were using the vendor's system and try to sell everyone on the modifications. This was a very difficult task, and usually produced frustration rather than results. For this reason, the hospital's management saw their shared system as insufficiently flexible and overly bureaucratic. The existing shared service system was termed "stagnant". In 1977, the Financial Director, the prime mover in the attempt to replace the three systems, considered developing an in-house staff which would build its own systems. This would provide the Financial Director with the greatest control over the software capabilities. Another possibility was contracting with a vendor which would provide facilities management. The final alternative was to adopt other replacement, shared service systems. Clearly, continuing with the current set of three vendors was no longer a feasible alternative.

The Financial Director initiated a limited search of vendors to identify potential contractors and shed light on the feasibility of the three alternatives. Instead of first deciding on one of the alternatives and then finding the best vendor to match the needs of that alternative, those two subdecisions were integrated. This was done in the belief that an insufficient number of quality vendors existed to to allow the hospital to partition the decision. Five vendors were contacted and presented with the hospital's problems and needs. Four of the five vendors were major, national vendors and were identified by peer contacts and general knowledge. Two of the vendors were major hardware vendors who had developed in-house software and who, incidentally, have since left the medical market. Both of these vendors did not respond satisfactorily to the hospital. The Financial Director indicated that they "clowned around" and were not serious about a potential contract with the hospital. The other two vendors represented major shared service bureaus. After investigation of the functions and the cost, they were perceived as over-priced. The fifth vendor was quite different and was identified in a different way. A field engineer from one of the hospital's MCSS vendors took a new job in an MCSS facilities management firm. Through him, his new company's interest in the hospital was researched. In response, the facilities management vendor reviewed the hospital's needs and indicated that they could meet these needs at a lower price than the hospital was currently paying.

Based on the facts generated from the analysis of these five vendors, the Financial Director concluded that neither he nor the other administrators knew enough about computer systems to manage an in-house undertaking. Further, they felt that other hospitals spent too much money for in-house data processing. These two conceptions led them to feel very insecure about doing the job on their own and led them to reject in-house systems development.

The choice between the service bureaus and the facilities management organization boiled down to an assessment of the vendors' abilities to meet the hospital's unique needs. The two shared service bureaus' common software were insufficiently flexible to meet the needs of the hospital. Therefore, the Financial Director concluded that contracting for facilities management would be the most sensible alternative. The Financial Director presented this alternative to the Hospital Administrator, who agreed with this decision. The hospital then entered into negotiations with the vendor to provide replacement services for the three current shared service vendors and modifications to the vendor's existing common software. One manager noted that this decision was made by the Financial Director and the Hospital Administrator, with no other administrative or clinical involvement whatsoever.

Contract negotiations went well and it was felt that the vendor provided an extremely competitive price for the services. The hospital felt that the vendor was a mature and responsive group with a very good reputation. They felt that the vendor would provide "built-in consultation", and that since this hospital's contract with the vendor was the vendor's first market penetration in the region, the vendor had a "big stake" in doing a good job. They sensed that the vendor wanted this hospital to be a showcase. The contract, however, did not cover all of the things discussed, and one hospital manager noted that numerous gentlemen's agreements were formulated to resolve the differences.

4.2.8.3. The System

The system implemented by the hospital is a vendor-provided in-house hardware and software complex. The vendor provides the service, maintains the software, and has the original equipment vendor maintain the hardware under a facilities management contract. This contract also calls for the vendor to provide operational support of the system within the hospital. Essentially, the system is oriented toward financial and administrative information processing. The in-house hardware includes an IBM System 3 Model 15, with two disk drives, two tape drives, a printer, a card reader/punch, a diskette reader, the console CRT, and one printer terminal. Loaded on the System 3 are the following applications: inpatient and outpatient receivables, accounts payable, general ledger, inventory, plant ledger, payroll, a bad debt module, and a medical record number allocation module. The complex also includes an IBM System 38, with one disk, a printer, seven CRTs, and two printing terminals. The System 38 handles outpatient registration (with batch input from the medical records number allocation subsystem) and is scheduled for additional applications in the future. Outpatient registration is essentially the only online function at the current time. All other functions are batched. Users report that they have had no operational difficulty with the hardware; that is, they perceive that system outages have not interfered with their operational capability. However, it should be noted that this system, even if temporary hardware failures should occur, is essentially immune to major disaster since only the outpatient registration system is online. Essentially, the batch systems serve as a self-backup system. If the system does go down, all that happens is that input is delayed. The core of the system software is common software which is in use in other facilities. However, in some cases the common software has been modified to tailor it to the hospital's needs.

4.2.8.4. The Implementation

The vendor was assigned the responsibility for training. It carried out in-house training which was perceived as being too oriented toward the system and not sufficiently oriented toward the macro-system, that is, the integrated hospital-MCSS combination. Still, by late summer of 1977, the first module, the billing system, was installed and brought up. At first all seemed to be working well; however, it was soon realized that there had been a major mistake. Patients complained of receiving double bills for the same service, which launched a frenzied search to find the cause of this problem. However, it was found to be neither the vendor's nor the hospital's fault; rather, the vendor who was previously handling this function had prepared conversion tapes which proved to be faulty. Since the hospital had terminated the contract with that vendor, there was no recourse and the new vendor had to attempt to resolve the problem unilaterally. This effort proved completely successful. The conversion accounted for activities in the range of $4 million and an a posteriori audit of the process revealed that the accounting was off by only one penny. In the next month the general ledger, payroll, inventory, cost reporting, and several other modules went live. The vendor was completely on time for these implementations; however, the cost of the conversion was turning out to be more than that which the hospital had planned. The conversion plan called for dropping the old vendors when the new system modules were validated. As a result, two vendors' contracts were severed; and at the time the third vendor's contract was to be ended the failure of that vendor's business obviated the need to terminate the contract. Hence, within the period of several months all three prior vendor services were terminated and an almost complete conversion to the new vendor's systems was accomplished.

However, at the operational level things were not proceeding quite as well as top management perceived. Although the limited implementation planning was based on what one manager referred to as "KISS - keep it simple stupid" and the recognition of the need to "make the users happy", some users were not made happy. Many felt the training was inadequate and slowly began to realize that the new system represented a complete change in the way they performed their work, even though the functions were supposed to be similar. As a result, the personnel office and purchasing office opted not to use the system. In particular, they felt that the fiscal division, which had implemented the system, had moved into a position whereby they exerted too great a control over other departments. This was especially true for personnel, which resented the fact that fiscal had control of the payroll. One hospital manager defined this as a turf delineation problem rather than any problem directly related to MCSS technology. This usage impasse was resolved not by negotiation, which was unsuccessfully attempted, but rather by force. Essentially, fiscal had control of the service contract with the old vendors. When fiscal abrogated those contracts, the previously existing MCSSs' support for personnel and purchasing ceased and both departments had to adapt to the new system, as fiscal had desired all along. This, as can be expected, resulted in "anger" on the parts of certain managers in the personnel and purchasing departments. This tactic had been approved by the Fiscal Director, since he sensed that these departments were "used to the old systems" and fearful of any new system. He perceived them to be "stagnant" and "incapable of accepting any change". In this way the fiscal division maintained control of the contract and the MCSS's processing support within the hospital. One fiscal manager stated that this created some "sensitivities" but that the hospital could not tolerate democratic control of an MCSS.

At about the same time, two other problems emerged. Both the pharmacy and the clinical laboratory decided that they also wanted computer-based support. There was an attempt by the financial managers, who had the most experience with computer sysstem vendors, to influence the pharmacy's and clinical laboratory's MCSS selection. However, the Pharmacy Director and the Clinical Laboratory Director had sufficient power over their own affairs so that they entered into independent contracts which finance was forced to accept. The clinical laboratory system never was implemented. As implementation planning was proceeding, the head of the laboratory died and with him died the laboratory's interest in MCBISs. On the other hand, the Pharmacy Director unilaterally identified a pharmacy system and attempted its implementation. This implementation has not gone well. It has been marred by insufficient vendor support and undelivered software modules. However, the Pharmacy Director is satsified with the progress of the system; it was his decision and he wishes to see it to a successful conclusion. However, the Financial Director and his staff are very much concerned that the pharmacy system will ultimately collapse. It is a prototype created by a vendor which has been characterized as a "one-man operation". The Financial Director is concerned about the system for two reasons. First, its collapse would affect the hospital's operational capability, and, secondly, the pharmacy system has a batch diskette interface with the financial system. Essentially, this interface captures pharmacy charge data and transfers it into the billing and receivables modules of the subject system. Financial managers have indicated that since they must rely on the system and since the system is so uncertain, they now feel that they must involve themselves in the review and approval of any other MCBIS procurement.

After the pharmacy system was implemented, the online outpatient registration system from the facilities management vendor was implemented. Staff reaction to this system was very good. Individuals felt that the training program was of sufficient quality and duration and that prior training experiences which were not as successful had contributed to the hospital's and the vendor's training abilities. To the users, one of the most important aspects of the training was that they could use the systems for practice sessions prior to going live. Further, they feel that the system was very well designed and developed so that it matches their needs and expectations.

In general, any staff complaints against the vendor were not considered of major consequence. The early training was not considered adequate. Vendor representatives often resolved issues by saying that things were not possible when, in fact, they were possible to achieve. As the hospital management realized that there are more to implementation costs than the contract reflected, they began to believe that the vendor in effect "low-balled" them. When there were minor difficulties, the vendor constantly referred to the fact that the software was operational in other hospitals. This generated a significant amount of resentment; staff stated that they were "tired of hearing about" the vendor's other hospitals. A general complaint about the vendor was that it performed insufficient analysis to determine if its common software fit the needs of the hospital. The vendor first brought up its unaltered common software and later modified it to meet the hospital's needs by encountering and resolving problems rather than a priori identifying needs. Various hospital staff members felt that vendor support was, in general, sufficient but that there was a time when it was temporarily insufficient in quality and quantity. At that point, a major competitor of the vendor went out of business and the vendor over-extended itself in attempting to gain more business.

A general feeling among the staff members is that they will eventually get all of the functions that they desired. They seem to be approaching the issue of system modification rather maturely. One individual's analysis indicates that the hospital's expectation that the vendor would also be a consultant was essentially naieve. However, this manager does feel that the vendor has an obligation to warn management of possible negative implications of hospital decisions involving the operation or structure of the MCSS.

Still, this generally positive view of the implementation was less positive at the lower operational levels. In fact, at the clerical levels, various individuals felt that their experience "went down the drain" since the new system was far different from the old in its operational characterisitics. They openly voiced complaints that "the system was no good". These complaints were too general. When vendor staff members attempted to understand the problems in order to correct them hospital staff failed to cooperate or be more specific. On the other side of the argument, a number of hospital staff members quit, claiming that their complaints were not being heard. They stated that they were frustrated and would no longer tolerate this work situation. Some remaining staff later said that they were "glad to see them leave". A number of the individuals who quit subsequently unsuccessfully attempted to be rehired.

In spite of the lower level problems in adapting to the system's use, the system has proved effective in meeting the hospital's needs. Further, hospital managers state that it has the flexibility they need for it to grow with the hospital. In this respect, plans are currently being made to convert more of the system to online processing from its current batch mode. The hospital has turned out to be a showcase for the vendor, and various hospital managers, recognizing this, have attempted to use this point to assure that they have gotten the level of service they desired.

4.2.8.5. Paradigm Fit

Objectives and Rational/Functional Processes

The hospital's goals for the system were essentially those of the financial division, since the system primarily dealt with financial issues. Financial managers indicated there were two sets of goals for the system. The short-range goal was to procure a replacement MCSS which would incorporate the three old vendors' functions. There were several qualifications to this goal. The replacement was to be responsive to management's ad hoc information reporting needs. It was to be modifiable. Finally, it was to cost less than the three prior MCSSs. The long-range goal was to provide a base for the development of a total hospital information system, as the vendor's capabilities and the hospital's needs grew.

By definition, the selection of the facilities management vendor achieved several of the short-range goal's qualifications, that is, of integrating the systems and of the economy of dealing with a single contract. Hospital managers claim that the objective of replacing functions has been met. They feel that the functions now provided by the vendor are insufficiently responsive; however, even this shortcoming provides a far better capability than had previously been provided by the three separate vendors. They feel it is too early to determine whether or not the long-range goal of evolving into a total hospital information system can be met. Nevertheless, they feel that their decision was correct.

Adoption Processes

Since the hospital had prior MCSS experience, the adoption paradigms came into play midway; that is, at the level of scanning the environment for potential alternatives. In this respect, the hospital laid out a reasonable set of alternatives. However, it restricted its search to only high visibility vendors. The managers who performed the search indicated that their main source of information was through peer contact and by general pre-existing knowledge that vendors had offerings in certain fields. They relied heavily on peer contacts for the evaluation of the acceptability of various systems. It is difficult to tell whether the search was real or whether it was a cursory check to validate a pre-existing penchant for accepting facilities management as the most reasonable alternative.

The system primarily affected the financial service, and the Financial Director did not attempt to look to other hospital departments for systems knowledge. The Financial Director was his own gatekeeper. However, when his assistant was hired, his information was used in the search and decision process. It appears that the Financial Director has evolved into a gatekeeper for the rest of the organization as well. Even though the politics of the situation indicate that other division managers are reluctant to seek information from the Financial Director because this would represent attributing greater power to him, he nevertheless is a key individual in consideration of the adoption of other systems. Clearly, the Financial Director is a significant influence leader in the organization (Exhibit 4.20). The decision to adopt a radical change in technology and the provision of that technology was unilateral. It appears that the agreement of the Hospital Administrator was merely confirmatory.

Political Process

Political arbitration and considerations were submerged until after the decision process was completed. The decision, in effect, was closed, and knowledge of it was not extant outside the financial division and top management. There was no staff involvement in the decision. Other sections of the hospital were informed rather than allowed to participate. An interviewed representative from the nursing division was completely unaware of the nature, scope, or extent of the change implied by the contract.

Still, when the financial division got the system they desired, some political maneuvering began which assured that the clinical laboratory and the pharmacy also received systems which they desired. The decentralization of power (Exhibit 4.20) allowed each of these ancillary department heads to acquire a system according to their own desires and in spite of the financial division's reservations about the systems' functionality, support, or cost-effectiveness. Clearly, there has been a reaction both within the financial division and outside of it to these events. This may be noted by the fact that the financial division intends to maintain veto power for all future MCBIS adoptions. On the other side, various subdepartments failed to cooperate in the implementation of the subject system, in part because they felt the financial division was gaining too much power over their affairs. These situations represent a fairly clear and straightforward demonstration of the political paradigm.

Bureaucratic Process

The bureaucratic paradigm's effects in the implementation seem to exist primarily at the supervisory management and operations level. Once again, these effects are integrated not only with the political process but also with the change process. In effect, users of the system, whether it be batch or online, recognized that the rules and procedures with which they had become expert were suddenly made invalid and obsolete by the new system.

Although these problems seem to have been overcome, there were individuals who quit, in part, due to the fact that they could not tolerate the change in the procedures with which they were accustomed. The first manifestation of this was in the bureaucratic area; that is, they attempted to disregard the changed procedures required by the system. Often, they attempted to continue using the pre-existing rules which were obviously ineffective under the logic of the new system.

Change Process

As has been mentioned in the preceding two sections, there were difficulties associated with the change the new technology engendered. The individuals who quit cited the incompatibility of the system with their previous processing rules. However, underlying this is the fact that they were not willing to accept the change brought about by the rules which would support the new system.

Nevertheless, there seems to have been general unfreezing in the hospital's staff prior to the adoption of the new system. Various individuals had, for a period of years, felt that the existing situation of having service provided by three separate vendors was satisfying neither the hospital's nor the individual worker's needs. When problems occurred, different vendors had to be contacted and different service representatives required different behavioral responses. For example, one vendor had to be badgered into providing service, while another vendor had to be cajoled into providing service. Hence, most of the individuals who dealt with the systems not only pleasantly anticipated change, but earnestly desired it. The observer should recognize, however, that the population of which we are speaking is very small and is essentially restricted to middle- and upper-level managers. In this respect, the transition was a desired event and the responsiveness of the vendor and the maturity with which the vendor's staff dealt with the hospital staff was seen as positive reinforcement for the decision to bring about the change. Although not all expectations were met, individuals within the hospital feel that most of their expectations, or at least the important ones, have been fulfilled.

There has been an additional source of positive reinforcement or refreezing in this case hospital. Various other hospitals have contacted the hospital's staff members to ask their opinion as to the feasibility of adopting facilities management and common software systems. As a result, the hospital's staff members have come to see themselves as progressive systems experts.

4.2.8.6. Success Level

Essentially, those members of the hospital who were asked to rate the system's level of success indicated that the system worked well and was generally successful. This assessment matches the success measure's outcome (Exhibits 4.21 and 4.22):

> It is almost unanimously agreed that the system fulfilled the major or all of its adoption goals. Further, most agree that the system has provided additional benefits. In spite of this, some people wish to discontinue its use in their departments.

Finally, there was strong agreement that success level should be based on the system's ability to perform in acordance with its goals.

	DIR FINANCE	ASST DIR FINANCE	PATIENT ACCTS MGR	HEAD NURSE	(vendor) DP MGR
External Management					
CHAIRMAN, BOARD OF GOVERNORS	I 0		I P 0	P +	
PRESIDENT, BOARD OF DIRECTORS	P 0				
1st VICE PRESIDENT, BD OF DIRECTORS	P 0				
Top Management					
EXECUTIVE DIRECTOR	P +	I P +	P 0	I P +	
Non-Line Clinicians					
CHAIRMAN, MEDICAL STAFF EXEC COMM				I P 0	
PRESIDENT, MEDICAL STAFF				I 0	
Middle Management					
ASSOCIATE DIRECTOR	P +	I P 0		I P +	
DIRECTOR, FINANCIAL SERVICE		I P +	I P +	I P +	I P +
CONTROLLER					I P +
Supervisory Management					
MANAGER, PATIENT ACCOUNTS					I P 0
MANAGER, PATIENT ADMITTING			I -		

NOTE: I => Influence (Opinion Leadership)
P => Power

+ => Pro-Adoption Attitude
0 => Indifferent, Neutral
- => Anti-Adoption Attitude

POWER DISTRIBUTION and SYSTEM ADOPTION ATTITUDE HOSPITAL F

EXHIBIT 4.20

SELECTION FREQUENCY	SCALE VALUE	ITEM NUMBER	
**	3.34	18.	The system fulfilled some of our goals but not all of them.
*	3.44	23.	The system fulfilled most of our goals but some people/departments have declined to use it.
*	4.06	3.	The system fulfilled most of our goals, but not all of them.
*	4.23	5.	The system fulfilled all of our goals but some people/departments disagree.
***	5.50	21.	The system fulfilled most of our goals and provided other benefits.
*	6.63	2.	The system fulfilled all of our goals and provided other benefits.

NUMBER OF RESPONDENTS = 5

ITEM RESPONSE FREQUENCY HOSPITAL F

EXHIBIT 4.21

HOSPITAL F

ITEM RESPONSES

ITEM SCORE	ITEM NUMBER	ASST DIR FINANCE	DIR FINANCE	PATIENT ACCTS MGR	HEAD NURSE	(vendor) DP MGR
Failure		<-stronger-early		advocacy-weaker->		N/A
0.00	11					
0.40	9					
0.75	1					
1.15	7					
1.20	6					
1.57	15					
1.58	10					
1.62	20					
1.69	14					
1.89	4					
2.20	22					
2.31	12					
2.95	17					
3.34	18			+	+	
3.44	23		+			
3.51	19					
3.78	13					
4.00	16					
4.06	3		+			
4.23	5	+				
4.39	8					
5.50	21		+	+		+
6.63	2	+				
Success						
MEDIAN		5.43	4.06	4.42	3.34	5.50
MEDIAN OF EXTREMES		5.43	4.47	4.42	3.34	5.50

MEDIAN of: COLUMN MEDIANS: 4.42 COLUMN EXTREMES: 4.47

MEAN of: COLUMN MEDIANS: 4.55 COLUMN EXTREMES: 4.63

VARIANCE of: COLUMN MEDIANS: 0.68 COLUMN EXTREMES: 0.63

EXHIBIT 4.22

4.2.9. Hospital "G": Case and Preliminary Analysis

4.2.9.1. The Hospital

Hospital "G" is a 650 bed hospital located at the edge of a small city. The hospital has Joint Commission on Accreditation of Hospitals accreditation and is a teaching hospital with a residency approved by the American Medical Association. It participates in Blue Cross and is certified for participation in the Medicare program. It is a referral hospital in its area and also has active primary and secondary care facilities. The hospital has a direct medical school linkage. As a result, the hospital is one of two entities under the Medical Center, the other component being the medical school. The patient population that Hospital "G" serves is approximately 250,000 people. Its care is reimbursed by the typical methods: 45% is covered by Blue Cross, 23% by Medicare, 15% by Medicaid, 10% by commercial insurance, and the remainder by self-pay, state programs, or is aid to the indigent and bad debts. The hospital, as well as the medical school, is a nonprofit, non-sectarian organization. It is an acute care, general medical and surgical hospital having approximately 2,900 employees and a total annual budget in excess of $71 million. The hospital was established in the mid-1920's and has remained at the same location since then. The current hospital physical complex consists of the older building plus a significant addition and rennovation completed in the mid-1970's.

The hospital's management structure is typical for a medical school related facility. The hospital has two chief executive officers (CEOs), a Medical Director and an Executive Director. The Medical Director is also the Associate Dean of the medical school. Above these two CEOs is the Dean of the medical school, who also serves as Director of the medical center complex. The medical center Director has a number of staff members who would be involved with MCBIS adoptions. Among these are an Associate Director of Finance and an Assistant Director of Computation. Within the hospital, and responsible to the Medical Director and Executive Director, is the typical array of Assistant Directors.

The reporting structure, however, is not reflected by the organizational chart. In reality the Medical Director has the physician staff reporting to him, as well as through the associate administrators for their ancillary or clinical departments. Additionally, the assistant directors (for finance, nursing, etc.) report to the Medical Director rather than the Executive Director. As a result, the Executive Director's power is not as great as that of the Medical Director. This situation has led the medical center Director and his staff to frequently review care delivery, ancillary department functions, and hospital administration. Regardless of this fact, the parent organization of the medical center, the university complex, provides insignificant funding to the medical center; therefore, the hospital is primarily an independent unit responsible for its own financial vitality. The hospital is also operationally independent of the medical school and, to a large degree, from the medical center complex itself. This independence does not interfere with strong cooperation and collaboration among members of the medical school and the hospital staff.

4.2.9.2. The Adoption Decision

As early as 1963, staff members from the hospital had begun discussing the use of MCBISs to assist in the hospital's operation. At that time there was significant discussion about the development of a unique software system to process accounts receivable. However, no action was taken and the next six years saw interest but little activity toward the adoption of any system. In 1969 the Assistant Director of finance in the hospital, as well as several other managers, started to discuss the possibility of adopting a clinical laboratory information system (LIS). The Assistant Director of finance initiated a fund, gradually setting aside monies which would be available for adoption of the system when the system's adoption was decided upon. Following two more years of inactivity, the years 1971-1975 saw the concept of an LIS spurred by several associate administrators within the hospital. They isolated the laboratory function for two reasons: laboratory operations had wide impact on the hospital and they were also highly decentralized. The hospital had numerous uncoordinated sub-laboratories whose operations were structured and seemed amenable to automation.

This managerial interest also led to the development of a committee to investigate the adoption of an LIS. The committee was comprised of the medical school's Chief Pathologist, representatives from bacteriology, chemistry, hematology, the blood bank, and a few of the special laboratories, plus representatives from medical records and pharmacy. The committee initiated a rather limited search for potential vendors in 1972. They looked into four systems, one of which was ultimately the successful vendor. However, they made no decisions until the mid-1970's.

These discussions had the indirect effect of making practitioners and managers within the hospital aware of the need to unify laboratory operations. In the mid-1970's, hospital hierarchy took action to bring laboratory operations under the control of a single individual and a committee was established to hire a Clinical Laboratory

Director who would also serve as the hospital's Chief of Pathology.

In turn, the decision to unify the laboratories under a single clinical laboratory director seemed to be a catalyst for further management activity in the adoption of a system. First, objectives for the system were devised. These objectives led to debate outside the committee itself and, in fact, were not unanimously held even within the committee. Then, a vendor search was initiated. Their selection logic called for the various committee members to advise their constituencies to initiate a search to determine which vendors provided the strongest capabilities in their particular discipline. This decentralized search pattern led clinical sub-laboratories to begin their own negotiations with vendors without coordination with the committee or other laboratories. Finally, the committee was advised of a number of vendors which the sub-laboratories thought to be appropriate. This led the committee to consider five vendors superficially and three more vendors closely, but with no actionable decision. One of the problems was that in early LISs, bacteriology packages were rather primitive. The bacteriology representative wished to delay the selection of a vendor until he could be assured that the vendor would provide a sufficiently flexible and useful bacteriology module. Similar behavior was exhibited by a number of other individuals which significantly frustrated several managers who were trying to advance the adoption process.

Shortly thereafter this committee was issued an ultimatum by the Assistant Director of finance. Since 1971, as was mentioned above, he had been reserving funds for the adoption of a system. He observed that since the objectives had been agreed upon but that the module capabilities were not agreed upon (e.g., microbiology's refusal to adopt a system which did not support its operations according to its wishes) and that since he felt microbiology, as well as several other laboratories, wanted excessively elaborate systems, he sensed that no consensus would be reached. He, therefore, issued an ultimatum to the committee that either it finally select and implement a system within three months or he would take the $400,000 fund and allocate it to other purposes within the hospital.

The ultimatum resulted in the committee's forcing microbiology to re-examine known vendors and to choose a system that appeared to be most useful to its section. Reluctantly microbiology complied, and shortly thereafter the successful vendor was contacted to determine the specifics of providing a system. The vendor agreed to certain modifiactions of the common software package which would make it more useful to the various laboratories in the hospital. The committee perceived that the successful vendor was quite different from others. They sensed that the sales and executive force of the vendor had a desire to implant a system of high quality and which could be used as a future pilot site for the continued development of other modules. This conclusion led to the signing of a contract with the vendor in the late 1970's. Shortly after the contract was signed, the new Clinical Laboratory Director assumed his position.

4.2.9.3. The System

The system adopted by Hospital "G" is an LIS. Its primary components are an admission-registration module for inpatients admitted through the admissions and discharge (A&D) office or through the emergency room (ER). It also has a microbiology component, a phlebotomy module, a chemistry module, a hematology module, and was to have a pharmacy subsystem. The system was provided by an MCSS vendor who wrote minor modifications to the system to meet the hospital's requirements. The system called for the adoption of in-house hardware configuration which is managed by hospital personnel. The system is configured with two minicomputers, 71 CRTs and printer terminals, 2 line printers, 4 disk drives, 1 tape drive, 2 cassette drives, and 6 on-line laboratory instruments. The system has an interface between the two CPUs. Most of the system's terminals are located in the numerous clinical laboratories scattered throughout the hospital. Laboratory test requests require hard copy input to be generated by the nursing units. The information from the hard copy requests is transcribed and entered into the system in the laboratories themselves. The primary use of CRTs outside of the laboratories is in the A&D and ER admissions processes. At the time of the completion of the implementation phase, the system was interfaced with no other system. However, since that time, the laboratory system has been interfaced with a hospital information system. The laboratory system was the first computer-based information system in the laboratories and replaced an entirely manual operation. The system's software remains proprietary and the hardware has been provided under the contract by the original equipment vendor not legally associated with the software provider.

4.2.9.4. The Implementation

Implementation planning by the committee was somewhat meager in that few individuals had previously experienced the adoption of an MCBIS. Competition began between the A&D and the pharmacy to be the first to implement a module. It was sensed that both agencies had significant manual information processing problems but that since A&D

customarily provided the basic demographic data to the rest of the hospital, the admitting component should be installed first. The pharmacy was unhappy about this decision but realized that their time would come and deferred further contention. A year after the contract was signed the admissions-registration module became operational. Further implemention was delayed several months while the hardware and software bugs in the admission-registration package were corrected. The personnel responsible for the implemention's processes were housed within the clinical laboratory structure and were split into two groups. The first group dealt with operational user problems; the second group dealt with the nature of the software. Implementation of the admissions package went very slowly, since they used this module for training not only the admissions personnel but also other future system users. The hospital deferred to the vendor's training mechanism. The vendor advocated cascade-type training; this called for the training of a core group of individuals who in turn would be training others in the future. The implementation process was further slowed by the fact that the manual processes derived to support the LIS did not work well. In fact, in the first year of operation the system claimed 850 patients as being active inpatients, when in fact they had been discharged up to eleven months before.

This delay in the admissions-registration package implementation may have been a benefit in disguise. It allowed the other clinical laboratory sub-sections to work on their subsystems' conversion. For example, if they had not had time to develop their dictionaries, their own implementations would have been delayed. Nevertheless, by late summer microbiology was ready to unilaterally implement its module. It had worked very diligently in preparation and training, so its implementation was essentially smooth. However, the microbiology staff had attempted to introduce too much change too rapidly and were forced to slow the change and reimplement some old manual methods. Microbiology's general success allowed the chemistry and hematology modules to be implemented only a month later. But, the chemistry and hematology systems' implementations were somewhat slow since the LIS's test result reports were not as useful as the pre-existing manual reports. The patient's daily summary was actually a cumulative report; it was too verbose. For example, one patient who had been subjected to intensive laboratory workups had 250 pages generated per day as a result of the cumulative reporting mechanism of the system. The system staff and the clinical laboratory personnel found that after only a month the system's two line printers were almost completely saturated with the reporting workload. This resulted in delays in reporting current laboratory test results and in massive physician displeasure with having to work their way through multiple pages of text to find the current results. In fact, the physicians became quite vocal in their displeasure and the clinical laboratory undertook negotiation with the vendor to modify the report logic. Since the use of chemistry and hematology tests are so pervasive in a hospital, there followed a period of general lack of acceptance of the system by most hospital personnel. The rest of the modules were implemented while the vendor was attempting to fix the report subsystem.

With generally high acceptance for the system's functions (other than report generation) finally the time came to implement the relatively primitive pharmacy module. But the Pharmacy Director had wanted a sophisticated system. Just when the pharmacy subsystem was to be implemented, the Pharmacy Director resigned. Then, his replacement did not want a computer-based system in his pharmacy. Consequently, the pharmacy module was never implemented. Regardless, the hospital has had to continue to pay for the pharmacy subsystem since it contracted for the service. Its implemention is now considered a dead issue because the pharmacy subsystem is too outmoded to be of any operational use.

Throughout the entire process, even when frustration was at its height due to software malfunctions and operational incapacity of the report generating system, the vendor's representatives continued to be very receptive to the hospital's needs, extremely helpful to its staff, and interested in developing a high quality system. Several hospital staff members credit the vendor's responsible attitude and its concern with quality as being the key to the system's eventual success. It should be noted, however, that the general impression of vendor concern was not universally held. There are sub-sections of the clinical laboratory that feel the vendor was less than helpful in their implemention attempt.

4.2.9.5. Paradigm Fit

Objectives and Rational/Functional Processes

Although the selection committee generally agreed upon objectives, those objectives were not known to many of the laboratories or other operating departments. The overall objectives were the following:

(1) To improve the laboratory billing capability by capturing all charges;

(2) To improve information flows to, within, and among the laboratories;

(3) To limit the growth of staffing which would be required if the laboratory had to manually process the anticipated workload increase.

(4) To improve internal laboratory work procedures by improving such mechanisms as workload scheduling;

(5) To derive research databases from patient information; and

(6) To adopt a pharmacy subsystem which would provide improved information processing, charge capture, and workload control.

It was the intent of the adopting committee that these objectives be met through a system which would provide the capability of adding later operational modules without significant interface difficulties.

An outside observer would be correct in noting that most of the objectives have been met by the chosen system; however, as noted above, the pharmacy system was never successfully adopted. Further, it is moot as to whether or not research databases have been provided.

Adoption Processes

It is difficult to discern the point at which a critical mass of individuals felt that the adoption of subsystem modules for admission, pharmacy, and laboratory was not only feasible but was a goal they were determined to attain. The system which was adopted affects the clinical operations of the hospital more so than the administrative operations. In that sense, it follows Allen's (from his presentation at the Harvard Medical School Symposium on Medical Education, 1980) findings that the scientist (in this case the physician) serves as his own technology gatekeeper. This varies with the findings in other hospitals, which also agree with Allen's findings, that the technical manager or engineer will make use of gatekeepers. In this sense, we include laboratory technicians at the managerial level with physicians in having a scientific gatekeeper orientation. The result is that in attempting to select a system, the gatekeeper function of information dissemination was dispersed by the committee of "scientists", so that technical experts in the various functions would be responsible for determining what technological capabilities were available and appropriate in their settings.

The evidence of an influence leader in the selection process did not exist, although definite evidence exists that an influence leader or set of leaders brought about the committee's recognition that a system adoption was an achievable event (Exhibit 4.23). Although the adoption process in this case was quite long and drawn out, the implementation paradigm generally applies. Once the gatekeeper function cascaded down to the individual laboratory level, one of the primary mechanisms for determing the availability and capabilities of systems was through individuals' peer networks. The alternate method was through vendor marketing in clinical journals and at conferences. This forced the testing of choices into the same decentralization. Testing of potential systems was done by peer assessment and by visits to other operating locations which had successfully implemented the systems. There are indications that the testing of the pharmacy system, the admissions-registration subsystem, and possibly the microbiology subsystem was delayed until the system was acquired. In this respect, staff commitment to use these subsystems was not gained before the hospital contracted for them.

Political Process

Political maneuvering was clearly observable in the adoption of the LIS. Initially, the committee was comprised of individuals from pharmacy and medical records in addition to laboratory personnel. The committee, by its very definition, represented individuals whose allegiances were with the departments to which they were professionally tied. As mentioned above, the committee decentralized its functional specification as well as part of its search activities. System functional specifications for a given department were to be determined by that department. These departments attempted to determine the functions they desired by brainstorming and by observing existing systems at other hospitals. Quite naturally this led to the identification by a department of those existing systems which seemed most capable of meeting its needs. When the time came to integrate the findings of the departments, disagreement as to which vendor should be selected broke down according to the system's capability to fill each department's expectations. Had there been one dominant system which was best in all areas, perhaps agreement would have been easier; however that was not the case (especially since diverse agencies such as medical records, A&D, and pharmacy were included in the committee). The ultimate specification of a single vendor represented a system optimization process. However, the departments were sub-optimizing and failed to agree on a system. This problem was reinforced by the fact that the individual departments went out to speak with vendors on their own and without coordinating their activities. The selection of a single system simply was not occurring until the Assistant

Director of finance forced the issue by threatening to withdraw the funds he had been saving for the system's adoption. When he issued his ultimatum, those clinics which had most experience in the functional definition phase seemed to band together for mutual support. They also tended to be the departments with some commonality in desired vendors. When this happened, political difficulties naturally erupted. The committee broke down into three factions: pharmacy, microbiology, and all others. Pulling their combined weight, the group of "all others" was able to force microbiology and pharmacy to accept a system which was suboptimal for those departments. Political bargaining ensued in which the pharmacy, in return for cooperation, was assured that a pharmacy subsystem of suitable quality would be derived from the successful vendor. Similarly, microbiology was assured that it would receive a system which would be ultimately satisfactory. In this bargaining process, the concept of reality of expectations was not discussed. This is unfortunate since those two departments which operated under departmental goals may have specified system capabilities which were unrealistic. It is interesting to note that these two departments were never satisfied by the system.

While the clinical laboratories, pharmacy, and A&D were in a political struggle over the nature of the laboratory system, there was a higher-scale political process occurring. Shortly before the LIS contract was signed, a new medical center Director of Finance was hired. The new Director, in turn, hired several associates with whom he had prior experience. This group determined that the hospital needed to adopt a total hospital information system. It was quite displeased when it learned that the laboratory consortium wished to proceed with the LIS adoption before a total hospital implementation could be operationalized. In this respect, the Director of Finance for the medical center considered the total hospital information system's acquisition to be the macro-system optimization effort, and viewed the LIS's acquisition as a sub-optimization effort. However, the political process remained dominant; the laboratory system was adopted ahead of, and in spite of, the selection of a total hospital information system due to the fact that the combined representatives of the laboratories, pharmacy, and A&D had the greater political weight.

Bureaucratic Process

Bureaucratic processes were not the predominant forces which shaped the implementation. However, the existence of rules and regulations within the departments which adopted or interacted with this system did have an effect on the system implementation. Since the decentralized functional specification approach was taken, each of the departments attempted to identify system characteristics which would produce the least interference with their existing protocols. Clearly, different systems would have been more appropriate or would have had a better match with existing procedures from department to department. It may be seen, then, that this bureaucratic structure of rules, regulations, and reporting relationships was one of the factors which led a department to select a particular vendor. This, in turn, contributed to the departmental sub-optimization tangle discussed previously and which led to the observance of political manipulation and bargaining processes.

Change Process

To a large extent, unfreezing preceded adoption by a period of years. The hospital's teaching and research led to the self-selection of staff members who, by their own admission, are subject to the technological imperative. In this sense, the adoption of a computer-based technology was not only a positive operational change but was also a change which they welcomed at an emotional level. Nevertheless, there were rational unfreezing mechanisms in effect. Hospital staff members came to the realization that having decentralized laboratories within the hospital was counterproductive in both the patient care sense and in the sense of having reasonable operational processes. That this factor led to cognitive dissonance with the status quo is evidenced by the rather smooth adoption of centralized directorship of the laboratories. In fact, the new Clinical Laboratory Director was selected in part because of his positive attitudes toward and experience with LISs. Still, other unfreezing was in evidence. The laboratory technicians had recognized the increasing workload for some time. With the increasing workload, their control over this process was beginning to break down. Charges were being lost and laboratory results, in some cases, were finding their way neither to the medical record nor to the attending physician. When this breakdown occurred, it led to complaints by the physician staff, by medical records, and by hospital management. Trying to backtrack and recover lost information only served to divert their attention even further from their primary tasks. Hence, even at the laboratory technician level there was sufficient unfreezing and readiness for a change to any mechanism which would improve the situation. Further, they too were subject to the technological imperative, since their work was integrally tied to advanced technology.

In Hospital "G" the phases of unfreezing, change, and refreezing were not discrete. While one department continued the unfreezing process another department had not only accomplished the change but was beginning to refreeze. This is true because of the phased implementation of the system. To assist this change process, vendor instructors were supplemented by an in-house training staff primarily derived from the clinical laboratories and the DP section. Essentially, training served the functions of education for process use, unfreezing, and reinforcing the change once it occurred. Hence, department by department, the change process phases were occurring concurrently.

Although the pharmacy and microbiology departments were as unfrozen as other departments before the system was specified, cognitive dissonance occurred when the system to be adopted was identified and when that system was recognized by those two departments as being less than expected. They had been prepared for a change according to the expectations they had internally developed, and the reality of the system was that these expectations would be unmet unless significant software modifications were made. Therefore, externally and internally these departments became dissatisfied with the change, entered the change process, as is the case with microbiology, only under protest that their needs would eventually be satisfied, and in the case of pharmacy did not enter into the change process at all. As a result, refreezing has never been finalized in microbiology, although the system has been successfully integrated into the other units who use its subsystems.

4.2.9.6. Success Level

Most people who were interviewed felt that the system was successful. When asked their reasons for their determination, most indicated that the system did what it was implemented for. The majority gauged success by goal achievement. One manager did not disagree as long as those making the success level determination were aware that hospitals do not always derive appropriate goals. Further, he claimed, they are not sufficiently knowledgeable about systems to make wise decisions.

Application of the success measure (Exhibits 4.24 and 4.25) revealed:

> There is consensus that the system meets all of the major goals which prompted its adoption. A minority disagree. Nevertheless, the system has provided additional benefits in spite of the sporadic operation of some of its components.

This assessment is valid.

	ASST DIR FINANCE	CLIN LAB DIR	NURSE COORD	BLOOD BANK ADMIN	ASST SUPV DP
External Management					
VICE PRES, UNIV TREASURER		P 0			
DEAN & DIRECTOR, UNIV MED CTR	P 0	I P 0			
FINANCE DIRECTOR, UNIV MED CTR	I +				P 0
DIRECTOR, COMPUTING, UNIV MED CTR		I +		I P +	
Top Management					
EXECUTIVE DIRECTOR, MEDICAL	I P +	I P +	I P +		
EXECUTIVE DIRECTOR, ADMINISTRATION	P +	I +	I P +		
Non-Line Clinicians					
CHAIRMAN, EXECUTIVE HOSPITAL COMM	P -		I +		
CHAIRMAN, A MEDICAL DEPARTMENT	P 0	I 0		I P 0	
CHAIRMAN, MICROBIOLOGY LABORATORY				I P +	
Middle Management					
ASST DIRECTOR, FINANCE	I +		P +	I 0	I P +
ASST DIRECTOR, (OTHER)	I +				
DIRECTOR, CLINICAL LABORATORY				I P +	I P +
DIRECTOR, RADIOLOGY			P +		
DIRECTOR, NURSING	I P 0		I P +	P 0	

NOTE: I => Influence (Cpinion Leadership)
P => Power

\+ => Pro-Adoption Attitude
0 => Indifferent, Neutral
\- => Anti-Adoption Attitude

POWER DISTRIBUTION and SYSTEM ADOPTICN ATTITUDE HOSPITAL G

EXHIBIT 4.23

SELECTION FREQUENCY	SCALE VALUE	ITEM NUMBER	
*	3.34	18.	The system fulfilled some of our goals but not all of them.
**	3.51	19.	The system fulfilled most of our goals but caused other problems.
*	3.78	13.	The system fulfilled most of our goals but some people/departments wish to discontinue its use.
*	4.00	16.	The system fulfilled all of our goals but some people/departments wish to discontinue its use.
**	4.06	3.	The system fulfilled most of our goals, but not all of them.
*	4.23	5.	The system fulfilled all of our goals but some people/departments disagree.
***	4.39	8.	The system fulfilled our major goals but not some of the minor ones.
***	5.50	21.	The system fulfilled most of our goals and provided other benefits.
***	6.63	2.	The system fulfilled all of our goals and provided other benefits.

NUMBER OF RESPONDENTS = 5

ITEM RESPONSE FREQUENCY HOSPITAL G

EXHIBIT 4.24

HOSPITAL G

ITEM RESPONSES

ITEM SCORE	ITEM NUMBER	CLIN LAB DIR	ASST DIR FINANCE	ASST SUPV DP	BLOOD BANK ADMIN	NURSE COORD
Failure		<-stronger----	----early	advocacy----	-------	---weaker->
0.00	11					
0.40	9					
0.75	1					
1.15	7					
1.20	6					
1.57	15					
1.58	10					
1.62	20					
1.69	14					
1.89	4					
2.20	22					
2.31	12					
2.95	17					
3.34	18					+
3.44	23					
3.51	19		+			+
3.78	13	+				
4.00	16			+		
4.06	3	+				+
4.23	5		+			
4.39	8	+	+	+		
5.50	21	+	+			+
6.63	2		+	+	+	
Success						
MEDIAN		4.23	4.39	4.39	6.63	3.79
MEDIAN OF EXTREMES		4.64	5.07	5.32	6.63	4.42

MEDIAN of: COLUMN MEDIANS: 4.39 COLUMN EXTREMES: 5.07

MEAN of: COLUMN MEDIANS: 4.69 COLUMN EXTREMES: 5.22

VARIANCE of: COLUMN MEDIANS: 0.99 COLUMN EXTREMES: 0.60

EXHIBIT 4.25

4.2.10. Hospital "H": Case and Preliminary Analysis

4.2.10.1. The Hospital

Hospital "H" is a general medical and surgical hospital located in a suburban area of immediate proximity to a major urban center. In its environment Hospital "H" is considered to be a prestigious institution which is known for its quality of care and consistency of management. It is fully-accredited: its hospital accreditation is by the Joint Commission on Accreditation of Hospitals, its cancer program is approved by the American College of Surgeons, its residency program is approved by the AMA, and it participates in Blue Cross and Medicare. The hospital is located in a rather attractive, fairly modern physical plant which is the result of several expansion projects. The original 200 bed building was completed and occupied in the late 1950's. The total bed count reached 450 through major expansions completed in the early 1970's. Additionally, the projects provided an adjacent professional building with offices for many of the physicians with admitting privileges. However, the hospital predates its current location, having been founded shortly after the turn of the century. It has remained throughout its existence nonprofit and nonsectarian. Although its managers had difficulty characterizing its patient population, it appears to be primarily middle- and upper-middle class patients whose care is paid for by the typical array of insurance mechanisms or is self-funded. The only approximation available was that 30% are Medicare charges. The hospital's annual budget is in excess of $26 million.

The management and structure of Hospital "H" is rather typical of general surgical and medical hospitals. The Administrator reports to the Board of Trustees while technically the medical staff report to him. However, the medical staff has a dotted line connection directly back to the Board of Trustees. Although its organizational chart appears typical, there are several atypical aspects to Hospital "H"'s management. The first is that there has been significant continuity in its managerial approach, which is not surprising considering that since its existence it has had but two Administrators. The current Administrator assumed his position in the mid-1960's. Similarly, there is very low turnover in other management positions, as well as the staff in general. Employees consider the hospital to be progressive and a very satisfactory place in which to work. They appear to feel that management supports their operations and seem quite content with current management-employee interaction.

There are no physicians in management positions. In fact, there are only ten physicians employed by the hospital and half of them are in residencies. Clinical services are provided by approximately 400 local physicians who have admitting privileges to the hospital. Since Hospital "H" is considered a prestigious institution, it has no difficulty in attracting and retaining referral physicians who have been given admitting privileges.

The average age of the hospital's 1300 employees is only 28. At first this might be an indication of high turnover, with younger people replacing more experienced people. However, upon investigation it seems that the low average age of employees is accounted for by the fact that the hospital had expanded its bed size considerably in the last decade. During that expansion the previous employees, that is, those who had experience, were placed in responsible positions and were augmented by the hiring of new employees of low age and low experience. This staffing mechanism was quite successful; the older employees saw their move to more senior positions as a positive career enhancement. So although such an expansion has the potential for numerous personnel problems, none were in evidence.

In general, the management style of the hospital, as characterized by the Administrator, is conservative. Decisions involving major changes, whether they were the expansion of the facility or the adoption of a computer system, were preceded by long periods of study in which the Administrator took positive steps to eliminate haste or unchecked enthusiasm. The Administrator and his managerial staff have very tight control of the management of the organization. Management appears to be very deliberate and when it decides upon a course of action it pursues it in a well-managed but unwaivering way. Complementing this management style is a very good relationship with the medical staff. The staff is provided with all of the facilities it needs to practice quality medicine, and in return has not involved itself with the day- to-day operation or even the tactical planning of the hospital. This relationship was characterized by one manager: "the physicians have complete confidence in the management of the hospital and need not worry about keeping tabs on its progress".

4.2.10.2. The Adoption Decision

In the early 1970's the Administrator became aware of the increasing use of computer-based information systems in competing hospitals. He was made further aware of these activities by members of his Board of Directors who suggested that it would be a good idea if Hospital "H" started looking into the use of these systems. Early interest might be characterized by its competitive nature.

The Board of Directors appeared to have been more interested in investigating and possibly adopting MCBISs because they were a new and exciting technology that others were adopting, and not for valid managerial reasons. They did not understand the capabilities of these systems, how they could be used, or whether their costs were offset by benefits. All they knew was that if other hospitals were getting this technology then it might be wise for Hospital "H" to do likewise so that it would not lose its image of being "progressive" in the community.

Considering his personal knowledge of other hospitals' experiences and his Board's indications of interest in MCBISs, the Administrator hired a consultant to analyze Hospital "H"'s information needs and to determine whether or not MCBISs would be useful for the hospital. The consultant also was to determine a logical adoption course if MCBISs appeared to be useful technology for the hospital. The consultant recommended that the hospital seriously investigate the adoption of MCBISs, at least for administrative and nondiagnostic clinical uses, and that the hospital hire an in-house information systems manager. Consistent with this recommendation the Administrator hired what was then called a Data Processing (DP, now called MIS) Director. The DP Director came from another industry but rapidly adapted to the hospital, its management structure, and its mode of operation. He did his own analysis of the information handling needs of the hospital and forwarded to the Administrator a report which concluded that information processing requirements were about to expand beyond the hospital's capability to manually cope with them. The report urged the adoption of a "total" hospital information system, to be procured from a vendor, rather than building a unique system in-house. Recall that this was occurring just before a major expansion of the hospital. Although the report was well conceived and recommended appropriate action, the massive change it implied, as well as the increased activity in construction and hospital expansion, led the Administrator to table the proposal temporarily. This was consistent with the hospital Administrator's philosophy. He stated that his hospital was "not on the cutting edge of research" and that it was conservative and had no need to be the first to adopt such systems. However, when the DP Director sensed that the proposal would not be acted upon he drew up a second report urging further investigation of the possible adoption of such computer systems. The second report was forwarded to the Administrator at about the same time the additional 200 bed capacity of the hospital was realized. The second report again proposed adoption of a total hospital information system, and it served to spur increased interest in MCBIS adoption. The DP Director believed that his role was one of guidance and leadership for the management staff which had little computer experience. He, therefore, did not rush the decision to adopt; he educated the staff at a controlled rate consistent with the amount of information which they could reasonably assimilate.

The DP Director's second intervention (the second report) was quite timely. It occurred when the hospital management was recognizing that, due to the additional expansion of the hospital, the manual information systems would soon be incapable of providing the hospital with the work processes and management information flows with which it was accustomed. In response to the DP Director's proddings, the Administrator authorized the original system consultants to reanalyze the hospital's information processing needs and to recommend systems which might be appropriate for the hospital. The consultants responded with a small set of vendors' names which the DP Director considered to be inappropriate. In at least one instance the DP Director felt that there were inappropriate connections between one of the vendors and the consultants. Consequently, the Administrator authorized the DP Director to begin a search of existing information systems for those which would potentially meet the hospital's needs. The DP Director screened approximately 20 systems and presented to management several which appeared to be appropriate. Site visits were then scheduled for at least two systems; one a total hospital information system, and the other a portion thereof. As a result of these site visits and further study of available systems, the DP Director chose the total hospital information system as his first choice and the smaller system as his second choice. He recommended that the total hospital information system be adopted as soon as possible. However, the Administrator preferred stepwise adoption of functions in the hospital. His overriding criterion was that the hospital adopt only systems which had a proven success record. Since the total hospital information system recommended by the DP Director had, at that time, only five installations in the United States, the Administrator chose the smaller system. He explained that such a system would be expandable to include future subsystems which may, if needed, ultimately become a total hospital information system. The DP Director stated that the rejection of his first choice was somewhat of a disappointment. However, he understood the rationale of the decision and enthusiastically began further study and consultation in compliance with the hospital Administrator's first choice.

The DP Director's investigation of the smaller system began with a review of the vendors' literature and a site visit to a hospital which had previously implemented the system and which had met with considerable success in its use. The DP Director insisted that representatives from the various user departments participate in the study of the proposed system. He set up a small working group staffed by those in leadership positions in the ancillary departments which would be affected by the system and created the new position of MIS Coordinator for one of the chief nurses of the hospital. Together this team analyzed the system's capabilities as they impacted each of the ancillary departments and the nursing units. The group also participated in site visits to determine whether or not the subsystems affecting their departments would be appropriate for their hospital. The user group, having analyzed the system in vivo, agreed that it would be a good system to adopt. There was dissent, however. The representative from the clinical laboratory recognized that his ancillary department would gain little benefit from adoption of the system, for the system had no laboratory component at that time.

4.2.10.3. The System

The system which the Administrator indicated as his first choice is a vendor provided, common software system which had been implemented in over 200 hospitals in the United States. It consists of a communication subsystem between the nursing units and Admissions and Dispositions (A&D) and other ancillary departments, an admissions, discharge and transfer subsystem, and order entry and management reporting subsystems for all ancillary departments. As part of the order entry communications function, the system charges for orders, credits departments, provides audit verification of internal orders and is capable of forwarding stat results electronically. The proprietary software runs on an in-house minicomputer leased from and maintained by a second vendor, but procured under the MCSS contract. The system's 65 CRTs and 57 printing terminals are located in the nursing units, recovery room, OR, ancillary departments, and computer center. The system will be referred to hereafter as the Communication System. After the Communication System's implementation, a prototype interface to a laboratory information system was installed. The interface is quite successful. It passes test requests and patient demographic information from the communications system to the lab system, and passes test results in the other direction.

4.2.10.4. The Implementation

The DP Director attempted to maintain positive control of the implementation process even before the adoption decision was made. He organized a user group which consisted of approximately 15 people. The members of the user group were chosen so that they represented each of the nursing and ancillary units which would be affected by the system. The people were considered to be opinion leaders within their respective departments. The DP Director recognized that staff training was part of his job. He used the members of the user group as the disciples of the adoption. User group members received elementary training about computer systems and participated heavily in the analysis of the selected system's compatibility with the hospital's needs. All user group members travelled to the implementations of at least two different systems and were charged with determining the appropriateness of each system for their own department's operation. The selection of the Communication System, rather than the total hospital information system, was almost unanimous among the user group members.

The members were allowed the freedom to reconfigure their department's operating processes to facilitate the adoption of the Communication System in any way consistent with continued sucessful operation.

The Communication System was rejected by only the clinical laboratory Technical Director. The Communication System was recognized as providing little support to the clinical laboratory at a time when the clinical laboratory's work processes were expanding more rapidly than those of the other operational departments. Other dissension was generated later by the pharmacy Director when he learned that the pharmacy subsystem seen during the site visit was only a prototype and was not available to be adopted by Hospital "H". The laboratory Technical Director and the pharmacy Director were both individuals whose departments interacted very heavily with the medical staff and who, if dissatisfied with the selection of the Communication System and chose to express dissension, would be easily heard by the Board of Directors. Further, since they communicated with every other department and nursing unit in the hospital, each of these directors could generate dissatisfaction with the adoption of the Communication System. The DP Director and the Administrator recognized the potential for serious difficulties in this case. Therefore, they chose to manage the situation by agreeing that the pharmacy would be allowed to implement the pharmacy subsystem as soon as it was available from the vendor and demonstrated to be successful. The clinical laboratory Technical Director was then authorized to begin a search of existing common software vendors that provided clinical laboratory information systems for a potential system to adopt. It is significant to note that the dissension evidenced by the Directors of the pharmacy and clinical laboratory was not against computer-based information systems, but was because their departments would not be supported by such systems.

The actual implementation was managed and controlled by the DP Director. He decided that the initial use of the system would be restricted to a single pilot nursing unit which was chosen because of its desire to adopt the system. If all went well with the pilot nursing unit for a period of approximately one month, then the other nursing units would begin to use the system. This methodology necessitated the adoption of the system in the ancillary departments when the pilot site went live. Initial use of the system was preceded by very thorough user training, which included hands-on use of the system with dummy patient records for approximately one month before the pilot site implementation. The accessibility of the system for training is credited by the DP Director as significantly improving the acceptance of the system. He indicated that users who were somewhat timid in operating the system were able to play, experiment and make mistakes with it in a nonthreatening environment. This resulted in greater confidence among the users when the system went live in their departments.

The pilot site implementation, as well as use of the system in other departments, was to be a direct cutover from the manual to computer system, rather than parallel processing of both systems. The DP Director felt that fewer resources would be required for direct cutover than parallel processing, and he felt that cutover would force the recognition that the system was to be used on an ongoing basis for productive purposes and was no longer a test system. The pilot nursing unit went into operation with little difficulty. Although the DP Director had provided significant support for the unit, it was found to be essentially unnecessary. The problems which were encountered lasted less than a week and were attributable to operators who were essentially inexperienced with the system, even though their prior training had provided some familiarization. They recognized they were dealing with real patient data for the first time and were somewhat tentative. Additionally, some problems were encountered because of the change in procedures required for the system's use. In spite of these minor problems, the DP Director and the hospital Administrator agreed that the pilot site's successful use of the system was of sufficient magnitude to allow the early cutover of the rest of the hospital. Therefore, two weeks after the pilot site began operating the system, all nursing units began to use it. The experience of the other nursing units paralleled the pilot unit's experience. There were a few problems but, again, these were related to the inexperience of the operators and several minor procedural difficulties.

When the system became operational throughout the hospital, some unexpected difficulties were encountered. Personnel and Central Services became disturbed by the fact that the system increased their information handling workload and provided essentially no benefits. The chief of each section complained that the section was already overworked and could not support the system. Hospital management responded by attempting to educate these departments' staffs about the system's hospital-wide benefits and showing how they would ultimately translate into better working conditions for the Central Services and Personnel staffs. This educational intervention was not too effective, but the problem was resolved when the Administrator allowed the hiring of additional staff to offset some of the workload. The Administrator, however, did not tie new staff hiring to the adoption of the system; rather, he insisted on cooperation and separately indicated that additional support was needed in any case. It became clear to the dissenting staff that they were part of the hospital, would have to cooperate in this hospital effort, and had best be satisfied with any additional staff member they would get out of the deal.

The clinical laboratory Technical Director, with the help of the DP staff, was able to identify a system whose characteristics seem roughly compatible and amenable to interface with the Communication System. The DP Director was able to specify an interface in the contract for both the laboratory system and the Communication System, and although the interface was a prototype, when implemented it seemed to work well. It did generate minor operational difficulties; however, these were overcome without a severe negative impact on either implementation. It should be noted that the implementation of the clinical laboratory information system was essentially independent of the implementation of the Communication System. The clinical laboratory system implementation is still uncertain and the system continues to experience operational difficulties.

Throughout the Communication System's implementation process the hospital experienced no significant hardware or software problems. Participating management staff members were gratified that their strategy was one based on the adoption of systems with a record of proven success.

4.2.10.5. Paradigm Fit

Objectives and Rational/Functional Processes

Interviews with various managers responsible for departments affected by the system generated a set of system objectives which were very consistent across departments. Their goals for the system centered in four areas:

(1) The system was to provide support for the increased flow of information in the hospital when the

expansion of the hospital occurred.

(2) The system was to facilitate the handling of the information flows in a way that would minimize the hiring of additional personnel.

(3) The system was to improve the internal information flow and reduce the incidence of lost or illegible charges or clinical information such as test results.

(4) The system was to improve staff members' job satisfaction. (Satisfaction with the existing manual systems among technicians, clerical staff and clinical staff had become quite low due to the requirement that these people expend an increasingly larger proportion of their time dealing with the creation, manipulation, and retrieval of patient and billing data.)

Various departmental managers expressed other objectives for the system. These other objectives were usually minor in nature, did not detract from the hospitalwide goals indicated above, and reflected personal or departmental issues.

The objectives listed above could be construed as both hospital and departmental objectives. As mentioned earlier, these objectives were consistent; that is, they reflected a shared goal structure across the hospital, its departments, and the individuals within those departments. The fact that this occurred neither supports nor detracts from the implementation paradigm's contention that individual, departmental, and organizational objectives may be inconsistent. (Inconsistency did occur when the hospital objectives no longer applied to the pharmacy and clinical laboratory as explained later.) General agreement may be an indication that objective conflicts are minimized in successful implementations. Another indication that fairly widespread agreement on goals existed, lies in the power, influence, and attitude data collected (Exhibit 4.26). Nine of the twelve individuals listed, positively favored adoption of the system. One of the twelve who was considered powerful by only one person and influential by none was indifferent. Only two other individuals in this category had any indifference score. Only three of the twelve were indicated as being against the change. These were the plant services Administrator, who was concerned with plant modification and wiring workloads, and the pharmacy Director and the clinical laboratory Technical Director. As mentioned earlier, the system's adoption provided little support for those ancillary departments, and each of their directors favored the adopted of a system for his own department. The fact that they were believed to be against the change is related to the fact that they were fearful that if the system was implemented, acquisition of systems for their departments would be delayed indefinitely. Regardless, the system's adoption was opposed by no one who was significantly powerful or influential.

Adoption Processes

Hospital "H"'s adoption of the Communication System was essentially consistent with the integrated implementation paradigm's description of adoption processes. The awareness stage came about due to an individual's awareness of the existence of the technical innovation. This manifested itself in the Administrator being made aware of the increasing use of computer-based information systems in competing hospitals. It seems that the internal need to investigate MCBISs was derived from the fact that respected peers were speaking positively about these systems and that his Directors indicated interest in such systems. He was unaware of the systems' potential utility, and his information was very sketchy. It was for these reasons that the evaluation stage was somewhat formal. The first evaluation step was the hiring of the consultants to determine what the information needs were, how applicable MCBISs were to solving these needs, and what appropriate MCSSs were available. The results of this effort forced another iteration of the investigation of these systems, and that was evinced by the hiring of a DP Director. The DP Director was, at one and the same time, a teacher, a leader, and a coordinator. Although the Hospital Administrator exhibited trust in the consultants and in his own DP Director, he was still uncertain as to the utility of such technology for his organization. This conclusion is indicated because: first, he failed to act on his DP Director's rather comprehensive MCBIS adoption report; second, he responded only after the second report from the DP Director, and; third, he rehired the consultants a second time essentially for the same reason as the first time. There is an indication that the Administrator turned to his peers and members of the Board for validation of the findings of the consultants and the DP Director and that he acted only after a positive response was received.

The trial stage was entered, as the paradigm suggests, on two levels. First, continued evaluation of the use and impact of the system within the facility was carried out on several different sets of combinations of functions. Secondly, site visits to hospitals which had completed system adoptions were made. The Hospital Administrator observed at least two systems, the one that was ultimately adopted and a total hospital information system. These "trials" are consistent with the implementation paradigm. The paradigm predicts such trials in contrast to Rogers' suggestion that the trial stage would result in actual small scale use of the system in order to determine actual utility. The adoption stage's decision to adopt the Communication System seems to have occurred as a result of the Administrator's communication with his peers, the Board, and, it seems, the successful system's vendor. The DP Director was left out of this loop and learned the system was to be adopted only after the decision had been made. The medical staff was deliberately excluded from participation in the implementation. The intent was that the adoption stage be a fait accompli and not a continuation of the trial stage; that is, the system was to be definitely implemented with no room allowed for possible rejection of the system.

Hospital "H"'s case offers some indication of the existence of a gatekeeper and influence leaders. The continued references to peers' knowledge of MCBISs and system adoptions in other hospitals, as well as the leadership role taken on by the DP Director indicate that the Administrator, who ultimately made the adoption decision, relied on these other sources as gatekeepers and influence leaders. That the DP Director was an opinion leader was evident from the responses in Exhibit 4.26. In fact, he was the only hospital staff member to be indicated as being an opinion leader by all of the personnel interviewed. That the Administrator retained the implementation decision unto himself might also be expected from the fact that he was the only individual indicated as having the power to effect change by all of those personnel interviewed. It is also interesting to note that his equivocation and multi-step evaluation stage led to two of the five respondents believing that he was indifferent to the MCSS adoption.

Political Process

That the political paradigm is relevant is indicated by the hospital's response to the clinical laboratory and pharmacy Directors' contention that the system was inappropriate. Although these department heads realized that the system was in the best interest of the hospital, they were still primarily motivated by departmental objectives and only acquiesced to the acquisition of the Communication System when the political deal assuring computer support for their divisions was completed. As indicated earlier, the pharmacy is still awaiting availability of the prototype pharmacy system from the vendor of the Communication System, and the clinical laboratory Technical Director was allowed to procure a system according to his specifications. Once these political issues were resolved, the two department heads provided essentially full cooperation with the implementation of the system. There is further evidence that the clinical laboratory Technical Director and possibly the pharmacy Director had made some statements derogatory to the system to members of the Board of Directors and the physician staff. This behavior also ceased when the directors were assured of acquiring their own systems.

Bureaucratic Process

Hospital "H"'s adoption provides no evidence supporting or conflicting with the political process paradigm. Before the system was used for production support, the user group members and others had developed replacement protocols which worked relatively well. Essentially, they were accomplishing the human factors and system engineering of the macro-system. Their frustration with the pre-existing rules and protocols significantly aided the process and is directly related to the management of change. This case, along with the others, tends to indicate that success level varies inversely with the degree that bureaucratic protocols differ from processes needed implementation process.

Change Process

The implementation of the Communication System in Hospital "H" demonstrates the effect of change paradigm. The statement of the goals for the system by the various managers indicates the unfreezing of prior complacency with manual systems was in evidence before the search began for an MCSS. Staff members were spending increasing amounts of time manipulating information through the manual paperwork system, and were becoming dissatisfied in having to do so. Further, there is evidence of increased loss of charges and poorer flow of information for clinical and managerial decisions. This provided one source of dissonance. Another source was positively managed by the DP Director. In discussing systems, he used the educational interventions mentioned earlier to educate the staff as to the benefits and pitfalls of computer systems. He was able to develop some relatively small scale but very successful in-house systems which demonstrated that MCBISs could be of positive value to the staff members. Further, he involved key staff members in the search and evaluation process so that they could see that manual systems in many cases were inferior to MCBISs, and would therefore develop the internal desire to change. All of this is part of the change process. Additionally, the involvement of the user group in planning for change allowed its members to believe that the system was theirs; they developed pride of ownership. They were involved in the development of new procedures to be used with the computer system and therefore became part of the change process. Again, many of these people, such as the Associate Administrator for patient services, the Associate Administrator for finance, the Associate Administrator for general services, the Nursing Director of and so forth, were indicated in the power and opinion leader derivation as being key members of the staff. Refreezing occurred rather easily because of their involvement. In creating the new procedures, they were able to apply their departmental technical expertise to the design the system's future state. This assured that most of the bugs in the system's support processes would have been worked out prior to implementation. Further, the Administrator had determined that he would only adopt a proven, successful system and this system's in-house hardware was tested before the pilot nursing unit began operation of the system. All of these, in effect, were efforts to assure that the change, once it occurred, would be consistent with staff members' expectations of improved processes and would therefore facilitate refreezing rather than developing new internal dissonance with respect to performance versus expectations.

4.2.10.6. Success Level

Determination of the system's level of success was attempted at several levels. The first deals with the researcher's appraisal; second deals with the manager's appraisal; and the third deals with the application of the interval success scale.

The system's success to the researcher appears to be unqualified. The hardware and software worked according to specifications. The system provided benefits consistent with the objectives of management. The difficulties associated with implementation were managed extremely well.

Hospital managers felt that the system was successful; but when questioned as to what they meant by successful or how they measured success, they had a very difficult time explaining themselves. In many cases the managers described peripheral indications of success and failed to mention that the system performed the functions which it was procured to perform. When this point was made, all of the managers indicated and appeared to believe that the system's fulfillment of its objectives was of primary concern and was assumed; therefore they did not feel the need of mentioning such a basic point. When these managers were asked to complete the system implementation success measure, they were able to do so easily and expressed no discomfort in thinking in terms of goals, benefits and costs in describing the outcome of the implementation. The results of this scale application appear in Exhibits 4.27 and 4.28. They reveal the following adoption synopsis.

> The system satisfied almost all of the major reasons for its adoption. The acquisition of a complete pharmacy subsystem was not viewed as a major objective, but it was a minor objective which was not fulfilled. Thus, some people or departments (pharmacy and clinical laboratory) disagree that all objectives have been met. Nevertheless, the system has provided benefits beyond its objectives.

Overall, the implementation of the Communication System in Hospital "H" appears to the researcher to be one of the most successful implementations of a vendor provided common software system in his experience. The implementation provided substantiation for most of the factors discussed in the unified implementation paradigm. That the systems implementation was successful is reflected in the belief, especially of the DP Director, that the issues discussed in the implementation paradigm were real and must be managed positively if they are to be neutral or positive forces. The staff of Hospital "H" involved with the implementation, planning, and execution achieved success, it appears, primarily due to the fact that they assured that those factors indicated by the implementation paradigm did not emerge as negative factors.

	HOSP ADMIN	ASSOC ADMIN FINANCE	ASSOC ADMIN PAT SVC	DIR MIS	NURSE COORD
Top Management					
HOSPITAL ADMINISTRATOR #	I P +	P 0	P +	I P 0	I P +
Middle Management					
ASSOC ADM, FINANCE	I +	I P +	P 0	I P +	I P +
ASSOC ADM, PATIENT SERVICES	I P +	I P +		I +	I P +
ASSOC ADM, GENERAL SERVICES	I P +		P +		
DIRECTOR, MGT INFORMATION SYSTEMS #	I P +	I P +	I +	I P +	I P +
DIRECTOR, NURSING	P +	P +	I P +	I P +	
ASSOC ADM, PLANT SERVICES				P -	
ASSOC ADM, PERSONNEL			P 0		
Supervisory Management					
DIRECTOR, PHARMACY		I -	I -		
ADMINISTRATOR, MEDICAL RECORDS			I +		P +
CHIEF CLINICAL LAB TECHNICIAN		I -			
ADMINISTRATIVE DIRECTOR, RADIOLOGY			I +		
NURSING COORD, MGT INFO SYSTEMS					I +

NOTE: I => Influence (Opinion Leadership)
P => Power

\+ => Pro-Adoption Attitude
0 => Indifferent, Neutral
\- => Anti-Adoption Attitude

POWER DISTRIBUTION and SYSTEM ADOPTION ATTITUDE HOSPITAL H

EXHIBIT 4.26

SELECTION FREQUENCY	SCALE VALUE	ITEM NUMBER	
*	3.34	18.	The system fulfilled some of our goals but not all of them.
***	4.06	3.	The system fulfilled most of our goals, but not all of them.
*	4.23	5.	The system fulfilled all of our goals but some people/departments disagree.
**	4.39	8.	The system fulfilled our major goals but not some of the minor ones.
**	5.50	21.	The system fulfilled most of our goals and provided other benefits.
**	6.63	2.	The system fulfilled all of our goals and provided other benefits.

NUMBER OF RESPONDENTS = 5

ITEM RESPONSE FREQUENCY HOSPITAL H

EXHIBIT 4.27

HOSPITAL H

ITEM RESPONSES

ITEM SCORE	ITEM NUMBER	HOSP ADMIN	ASSOC ADMIN FINANCE	DIR MIS	NURSE COORD	ASSOC ADMIN PAT SVC
Failure		<-stronger	----early	advocacy	-------	weaker->
0.00	11					
0.40	9					
0.75	1					
1.15	7					
1.20	6					
1.57	15					
1.58	10					
1.62	20					
1.69	14					
1.89	4					
2.20	22					
2.31	12					
2.95	17					
3.34	18					+
3.44	23					
3.51	19					
3.78	13					
4.00	16					
4.06	3			+	+	+
4.23	5					+
4.39	8			+		+
5.50	21	+			+	
6.63	2	+	+			
Success						
MEDIAN		6.07	6.63	4.23	4.78	4.15
MEDIAN OF EXTREMES		6.07	6.63	4.23	4.78	3.87

MEDIAN of: COLUMN MEDIANS: 4.78 COLUMN EXTREMES: 4.78

MEAN of: COLUMN MEDIANS: 5.17 COLUMN EXTREMES: 5.12

VARIANCE of: COLUMN MEDIANS: 1.00 COLUMN EXTREMES: 1.13

EXHIBIT 4.28

4.3. FURTHER ANALYSIS OF THE EXPLORATORY RESEARCH

4.3.1. The Success Measure

A priori, three points were to be tested:

Test #1: Do hospital decision makers, when actually determining the outcome of a decision to adopt or retain an MCSS, base decisions, to a large degree, upon the goals (goals, objectives, reasons) the system is to fulfill?

Test #2: Does the use of the scale provide a reasonable measure of success level? Does the success level derived from the scale's use correspond to reality?

Test #3: Does the use of the scale provide additional insight into the dynamics of the implementation?

4.3.1.1. Test #1

Virtually all of the decision makers interviewed claimed to have taken objectives into account when adoption and system retention decisions were made. However, such a response may be a "socially desirable" answer and is of unknown validity.

A more important indicator that they do consider objectives came from peripheral questions. Most of those interviewed would frequently defend or explain actions via arguments which would relate the decision to objectives as well to as other considerations. In fact, objectives do appear to be considered in their decision making processes. Of the key decision makers interviewed at the case hospitals, 82% argued that success level should be related to objectives. Typical responses were:

"...based on why we bought the system"

"It works - it meets our objectives"

"...served the purpose it was devised for"

"...should be tied to goals"

"...have to have some kind of goals in mind to measure it"

"It did what they wanted"

The 18% who did not explain their concept of success in terms of objectives tended to be unable to explain how they decided whether or not something was successful. For example, one person responded: "I don't know what success is". As they thought more, they usually explained their concept in terms of individual or departmental objectives, not considering them as objectives since they were not the organizational objectives.

The value of objectives as decision benchmarks is decreased in a number of ways. First, the case research revealed that hospitals' objectives tend to be global. Often, they are so non-specific (e.g., "to acquire a financial system") that they are not useful guides for specific action. Second, decision makers have not advanced far along the MCSS learning curve before implementation. However, early implementation experience educates them very rapidly. As a result, objectives evolve into more sophisticated and realistic goals during the course of the adoption. Frequently, this occurs without the decision maker's realization because original system objectives are seldom recorded. Third, characteristics of the objectives are seldom measured. Without pre- and post-implementation measurement of the relevant factors, the magnitude and, in some cases, the direction of any change is uncertain. Hence, managers seldom know to what degree the objective is (or is not) met. This is further complicated by the fact that implementations are often consciousness raising events. The system may make people aware of problems that they had previously ignored. Often the system is criticised as making the situation worse (not meeting objectives), when in fact, it has improved the situation (has partially or fully met objectives). For example, one objective for a clinical laboratory information system was to improve test result reporting. During its implementation, physicians demanded that the system be removed. They claimed to have measured the result loss rate at 10-12%. The hospital management, at first, thought this demonstrated that the system was not fulfilling its objectives. Fortunately, a rare event had occurred prior to the implementation; the DP Manager had measured the result loss rate and found it to be 23%. Hence, a system retention iecision would have been based on objectives, but wculd have been wrong without proper measurement.

Nevertheless, these problems with objectives are peripheral problems. They are problems of implementing and assessing the results of objective-based decisions. They do not diminish the validity of basing decisions on objectives. This is a consideration with which most of those interviewed tended to agree.

4.3.1.2. Test #2

The success level measure developed in Section 4.2.1. was administered in each of the eight case hospitals to a total of 40 people. An individual completed the measure by simply marking all of the statements that the individual believed to be generally true. This was preceded by an explanation of the terms found in the statements (the same definitions used in creating the scale). No respondent had difficulty in completing the form. Every respondent marked at least one statement.

The researcher's analysis of each case would have led to approximately the same responses as the respondents marked. This indicates the existence of a logical correlation between an experienced, unbiased researcher's observations and implementation participants' conclusions about a system, as revealed through the success level measure. Hence, at a first approximation, the success level measure may be used by either implementation participants or outside observers to generate a success level measurement for a hospital.

A second logical test of the success level measure is the comparison of a success level ordering of the hospitals, based on their derived scale values, with the researcher's ordering, based on the case research. The researcher's assessment of the implementations' success levels are reflected in the ordering of the cases. Based on a summary of each case, the cases were ordered from the lowest success level case to the highest and labeled from "A" to "H", respectively. Obviously, this reflects subjective interpretation. The ordering was not obvious. It was felt that since these systems are all operational, none should be rated below 2.0 on the success level scale (scale range: 0.0 to 6.63). The choice of hospitals "A" and "B" at the lower end; "C", "D", and "E" in the middle; and "F", "G", and "H" at the higher end was fairly clear. That "H" was the most successful was also clear. However, the other relative positions within groups was moot; this is especially true for "C", "D", and "E". Had the Financial Director's hidden objective for Hospital "D"'s system been generally known, it should have been ranked as more successful.

The success level scale values were generated by four methods:

(1) Method "a": calculating the median of the respondents' median responses;

(2) Method "b": calculating the median of the respondents' median of extreme responses;

(3) Method "c": calculating the mean of the respondents' median responses;

(4) Method "d": calculating the mean of the

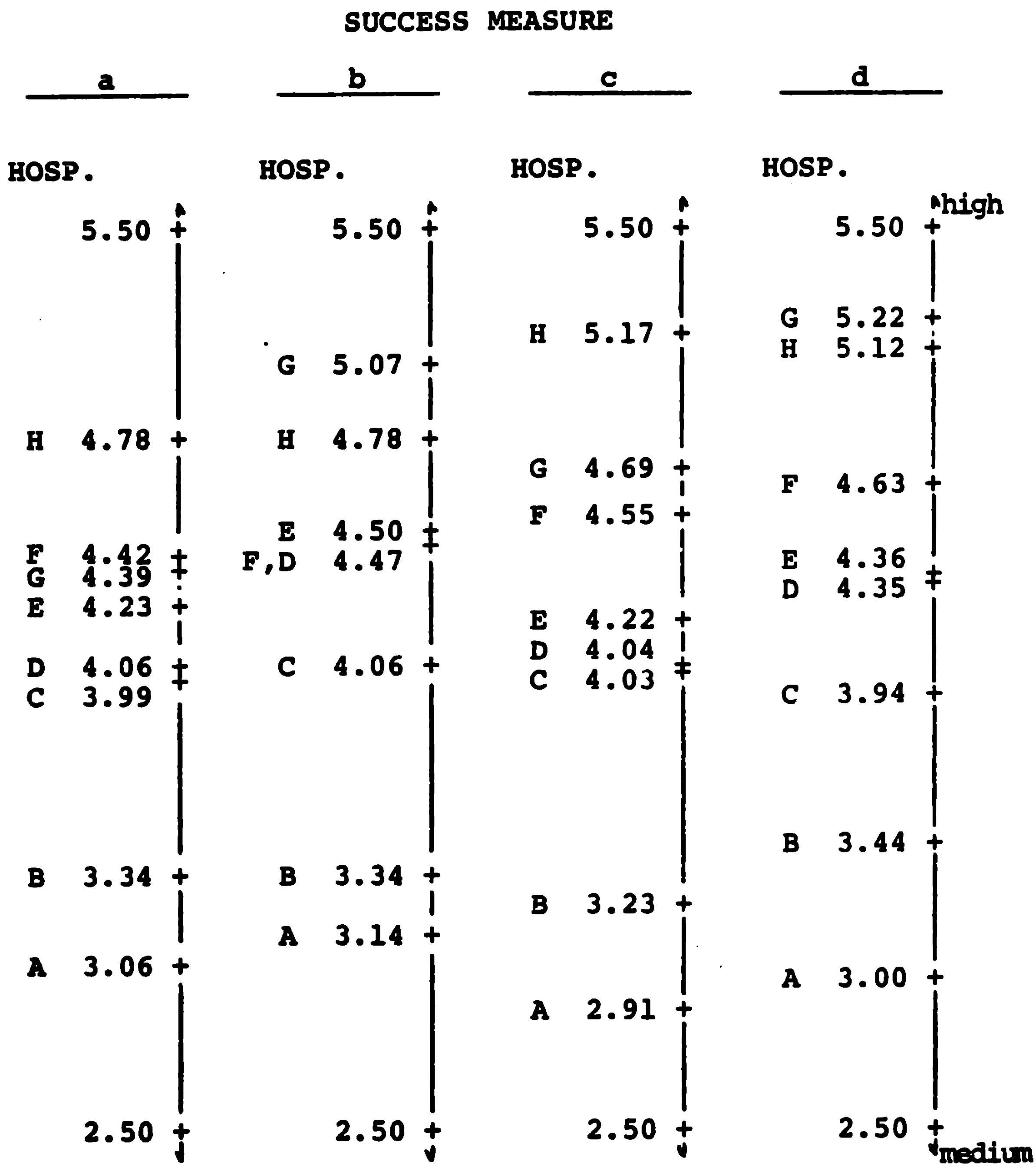
respondents' median of extreme responses.

Plots of the results appear in Figure 4.5. Method "c" most accurately reflects the researcher's ordering. Further, it provides reasonable dispersion between the three groupings and especially between "G" and "H". Another attractive attribute of Method "c" is that it is the method which allows weighting of the respondents. However, since weights may be site dependent, we have defaulted in setting weights (which is equivalent to setting all weights equal to unity). The default weight of unity is not illogical. The individuals in upper management positions have decision power, but those in lower positions may represent a larger population, thus balancing the respondents. In any event, Method "c" would be the choice for further use of the success measure.

These factors and logical tests indicate that the scale appears to match reality quite well.

4.3.1.3. Test #3

The scale's utility and applicability for its intended purpose has been demonstrated. However, the experimental use of the scale has revealed that it has several



Where: a ≡ Median of Column Medians

b ≡ Median of Column Medians of Extremes

c ≡ Mean of Column Medians

d ≡ Mean of Column Medians of Extremes

Note: Derived scale ranges from 0.00 (relative failure) to 6.63 (relative success).

FIGURE 4.5

additional uses.

In developing the cases, some people would not inform the researcher of certain points of concern (e.g., the MCSS implementation caused several staff members to quit their jobs). Whether this was by design or accidental omission is unclear. However, these people would check off statements indicating staff disagreement with goal fulfillment. This alerted the researcher to pursue a line of questioning which provided a more complete and unbiased view of the implementation events.

Administering the scale measure to individuals from different organizational strata usually resulted in non-homogeneous responses. These response differences were useful in determining the different individuals' (and stratas') understanding of a host of things ranging from actual implementation events and staff beliefs to the communication of objectives, etc.

The fact that attitudes and beliefs are revealed through the use of the scale measure indicates that the scale could be used throughout the adoption process to diagnose problems and to identify groups which may benefit from training, communication or other interventions. Before the implementation, it may reveal expectation;

afterward, it may reveal beliefs, attitudes, and expectations. Therefore, the scale could be easily converted into a diagnostic tool useful for improving the implementation's probability of success.

Finally, the test of the scale measure in the cases indicates that all implementations vary in perceived success level over time, and that this shift in level is important in understanding and intervening in the dynamics of the implementation. This necessitates that the researcher have a way to determine these levels longitudinally. Fortunately, the scale measure is quite capable of being used for this purpose.

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4.3.2. The Adoption Paradigm

The paradigm's global arguments are:

(1) that the Human Factors Engineering view of MCSS implementation, that the hardware/software system, human users, and operational environments are inseparable components of the actual "system", is valid and useful; and

(2) that existing research, knowledge, and paradigms in diverse fields, if unified into a cohesive paradigm, are useful in explaining MCSS adoption events.

The exploratory research offers evidence to support both arguments.

4.3.2.1. The Human Factors Engineering Perspective

Almost all of the case hospitals failed to implement their systems with sufficient thought for the users' reactions or for operating environment redesign. Hospital "H" is atypical. It may not have realized the full implications of human factors tenets but approximated those concepts by involving users in designing the processes which would complement the MCSS. In fact, they were relatively careful not to exclude consideration of the human users. This was consistent with the fact that their fourth objective was to improve employee job satisfaction.

To varying degrees, the other hospitals acted as though the introduction of an MCSS was akin to substituting a mechanical pencil for a clerk's lead pencil. They acted as though the new technology would engender little or no change in interpersonal relationships or work processes. While the amount of such change is dependent on the fit of MCSS and pre-existing organizational characteristics, for the class of systems discussed here, change is inevitable.

The case of Hospital "A" offers an interesting contrast within a single implementation. Having failed to manage the MCSS's integration into the outpatient setting, some of the staff undertook a massive effort to properly prepare for the inpatient subsystem's introduction. This led them to consider how the system would and should affect the operational environment and vice versa. As a drect result of their altered outlook and actions, the inpatient subsystem's implementation was a marked improvement over their outpatient subsystem experience.

Evidence indicates that most vendors behave as product sales organizations rather than service organizations. This does not imply that the vendor is not concerned with the successful use of the system. In fact, one of the vendors studied in this research has a history of refusing to lease its system to hospitals which it deems incapable of successfully adopting its MCSSs. Rather, it demonstrates that most vendors do not believe that their responsibility extends to providing general systems education to hospitals. They feel that the hospital should understand the implications of system adoption. Hospital management should be capable of specifying needed system capabilities as well as knowing how to prepare the hospital, its people, and its work processes for the introduction of sophisticated new technology. Hence, the typical type of vendor-provided training should be all that is needed to assure the linkage between the prepared adoption setting and productive MCSS use. Their view is that the hospital's management should be intelligent adopters and, therefore, it would be inappropriate for vendor field engineers to cause the alteration of the hospital's internal operation. (It should be noted that this characterization of vendors' views varies in applicability among vendors. One vendor studied in this research (the facilities management group) will provide consultation and unique software modification to fill the void caused by hospital inexperience.)

One major problem syndrome (further discussed in Section 4.3.3.2.) which has emerged is that hospital staff do not share the vendors' view. No hospital in this study performed other than superficial functional analysis before selecting a system. Most relied on the vendor to tell them how to implement the system and to provide the majority of user training. Only the more sophisticated management staffs augmented training, provided hands-on user experiences before cutover, or redesigned their work processes. The vast majority of managers interviewed stated that they thought the vendor would provide free consultation for internal process redesign when the implementation occurred.

Hence, in many hospitals, the vital need to redesign the work environment and account for interpersonal relationships, reward structures, power structures, and so forth, is unmet. These activities are falling through the cracks between vendors' notions of responsibility and hospitals' expectations. Each group expects the other to perform this function. Finally, the level of success achieved by an MCSS has been shown to vary directly with the degree to which the human factor engineering of the implementation occurs.

4.3.2.2. The Unified Paradigm

The case discussions (Sections 4.2.3. to 4.2.10.) provided the raw data and preliminary determinations of the applicability of paradigm elements. Hence, this information will not be repeated here. Rather, each of the hypothesized characteristics will be given a gross indicator representing the degree of support that the cases have revealed. These indices are:

(1) Strongly Supported

(2) Moderately Supported

(3) Weakly Supported

(4) Not Supported

(5) Contradicted

The indices will be followed by qualifications revealed through the research.

H1: Hospital and Vendor personnel refer to each other as monolithic actors.

Strongly Supported. This was generally the case unless specific incidents were being related. Both vendor and hospital staffs tended to pool complex events and describe them in simplistic statements which referred to the other organization in monolithic terms. However, vendor personnel used specific, personnel references more than hospital personnel.

H2: Hospital-wide objectives exist and are rational, based on system objectives (overt and/or covert), and the limited knowledge of the staff.

Strongly Supported. Even when the "prime mover" had resigned, hospital-wide objectives were known to upper level managers and these were relatively consistent among managers. Without exception, these objectives were rational for the organization. This does not mean that they were always correct or feasible, but they were reasonable considering the information base and expertise of the key managers who developed them. Several cases revealed rational, covert objectives.

H3: Individual and departmental objectives exist and are rational, based on individual objectives (overt and/or covert), and the limited knowledge of the staff.

Strongly supported. Most of the cases revealed the existence of individual or departmental objectives. These, too, were rational based on the understanding of the individual or department. The fact that no irrational objectives were uncovered does not deny their existence. They may have existed but the respondent did not reveal them for any number of reasons including the possibility that experience has altered the manager's perception of their validity.

H4: Individual, departmental and organizational objectives may be inconsistent with each other.

Moderately supported. Several sets of divergent objectives existed in the case hospitals. However, their inconsistency was often time dependent. For example, at the outset of the adoption, a departmental desire to acquire a clinical laboratory information system was not inconsistent with overall hospital objectives. Such a system would improve the quality of the information flow through the clinical laboratory. However, when investigation of the MCSS revealed that a system should be procured which did not have a laboratory subsystem, the laboratory's objective caused the laboratory to fail to support the organizational objective, leading to actions inconsistent with optimization of organizational objectives.

H5: The amount and quality of implementation planning varies directly with the MCBIS-related knowledge and experience of the adoption's key hospital participants.

Strongly supported. Those hospitals which had and exploited their MCBIS-related knowledge and experience tended to do more planning of higher quality (e.g., it was realistic and appropriate). This activity resulted in improved implementation. Refer to Section 4.2.3. for a comparison of this effect on individual modules of a single implementation.

H6: The median level of MCBIS-related knowledge and experience of the adoption's key hospital participants is low.

Moderately supported. This would probably be strongly supported if non-surviving adoptions were also examined. Nevertheless, most individuals demonstrated a poor understanding of MCSS impacts and a lack of knowledge of system factors which could impact the MCSS and hospital. For example, few managers had heard of - much less understood - backup procedures, communication issues, throughput, etc. The obvious exceptions were in those hospitals which had hired individuals with MCSS implementation experience, or information systems specialists. In the former case, the knowledge tended to remain only with the experienced individual; in the latter, the systems person usually attempted to transfer subsets of his knowledge.

H7: Most adopters consider only a small set of potential vendors.

Strongly supported. For hospitals "A" through "H" the total numbers of systems considered and the number of systems finally considered were:

Hospital	A	B	C	D	E	F	G	H
# Considered	4	6	3	6	5	5	6	20
# Finally Considered	2	1	2	4	3	1	3	3

Hospital "H", the exception, initiated three structured searches, two carried out by consultants, one by the DP Manager.

H8: System selection is based on objective-satisficing rather than objective-maximizing behavior (e.g., a reasonably "better" system is chosen from a small search set).

Strongly supported. That small search sets are used has already been demonstrated. Decision makers consistently, with the exception of Hospital "H", carried out their search until a satisfactory system emerged. They then ceased the search which may have revealed another system more capable of maximizing their objectives. However, two of the case hospitals were under adoption time constraints which may have altered their behavior. (Although the researcher feels that this may have caused only marginal behavioral change.)

H9: The hospital's departments do not exhibit consistent monolithic actor behavior. They frequently exhibit sub-optimizing behavior, a portion of which is departmental optimization.

Moderately supported. Departments are definitely revealed as separate actors. Sub-optimizing behavior was demonstrated in several cases in which individuals or departments did not fully support the organization's objectives or decisions and acted in accordance with their own desires (individual objectives) or those of their departments (departmental objectives).

H10: Departmental goals are usually unstated tendencies or assumptions usually consistent with the department's discipline (e.g., if hospital objectives conflict with the professional discipline's dictums, the department will attempt to conform with disciplinary dictums).

Weakly supported. Those departments which evolved objectives ultimately inconsistent with organizational adoption objectives were often basing their action on discipline-related issues. For example, peers in one's discipline were a major source of expectation of what a nursing unit, pharmacy, laboratory, etc. subsystem should do. In several cases, this information was used to counter hospital actions. This should not be construed as an inappropriate action. Often, such diverse sources of information improve the overall understanding of what a system should do and thus improve the adoption process.

H11: Political bargaining or other action may result if the adoption causes disequilibrium in power, resource allocation, workload, etc. Through political action, departments will attempt to (at least) regain prior equilibrium.

Strongly supported. Evidence has been discussed in the cases.

H12: Political bargaining or other action may be used to gain departmental or organizational cooperation for the adoption process.

Moderately supported. The cases offer several examples of attempts to gain adoption cooperation in this manner. Section 4.2.10. describes an overt case in which the clinical laboratory bargained for acquisition of its own system in return for its MCSS implementation cooperation.

H13: Early adoption interest is usually manifested by managerial level individuals who have evolved positive (not necessarily accurate) mental simulations of the system's use. These individuals are usually interested in systems which affect the organizational sub-systems with which they are associated.

Strongly supported. This was true in almost all cases. In all cases, the financial director was a "prime mover". In each case, his motivation included system attributes related to financial affairs (e.g., financial subsystems, charge capture, etc.). In both laboratory systems, the Clinical Laboratory Directors had early involvement. Even in the two cases in which DP Managers were involved in urging system adoption, it must not be forgotten that these systems are the essence of their departments. Finally, in all of these cases, the "prime movers" were managers.

H14: The success of the implementation usually varies directly with the power of the system advocates, especially the "prime movers".

Moderately supported. This would probably be strongly supported if non-surviving MCSS were among the cases. However, in each case, one of the "prime movers" was a financial director. In each case the financial director is rated as a very powerful/influencial individual. In fact, in no case was he rated less than tied for second in power/influence. This, at least, demonstrates that these surviving systems had the support of those in power and were opposed by no one with significant power.

H15: The success of the implementation usually varies directly with the commitment of the system advocates.

Strongly supported. In the six more successful cases, there existed a committed group of individuals whose continued support, especially during the most difficult implementation periods, assured continuity in the use of the system until problems could be resolved. In the two hospitals exhibiting less success, the commitment is less strong.

H16: Any technology gatekeepers exist at the departmental level and are restricted to technology associated with their departmental functions. If a computer systems department exists, it is the computer science gatekeeper and shares the application gatekeeper role with the departmental gatekeepers, if any exist.

Moderately supported. At fact value, H16 is strongly supported. However, the quality of the gatekeepers' information has not been of "expert" calibre. Regardless, lab system adoptions have relied on the clinical laboratory directors, pharmacy system adoptions on pharmacy directors, financial systems on financial directors, and so forth.

H17: One hospital may use another hospital as a technology gatekeeper. The primary source of information about systems is through peer contact.

Strongly supported. Without exception, those interviewed listed peer contact as at least tied for the major source of system information. Hence, peers serve as gatekeepers.

H18: The trial stage may be satisfied by other hospitals' experiences with the system and/or site visits, especially those suggested or arranged by the potential vendor.

Strongly Supported. This is discussed in the cases. Without exception, adopters made site visits to determine the success of a system rather than constructing their own trial.

H19: The adoption phase may be seen by some staff as only a continuation of the trial stage. The adoption stage may occur before all parties are committed to the system's use.

Moderately supported. Those not involved with the adoption decision seldom were aware that the hospitals had contracted for delivery of the MCSS until post-contract announcements or training sessions occurred. Hence, adoption began before full staff committment was assured. However, once apprised of the situation, only a small minority of staff in any hospital viewed the adoption as a trial. But, these minorities did exist sometime during all but Hospital "H"'s implementation.

H20: Implementation decisions are often those of bureaucratic entities rather than of central management.

Moderately supported. Most decisions were made along bureaucratic jurisdictional lines. In several cases, the adoption decision was made contrary to existing protocols for such decisions (e.g., Hospital "A", in which the Financial Director signed the contract without Board approval) with severe consequences. However, this is most noticeable in implementations lacking redesign of the work environment. In such cases, existing protocols are applied to the system by the bureaucratic entity responsible for those protocols, usually with sub-optimizing results.

H21: Departments may attempt to use pre-existing bureaucratic protocols to deal with unexperienced implementation events.

Strongly supported. This is addressed in the cases and in H20. Essentially, they have no recourse if the human factors oriented systems engineering of the MCSS is insufficient.

H22: Pre-existing rules may interfere with the adoption of new work processes needed to support the system.

Moderately supported. This phenomenon is very widespread. However, its negative impact in these eight cases is severe in only two of the hospitals.

H23: Pre-existing bureaucratic responses and rules inhibit unfreezing.

Moderately supported. In few instances were replacement protocols, required for optimized systems use, available. Hence, the old protocols were used or modified. This tended to retain the prior systems' operating characteristics which had the effect of maintaining old system stability. Further, it caused dissonance as the system functions failed to match the only protocols available.

H24: Common software systems' adoptions, cause a change in work processes, power relationships, reward structures, and risk structures of participants.

Strongly supported. Examples appear in every case.

H25: Individual positive expectation can aid the unfreezing phase.

Strongly supported. In all cases, the individuals who had positive expectations for the system extended their positive feelings to the anticipated work setting. They tended to view the future state as desirable. By contrast, then, their present state seemed less desirable. This contrast destabilized the current setting, unfreezing them.

H26: Individual unrealistic positive expectation can inhibit the refreezing stage.

Strongly supported. In every case, certain staff populations experienced unfulfilled expectations. In many cases these expectations were unrealistic. Either they were misled to capture early staff support, or they created their own false expectations. The latter occurs often, especially among staff members with little or no CBIS experience. These people tend to derive and aggregate expectations from gossip, communication media, etc. and invariably find that the reality they experience does not map into their expectations. In such cases, cognitive dissonance occurs, inhibiting refreezing.

H27: Success varies directly with the active recognition and management of the change process.

Strongly supported. All cases support this. In particular a comparison of Hospital "A" and "H" demonstrates this issue. Further, Hospital "A"'s contrasting implementations of its outpatient and inpatient subsystems offers support of this hypothesis.

H28: Success varies indirectly with the degree of change the system engenders.

Weakly supported. These cases were not conducive to testing this hypothesis. However, a comparison of Hospital "C" and Hospital "A" weakly supports this point. To test this hypothesis, implementations with resource, experience, planning, etc. similarities but with different degrees of change are required. Such situations did not emerge in these cases.

H29: Success varies directly with the level of human factors engineering of the system.

Strongly supported. This, in a sense, is an aggregate hypothesis. Various elements have been discussed in the cases and the other hypothesis discussions. Clearly, the system designed for its working environment and its users' capacities has met with proportionately increased success. Contrasting Hospital "F", "G", and "H"'s experiences with the others' offers support for this hypothesis. However, the quality of human factors engineering was too low in all of these implementations. This is one of the drawbacks to MCSSs in general.

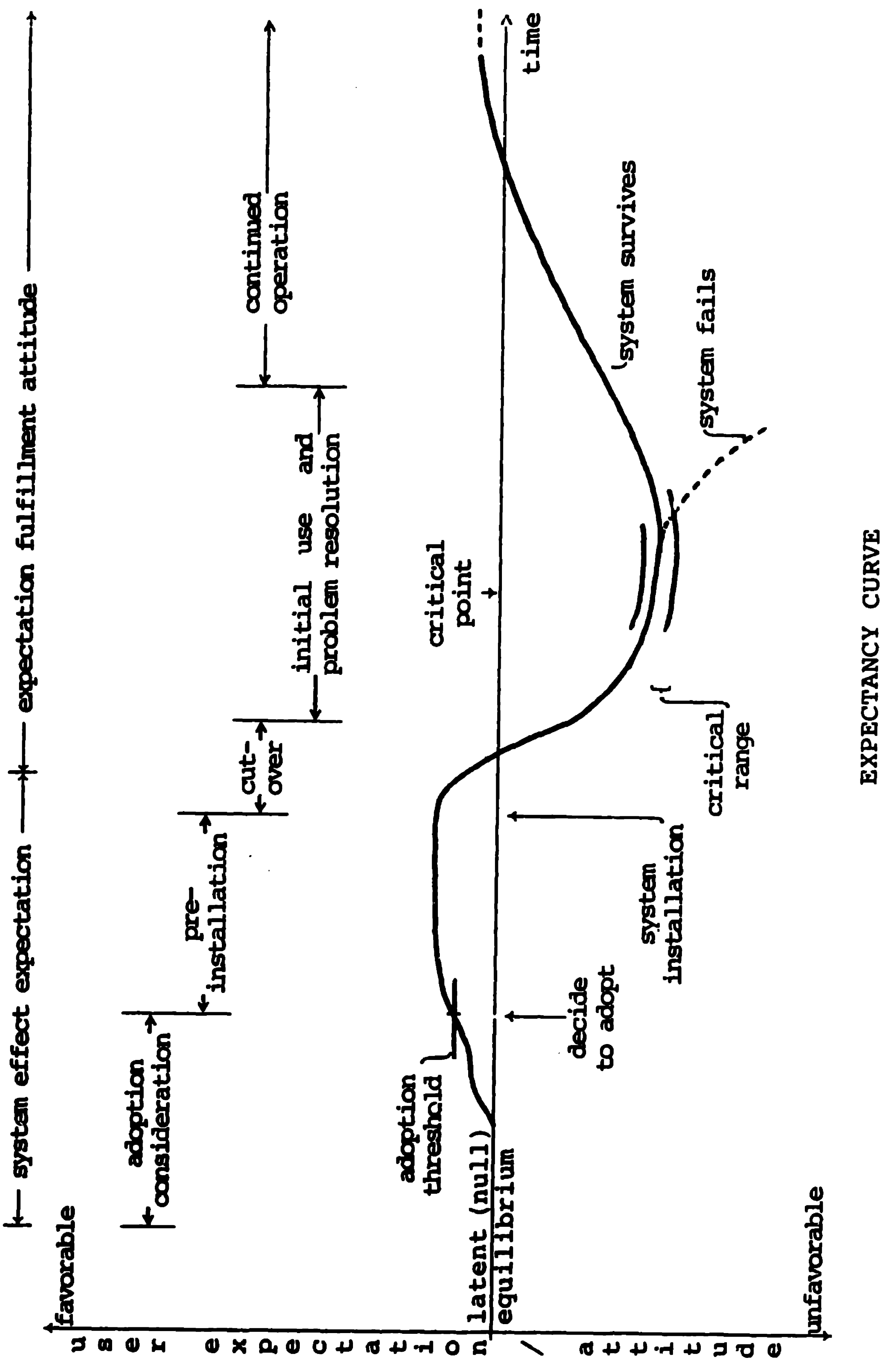
Overall, we may conclude that these cases have provided strong support, hence, validation of the MCSS adoption paradigm. Further, there are indications that the paradigm would have been very strongly supported had cases of non-surviving systems been included. The paradigm proved very useful in indicating issues or factors which should be examined. Conversely, the cases offered insights which will lead to the continued enhancement of the paradigm.

4.3.3. Adoption Factor Syndromes

This research has yielded many insights into the MCSS adoption process, most of which have been discussed in prior sections. These insights describe identifiable clusters of causes and effects which are what the framework calls factor syndromes. The existence of syndromes means that certain factor relationships usually have consistent relationships. Therefore research attention, at the level of first approximation, can be productively focused by the syndromes emergent from the paradigm. There were several syndromes which are particularly interesting and which warrant further explanation. These will be addressed in this section.

4.3.3.1. The Expectancy Curve

Adoption decisions are not only based on fact, but also on beliefs and attitudes. An important attitude is that of how well the system matches expectations. If we were to measure such an attitude, it would be manifested as "system effect expectation" before the cutover point and "expectation fulfillment attitude" afterward (Figure 4.6). We may define system effect expectation as the expectation staff have about the system's nature, its effect on the



EXPECTANCY CURVE
user expectation / attitude
favorable
unfavorable
time
system effect expectation
expectation fulfillment attitude
adoption consideration
pre-installation
cut-over
initial use and problem resolution
continued operation
latent (null) equilibrium
adoption threshold
decide to adopt
system installation
critical point
critical range
system survives
system fails

FIGURE 4.6

hospital, and its effect on them. Expectation fulfillment attitude may be defined as the judgment of the system's fulfillment of staff expectations, both personal and organizational, and its potential for ultimately meeting those expectations. These are grossly the multi-variate, composite attitude that individuals have toward the system. We shall call the curve that this composite attitude traces over time as the "expectancy curve".

Reconstruction of the expectancy curve in the eight case hospitals produces a general curve which the researcher has observed in more than twenty other MCBIS adoptions. Hence, there appears to be a recognizable syndrome in operation. It is important to note that since the curve has never before been identified, no estimates or ranges of amplitudes or other parameters have been made. Further, a single curve represents the composite attitudes of all staff toward a single MCSS implementation. It does not necessarily represent an individual's attitude curve.

The curve starts at some latent equilibrium value which seems to approximate null. When the staff members learn of an impending MCSS implementation, the aggregate attitude begins to rise into the favorable range. In this pre-installation time period staff seem to have a net favorable attitude for several reasons:

(1) They have received indications from society, communication media, etc. that computer systems are good; that, by association, the implementation will be a personally good and progressive experience.

(2) They are usually told, or infer, that the system will bring about an improvement in the hospital's operation.

(3) They infer that the MCSS will improve their personal work life, even if only via increased prestige.

(4) They often think that the implementation will be "exciting" and "fun".

(5) Often, vendor analysts, consultants, or other hospital staff have interviewed them asking what they would like the system to do for them. This implies, to the naive, that their desires will be fulfilled.

However, the curve begins to fall at system installation and has usually returned to null at or shortly after cutover. Several factors contribute to this effect:

(1) Staff begin to realize that the system is going to alter their work environment in an unknown, and possibly

adverse, way.

(2) Vendor training usually turns out to be incomprehensible. Staff want to be told exactly what to do and when. Vendors only tell them what the system does and in a language that they can not use to relate the information to their reality. Vendors tell them not to worry, documentation manuals will be available to fall back on. However, either the manuals are never provided or they, too, are incomprehensible or incomplete.

(3) Individuals often begin to wonder if they will be able to learn or cope with the system. They do not know, and are afraid to ask, if everyone is confused or if it is just them. Even if they understood the training sessions, they are usually uncertain about the employment of the technology.

(4) Some of them are being asked to work overtime to convert files, to do more manual data preparation tasks that they thought the computer was going to alleviate, not aggravate.

The staff are beginning to learn that there is a difference between their expectations and reality. But they do know if it is the system or their expectation which is faulty.

After cutover, the curve continues to descend. Again there are multiple reasons:

(1) Functional problems, including hardware and software bugs, appear. The experts prove less than infallible at correcting these problems.

(2) They are afraid, even if they had hands-on training, that their mistakes may harm the system or the database.

(3) They learn that the system will never provide all of the functions that they thought would be available.

(4) They hear of other departments or individuals that are being adversely effected by the system.

(5) When the system "goes down", the recovery procedures prove, at best, to be quite cumbersome and annoying.

(6) The system may be improving information processing, but it has not decreased their workload. Further, it has removed much of the flexibility from their work.

At some point after the cutover, the curve levels temporarily. In surviving systems it eventually climbs to some positive level as problems are slowly resolved. However, the curve again descends for non-surviving systems. This, obviously, is the turning point. In surviving systems, there always emerges a critical mass of people whose extraordinary actions in behalf of the system and problem resolution improve the situation. This critical mass of people is not observed in systems which do not survive. Conversely, in failing systems, a critical mass adverse to the system's continuation emerges. This group usually includes clinicians and some managers.

We conjecture that the curve has other benchmarks. The amplitude of the high and low points are not necessarily correlates. The amplitude of the high point may require a threshold to be achieved for the adoption decision to be positive. The amplitude of the low point varies and may have a measurable threshold below which no system survives. It may have a higher threshold above which the implementation is never in jeopardy. The very existence of the curve significantly improves description of the longitudinal dynamics of the adoption. The measurement of these hypothetical benchmarks would extend both description and prescription.

4.3.3.2. Human Factors Guided Systems Engineering

The point that the operational environment must be designed prior to implementation and in accordance with the tenets of human factors engineering has been made in previous sections. Such systems engineering is seldom performed. As a result, the MCSS implementation typically is somewhat chaotic. When operational relationships, information flows, support systems, responsibility, etc. are unspecified and left to the intuition of inexperienced staff, chaos is to be expected. (re: Section 4.3.2.1.)

Approximately 75% of the staff interviewed in the cases expected the vendor to provide this systems engineering. Essentially, they expected to be told how the vendor's common system should be adapted to their unique environment. They expected the vendor to provide the necessary consultation as a lease related service, the cost of which would have been included in the lease.

Generally, the vendors believe that they have no consulting responsibilities. They feel that their systems are generally applicable and therefore, that site specific systems engineering is not essential. Exceptions to this generalization are usually those vendors who provide the hospital with the option of contracting for modifications and consulting. But this exception demonstrates the rule. Even these vendors provide the service outside of the basic lease contract. Thus, they do not consider these services as their usual and customary responsiblity.

With conflicting vendor and hospital expectations, it is not surprising that appropriate systems engineering is usually not accomplished unless the hospital has and brings to bear its own resources to perform the task. Unless the current sets of beliefs are altered, implementations will continue to suffer. The resolution will occur when hospitals appreciate the need for systems engineering and take the responsibility of providing it, or writing it into the MCSS contract and legally demanding it of the vendor (at a cost). In any case, the vendors, who are marketers of a product, will not alter their offerings until demanded in the marketplace. They are not non-profit service organizations.

4.3.3.3. Atypical Common Software And Hardware

Hospital staff make site visits to see their prospective sytem in operation. They believe that this is a test that the system they chose is "successful". They seldom realize that the system they visit is not the system they receive.

The site that they visited, unless they selected it without vendor involvement, was probably recommended by the vendor precisely because it was successful. Of the case hospitals, "H", "G", and "F" are routinely recommended by their respective vendors for site visits. That these three hospitals are the most successful in the sample should not be unexpected. Obviously, the vendor desires potential customers to see success. But what the visitor may not realize is that these hospitals are not common. In each case, staff members revealed that they consent to be visited and, in return, expect to receive levels of software and consultation support not called for in the contract and atypical of the support the vendor provides other hospitals. Each offered evidence that their expectation is fulfilled. Hence, the potential client is seeing a system supported at levels higher than he will experience. He does not see the same system he is leasing.

With few exceptions, the common-software vendors will contract for software modifications. Usually the hospital does not understand that its modifications may be unique and, as such, carry development risk. When their unique function or interface fails, they experience cognitive dissonance since the system they tested (visited) did work.

Conversely, too many vendors, through marketing efforts, promise the availability of modifications, and often the entire MCSS, earlier than they can deliver it. Several allegations that the vendor deliberately deceived the hospital about delivery emerged in several of the case hospitals. A severe complication of this problem is that in an effort to realize contractual deadlines, several vendors (not necessarily the case vendors) are causing hospitals to load software which is known to have been insufficiently tested.

All of this demonstrates a syndrome in which hospitals are frequently not receiving the systems which they expect nor the technical support that they deserve.

4.3.3.4. The "Top Management Support" Truism

Anyone remotely familiar with MIS prescription is familiar with the claim that the key implementation factor is having top management support for the system. Some MCSS vendors, as a result, refuse to negotiate a system lease with anyone but the individual identified in the hospital's organizational chart as the top manager, the Administrator. Several have stated that they deal with this individual because he has the organizational power.

However, this exploratory research has demonstrated that organizational power and influence in hospitals does not necessarily follow the organizational chart. For example, in 50% of the cases, there was another individual with a power/influence rating equal to or exceeding that of the Administrator's rating. The Financial Director, in all cases, was never rated lower than a tie for second in this rating, when usually his position was farther down in the organizational chart. Even in Hospital "A"'s case, in which the Administrator and Financial Director were rated first and second, both lost their positions for reasons partially attributable to the leasing of an MCSS without the Board of Directors' approval. A review of the "Power Distribution" tables in the cases shows the significant decentralization of power in hospitals.

This information may not alter the concept that top management support is useful in a system implementation. But it should cause those who deal with hospitals to re-assess what "top management" means in the health care delivery industry. This is especially significant since the "prime movers" for each case system were invariably, regardless of position, rated as among the most powerful managers. A better understanding of reality may carry with it potential benefits for system implementation.

4.3.4. Summary: The Research Framework

The preceeding sections have discussed the validation of three major portions of the framework: first, the paradigm which directs factor and factor syndrome identification and testing; second, the dependent variable, success level, and its measurement; and third, the existence of factor syndromes.

While the applicability of the paradigm was discussed in two ways, case analysis and hypothesis analysis, this latter method was also a test of the feasibility of abstracting and examining characteristics of the paradigm. This efort is analogous to identifying factors and factor syndromes for analysis. The result is that this method of identifying factors is feasible.

The fact that factor syndromes can be identified implies that, in future rsearch, they can be examined in accordance with the logic of the framework. The existence of factor syndromes makes the directed factor study far more feasible. It allows the manipulation of fewer variables at the first level of analysis, thus improving the probability that a correct descriptive model of MCSS adoption can be derived. Further, it improves the probability that useful prescription can be derived.

This exploratory research reinforces the fact that data collection for this type of research requires the researcher's direct contact with the site and respondents. Survey methods alone will not be sufficient to assure that the collected data accurately reflects the phenomenon under investigation. There emerged much important information which was viewed by the respondent as personal, embarassing, or otherwise confidential. This information had to be drawn out with the researcher's personal assurances of confidentiality. It would never have been revealed using typical, remote survey methods. The obvious corollary is that MCSS research is time consuming and expensive.

The overall conclusion derived from this exploratory research is that the "directed factor study" framework is valid, appropriate, and represents the best method for the next level of MCSS adoption/implementation research.

5. CONCLUSION

We have observed that even technically sound MCSSs frequently have very difficult implementations and often either fail and are removed from the hospital, or are not used to their potential. These partial or complete failures adversely impact the hospital's financial and organizational viability, hinder the delivery of quality health care, and on a national level, impair the realization of the benefits of MCSSs and the containment of health care delivery costs.

The research presented here has addressed this problem by exploring the processes by which MCSSs are implanted in health care delivery facilities. If we know how and why implementations go awry, we can improve the systems, the adoption processes, and the structures in which they are imbedded. It has not been our purpose to demonstrate the value or appropriateness of MCSS technology.

In particular, this research has investigated the adoption of vendor-provided MCSSs by primary and secondary care, private sector, non-profit hospitals. Its objective was to develop and test a framework for meaningful descriptive MCSS research which will facilitate the identification and measurement of the factors which most affect the level of success of an MCSS implementation. In fulfilling its objective, this research has extended our understanding of the complex set of implementation sub-processes so as to facilitate the derivation of the descriptive and prescriptive knowledge necessary to increase the probability of success in MCSS implementation.

The more significant contributions of the research include:

(1) The development of a unified paradigm of MCSS adoption.

(2) The development of the Directed Factor Study, a theoretical framework for MCSS research into the factors which most affect an implementation's outcome.

(3) The definition of Success Level as the outcome or dependent variable and the development of an interval scale measure for this variable.

The completion of this research opens the way for the continuation of the descriptive and prescriptive research into MCSS implementation. Follow-on research must package factor syndromes using the foundation provided by this research. Then, it must execute the remainder of the Directed Factor Study process developed here. Once a factor map is produced that is within error tolerances, prescriptive strategy must be devised and tested.

Although this research was not intended to produce prescription, it has shown several areas which need prescription. The following observations suggest actions that system implementors would probably find useful in improving the adoption process. In discussing them, we caution the reader that they are incomplete and should not supercede continued descriptive and prescriptive research.

Hospital managers and clinicians must come to understand that vendors are profit-oriented. MCSSs are the vendor's response to what it believes the market is demanding and is willing to pay for, and to what will be profitable. The case studies and prior experience demonstrate that even those hospitals which appear to deal with the vendor in an economically and legally competent way are nevertheless exhibiting naive expectations of the vendor's role. Often they place great emphasis on contract review (which is appropriate) but fail to understand the implication of their action. Seldom do they know about the environmental support the system may need. They are usually unaware of work process changes that the system entails. They seldom ask about system backup, preventive maintenance, data confidentiality, system reliability, and other critical issues. They naively believe that if the system works elsewhere, it will work for them. Many hospital managers seem to think that these issues can be left completely to the vendor. Sometimes they are correct; usually they are wrong. Virtually all of the vendors' staff members interviewed wished that hospital managers would assume a greater rsponsibility in the implementation process and develop better system expertise. One vendor said that "if they knew what they were doing, it'd make our job easier".

The fact that this research advocates a human factors engineering approach to MCSS adoption should not be construed to mean that systems can be built which are completely "idiot proof". Besides, unless hospitals demand a better designed product, there is no economic incentive for vendors to alter their systems to make them easier to use. But, even now, commercially available systems have a range of design quality. Some vendors simply do a better job than others. So if hospitals merely expanded their search sets, they would probably find a significantly better MCSS and they would begin to have an economic impact on the MCSS industry. A positive correlation would emerge between the quality of an MCSS and its sales level. This correlation does not necessarily exist today.

The hospital manager should understand that the MCSS's quality must not be considered separately from the responsibleness, responsiveness, and quality of the vendor's support staff and systems. MCBISs need to be flexible. The needs of the hospital change and the information requirements levied on the hospital from the outside (i.e., government agencies, insurors, etc.) are constantly in flux. Ignoring the vendor's ability to provide continuing support for reasonable remuneration has caused unpleasant surprises for many hospitals.

One of the vendors' major complaints about dealing with hospitals is that hospital managers and clinicians with whom they deal do not understand their own work processes. This complaint is understandable but not completely accurate. What is true is that the managers seldom have prepared a sufficient functional design for the system. They believe that the vendor will provide the consultation necessary to redesign their work processes or, worse, they think that little or no change will occur. However, most MCSS contracts do not call for consultation. Therefore, the vendor expects the adopter to understand how the MCSS is to be integrated into and used in the hospital.

Clearly, this expectation is often naive. Reviewing the case hospitals, we may position them in the matrix of Figure 5.1.

VENDOR NAIVETE	HOSPITAL NAIVETE: higher	HOSPITAL NAIVETE: lower
higher	Hospitals "A" "B" "C"	Hospital "D"
lower	Hospitals "E" "F"	Hospitals "G" "H"

FIGURE 5.1 IMPLEMENTATION OUTCOME IN THE HOSPITAL - VENDOR NAIVETE MATRIX

As we would expect, the more sophisticated the hospital and/or the vendor is, the higher the success level. Caveat emptor. The ultimate responsibility for the human factor engineering of the implementation resides with the adoptor. So, the hospital must do several things well that most hospitals now do poorly or not at all. It must assure that the functional definition of the system is performed and performed well. It must, based on the functional definiton, accurately inform prospective vendors of specific system specifications that it requires. It must not expect the vendor to know more about the hospital than its own staff knows. If it does not have the internal capability to do these things, it should procure it (e.g., good consultants, etc.) or defer the adoption.

Value Engineering argues that the hospital should only specify, procure, and pay for those functions it needs. However, balancing Value Engineering and objective maximizing behavior will lead to the hospital's reasonable systematized expansion of its MCSS search.

The hospital should assure that the product it is procuring performs the task within the hospital's error tolerances. Hospitals should have contract clauses which allow acceptance testing. The system should be rejected if it does not perform according to specification. However, this should be done fairly. It is not fair to blame a system for hospital problems. Further, evaluation should be a continuous process. An adoption decision should be based on an evaluation (quantitative and qualitative) that demonstrates the system's feasibility and favorable cost/benefit ratio. This effort has the side benefits of staff education, involvement, and unfreezing. (Note: no case hospitals performed this task.) During the implementation and after implementation is "complete", the system should be evaluated to determine if it meets its adoption specifications (which include its goals). This helps assure that a system that deserves to be discontinued is not retained by default. Also, it shows management if some departments or individuals are not using the system, if some departments need additional support, or if all is well. (Note: only Hospital "H" performed a post-implementation evaluation.)

Then, hospital managers must not forget their own people. Implementation is change. Such change usually alters interpersonal relationships, the nature of an individual's work, the individual's reward and risk structures, and so forth, throughout the organization. Hence, individuals tend to see themselves as gaining or losing because of the change. One of the manager's main tasks is to manage this change process. He should design the functional system to maximize individual's gains and minimize their losses within the objective needs of the organization. And he should be aware that some individuals will invariably lose something. In such cases, he should be alert for staff interference with the implementation.

All of this may be condensed into the fact that it requires excellent management to achieve a successful and productive MCSS implementation.

Our discussion here is not intended to be a managerial check list for an adoption. The things mentioned are but some of the frequently observed chinks in the process. Many structures and processes may be beyond the hospital's control. For example, the manager's control of the change process includes the management of staff expectations. However, vendors' field engineers have been known to raise expectations unduly in order to gain a sale or the cooperation of the hospital's staff. Perhaps part of their job is to develop excitement for the change. But if it goes too far, if it raises expectations too much, this behavior can prove very detrimental. It can make a good system seem poor in view of unrealistically high expectations. The vendor faces the following paradox. If it is completely honest, the hospital will realize the risks and problems of adoption and expectations will be realistic, but it may well lose the contract because the hospital needs encouragement to act. Conversely, if it unfairly raises expectations, it may get the contract but doom the implementation. Any moral judgement is left to the reader, but it is clear that the vendor's information flow to the hospital will be affected by the vendor's decision on this issue. Hence, this is an example of an important issue which will remain out of the hospital's control until its managers are sufficiently expert to determine the validity of vendors' claims.

This research has demonstrated that there are factor syndromes which affect the implementation's success level that are amenable to intervention. Further research is required to determine which factors have the greatest affect on success, which are controlable, and which interventions will control them. However, this research has produced exploratory evidence that MCSS adoption problems are understandable and that hospital and vendor managers and staffs have the potential to exert beneficial control over implementations. Therefore, the outcome of this research is encouraging. The prospects for significantly improving the probability of success for future MCSS implementations are quite good.

Agbalajobi, F. "Characteristics Of The Software For Computer Applications In Medicine," Medical Information, Vol.4 No.2, April - June 1979, pp.79-88.

American Hospital Association. AHA Guide to the Health Care Field, 1978 ed. Chicago, 1978.

Ashcroft, J. M. "The Implementation Of a Completely Operational Computer System In A Cardio-Thoracic Department," Computer Programs In Biomedicine, Vol.8, September 1978, pp.311-314.

Austin, C. and Greene, B. "Hospital Information Systems: A Current Perspective," Inquiry, June 1978.

Barnett, G. Octo. "Computers in Patient Care," New England Journal of Medicine, Issue 279, December 1968, pp. 1321-1327.

__________. "Medical Information Systems - Present Illness and Prognosis," Advanced Medical Systems: The Third Century, Hinman E., Ed. Symposia Specialists, Miami Fl., 1977.

Beckhard, Richard and Harris, Reuben T. Organizational Transitions: Managing Complex Change. Addison-Wesley, Reading Mass., 1977.

Beynon, H. "Car Making, An Industry at War With Its Workers," New Society, Vol. 32 Issue 662, June 1975, pp. 639-642.

Bowker, Albert H. and Lieberman, Gerald J. Engineering Statistics. Prentice Hall Inc., Englewood N. J., 1959.

Brandeis, J. F. "C.A.P.O. Program," Journal Of Clinical Computing, Vol.6 No.4, 1977, pp.176-191.

Campbell, Donald T. and Stanley, Julian C. Experimental And Quasi-Experimental Designs For Research. Rand McNally College Pub. Co., Chicago, 1963.

Corby, C. S. "Are You Ready For A Computer," Dental Economics, Vol.68 No.8, August 1978, pp.32-36.

Dowling, Alan F. "Do Hospital Staff Interfere With Computer System Implementation?," Health Care Management Review, Vol.5 No.4, Fall 1980, pp.23-32.

Drachman, R. H., O'Neill, M. J. and Ledford, K. V. "Implementation Of A Medical Information System In An Ambulatory Care Setting," Proceedings Of The Third Annual Symposium On Computer Applications In Medical Care, October 1979, pp.225-228.

Edwards, Allen L. Techniques of Attitude Scale Construction. Appleton Century Crofts, New York, 1957.

Evans, John A. and Campbell, Robert V. "The Structuring Of Health Information System Options: Summary And Assessment Of Methodology," Socio-Economic Planning Science, Vol.4, 1970, pp.291-309.

Feldman, S. ed. Cognitive Consistency. Academic Press, New York, 1966.

Festinger, L. A Theory of Cognitive Dissonance. Stanford Univ. Press, Stanford Calif., 1957.

Flanagan, R., Strauss, G. and Ulman L. "Worker Discontent and Work Place Behavior," Industrial Relations, Vol. 13 No. 2, May 1974, pp. 107-123.

Fuchs, Victor R. Who Shall Live?. Basic Books, Inc., New York, 1974.

Gershefski, George W. and Harvey, Allan. "Factors Making for Implementation Success and Failure," Management Science, Vol. 16 No. 6, February 1970, pp.B-312-B-321.

Ginzberg, Michael J. "Implementation as a Process of Change: A Framework and Empirical Study." M.I.T. Sloan Working Paper 797-75, 1975.

__________. "A Process Approach to Management Science Implementation." Unpublished Ph.D. Thesis, Sloan School of Management, M.I.T., 1975.

Granger, Charles H. "The Hierarchy of Objectives," Harvard Business Review, Vol.42 No.3., May - June 1964, pp.63-74.

Green, Bert F. "Attitude Measurement," Handbook of Social Psychology, G. Lindzey, Ed. Addison Wesley, Cambridge Mass., 1954.

Grossman, Jerome H. and Rockart, John F. "A Managerial Perspective On Information Systems In Medical Care Organizations, Advances in Biomedical Engineering, Vol.6. Academic Press, New York, 1976.

Gorz, A. "Tyranny of the Factory: Today and Tomorrow," Telos, No. 16, Summer 1973, pp. 61-67.

Gunji, A. "The Strategic Analyses And Initial Implementation Of The Shared Hospital Information System," Medical Informatics Europe 78, 1978, pp.663-670.

Hospital Financial Management Assoc. "The State of Information Processing in the Health Care Industry." Chicago, 1976.

Hsaio, D., Kerr,D. and Madnick, S. Computer Security Problems & Solutions. Academic Press, New York, 1979.

Keen, Peter G. W. "Implementation Research in OR/MIS: Description Versus Prescription." Stanford University Graduate School of Business Research Paper No.390, July 1977.

__________ and Scott Morton, Michael S. Decision Support Systems: An Organizational Perspective. Addison-Wesley, Reading, Mass., 1978.

Lewin, Kurt. "Group Decision and Social Change," Readings in Social Psychology, Newcomb and Hartley, eds. Henry Holt & Co., New York, 1952.

Lipset, Seymour M., Trow, Martin A. and Coleman, James S. "Generalizing from a Case Study: Problems of Analysis," The Sociology of Organizations: Basic Studies. Free Press, New York, 1970.

Lorange, Peter and Vancil, Richard F. Strategic Planning Systems. Prentice-Hall, Englewood Cliffs, N.J., 1977.

McCormick, Ernest J. Human Factors Engineering. McGraw-Hill, New York, 1970.

McGehee, Peter W., Kwon, Ik-Whan and Volger, Thomas K. "A Distributed Processing Medical Information System: The Case of the SSM-MIS System," Proceedings of the Fourteenth Hawaii International Conference on System Sciences, Vol.II, January 1981, pp.11-27.

McLaughlin, Curtis P. "Health Operations Research and Systems Analysis Literature," Systems and Medical Care. M.I.T. Press, Cambridge, Mass., 1970.

Merriam Co. Webster's New Collegiate Dictionary. G & C Merriam, Springfield, Mass., 1976.

REFERENCES

Mumford, Enid and Pettigrew, Andrew. Implementing Strategic Decisions. Longman Group Ltd., London, 1975.

Rockart, John F. "Chief Executives Define Their Own Data Needs," Harvard Business Review, March - April 1979, pp.81-93.

Rogers, Everett M. Diffusion of Innovations. The Free Press of Glencoe, New York, 1962.

Rushmer, Robert F. Medical Engineering. Academic Press Inc., New York, 1972.

Schein, Edgar H. Coercive Persuasion. W. W. Norton, New York, 1971.

__________. Professional Education: Some New Directions. McGraw-Hill, New York, 1972.

Schmitz, H. Hospital Information Systems. Aspen Systems Corp., Germantown Md., 1979.

Sheldon, Alan. "Toward a General Theory of Disease and Medical Care," Systems and Medical Care. M.I.T. Press, Cambridge, Mass., 1970.

Simon, Herbert. Administrative Behavior, third edition. Free Press, New York, 1976.

__________. Models of Man. John Wiley and Sons, New York, 1957.

__________. The New Science of Management Decision. Prentice-Hall, Englewood Cliffs, N.J., 1977.

Sobolewski, J. S. "Toward The Implementation Of Successful Medical Computer Applications," Proceedings Of The First Annual Symposium On Computer Applications In Medical Care, October 1977, pp.84-89.

Story, Guy and Hirschman, Lynette. "Database Design for Natural Language Medical Data," Proceedings of the Fourteenth Hawaii International Conference on System Sciences, Vol.II, January 1981, pp.470-480.

Szolovits, P. and Pauker, S. G. "Computers And Clinical Decision Making; Whether, How, And For Whom?," Proceedings of the IEEE, Vol.67 No.9, Septermber 1979, pp.1224-1226.

S.E.T. "Philosophy of Science," Encyclopaedia Britannica, vol.16, 1976, pp.375-393.

Tolchin, S. G. and Stewart, R. L. "The Distributed Processing Approach to Hospital Information Processing," Proceedings of the Fourteenth Hawaii International Conference on System Sciences, Vol.II, January 1981, pp.3-10.

Turner, Merle B. Realism And The Explanation Of Behavior. Appleton Century Crofts, New York, 1971.

Veazie, Stephen and Dankmyer, Todd. "HISs, MISs, DBMSs: Sorting Out The Letters," Hospitals, JAHA, Vol.51, October 1977, pp.80-84.

Interview Structure

Case interviews were open ended but guided by an underlying structure to prevent omission of potentially important information. The structure reflects the MCSS implementation paradigm's structure. The major components of the interview (and, hence, the paradigm) are listed below. Following each is a typical set of questions which were used. These sets of questions are illustrative, but not exhaustive.

(1) Rational Model, including Objectives and Functional Model

At the time of the adoption decision, were there any (organizational, departmental, or individual; covert or overt) objectives for the system? If so, what were they?

How was the system justified?

Did some departments disagree with the orgainzational goals? How so?

Did any individuals disagree with the organizational or departmental goals? How so?

What are the objectives for the system now? Account for any shift.

Assuming that the system satisfied the hospital's goals in theory, did the hardware, software, PM, MTTF, MTTR, daily/weekly availability, backup, recovery, etc. meet the hospital's operational requirements?

Was the system installed, debugged, and available when promised?

A priori, was the system's cost considered to be reasonable for its functions?

How was the cost of the system justified?

What was the nature of the functional needs analysis?

Was there a match between available systems and identified needs?

What was the nature of implementation planning?

What was the planned nature of cutover (parallel or direct, subsystem or entire system, dept. by dept. or entire hospital)?

What was the nature of the actual cutover?

What were the plans for back-up, security, etc.?

At the time of the adoption decision, who were the most powerful and who were the opinion leaders? What was their position on the MCSS adoption issue?

(2) Adoption Processes

At the time of the adoption, who among the hospital staff were most familiar with MCBISs? What was the extent of their knowledge and experience?

Who first generated the idea of investigating the adoption of a system?

Was that person's department(s) the one(s) most affected by the system? If not, what was the responsible person's role?

Who did people turn to for information about CBISs?

How did early interest result in a decision to adopt an MCSS?

Were multiple systems considered? If so, how did you learn of the availability and nature of them?

Was there a trial of the system? If so, how (visit, temporary use, etc.)?

Were there any individuals who viewed the implementation as a trial?

Was a critical mass of supporters achieved? How? Was the domino theory in evidence? Were opinion leaders involved?

(3) Political Process

Was there any evidence of departments using political efforts in any phase of the implementation? How so?

Did the system cause an increased (even if only perception) workload for any department? Were there commensurate benefits? If so, what were they? If not, how did the department (and its people) react?

What was the impact of any political/power bargaining process?

Who was involved? Any of the individuals previously indicated as powerful or influential?

What were the trade-offs required to gain support for the system? Were they really necessary?

(4) Bureaucratic Process

Were there any pre-existing agreements, practices, rules, protocols which inhibited or aided the adoption decision?

Were there any pre-existing agreements, practices, rules, protocols which limited the choice of systems?

Were there any pre-existing agreements, practices, rules, protocols which made the use of the system difficult for any departments or individuals?

Were there any pre-existing agreements,

practices, rules, protocols which made temporary management (TMS) difficult (getting overhires, funding, or other resources)? What was it and what was the effect?

Were there any pre-existing agreements, practices, rules, protocols which made training, installation, etc. more difficult or easier?

(5) Change Process

What was planned/done to cause unfreezing? Was it successful?

What was planned/done to cause change? Was it successful?

What was planned/done to cause refreezing? Was it successful?

(For the last three statements: (a) consider training, individual attention, opinion seeking, design involvement, etc. (b) consider the effect of each at the hospital, departmental, and individual levels.)

Was there any evidence of any of the types of staff interference (Dowling, 1980)?

(6) Success

How successful or unsuccessful was this system?

How do you know? How did you derive this conclusion?

Is your logic valid for other hospitals?

In general, what is success? When and why are systems successful?

Administer SUCCESS MEASURE.

Capture their reaction.

Alan F. Dowling, Jr. received his A.B. in Physics from the College of the Holy Cross in 1969, his M.S. in Engineering Management (Health Systems Option) from the Graduate School of Engineering, Northeastern University in 1973, and his M.C.S. in Computer Science from the University of Dayton in 1975. His Ph.D. work at M.I.T.'s Sloan School of Management is in Health Care Management and Management Information Systems. He has been the recipient of several awards and scholarships and was a Whitaker Health Sciences Fellow at M.I.T.

From 1969 to 1976, he was an officer in the U. S. Air Force. From 1969 to 1971, he was a Weapons Director, an Intelligence Officer and an Academic Instructor at the Tyndall BUIC NORAD Control Center in Panama City, Florida, engaged in air defense activities and staff education. He continued this work in 1971 as Deputy Commander and Weapons Director of the Makung Air Defense Operations Team stationed in Nationalist China. In 1972, while pursuing his graduate studies under Air Force sponsorship, he was a management consultant for the Ambulatory Services Division of the Boston Childrens Medical Center. From 1973-1976, he was the Director of the Medical Computer Systems Research Office, USAF Medical Center, Wright-Patterson AFB, Ohio. In this capacity, he performed research, development, implementation, and evaluation of medical and managerial computer systems. He also provided medical systems engineering consultation and academic instruction to the staff of the medical center. At the same time, he was a consultant to the Office of the Surgeon, Air Force Logistics Command, and directed the medical computer systems development and management of that office.

Since leaving active Air Force service in 1976, he has been a consultant to the Medical Systems Division, Office of the Air Force Surgeon General as a reserve officer. He is currently a Major, Medical Service Corps, USAFR. He also maintains a private consulting practice in management information systems. While a doctoral candidate, he was a Research Assistant at M.I.T.'s Center for Information Systems Research. Since 1978, he has been a management information systems lecturer in the Graduate School of Management, Simmons College. He is a member of the American Institute of Industrial Engineers, the Human Factors Society, the American Association of University Professors, and was a charter member of the Ohio Hospital Association's Medical Systems Engineering/Management Division.

His publications and papers include:

"The Relationship Between Medical Data Accuracy and Confidentiality." Invited paper delivered to the AMRA Conference on Data Quality, Washington D.C., November 1980.

"Do Hospital Staff Interfere With Computer System Implementation?" Health Care Management Review, Vol.5 No.4, Fall 1980.

"Hospital Staff Interference With Medical Computer System Implementation: An Exploratory Analysis," Proceedings of the 14th Hawaii International Conference on Systems Sciences, January 1981. M.I.T. Sloan School of Management Working Paper #WP 1073-79 and Center for Information Systems Research Working Paper #49, 1979.

"The Air Force Composite Hospital Information System: A Functional and Technical Comparison of Three Candidate Public Domain Hospital Information Systems," Medical Systems Division, Office of the Air Force Surgeon General report, 1979.

"An Analysis of the Medical Information Systems of the Boston Veterans Administration Medical Center," Massachusetts Institute of Technology-Boston VA Medical Center, Center for Health Care Management report under contract #V523P-3365, 1979.

"Design of a Large Scale Computer-Based Outpatient Scheduling System for Department of Defense Hospitals," Air Force Logistics Command Medical Service working paper, 1975.

"Health Systems Engineering, An Introduction to an Emerging Discipline," USAF Medical Service Digest, September 1974.

"Computer Vs. Manual Electrocardiogram Systems, An Analytical Comparison," Air Force Logistics Command Medical Service working paper, 1974.

"Computer Systems in Medical Treatment Facilities," Invited paper delivered to the USAF Medical Resource Management Symposium, 1973.

Several other working papers and reports dealing with computer system design, implementation, evaluation and management, 1974 - 1978.