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Structure-technology fit: An exploration of two perspectives

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University of California, Los Angeles, 1988

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UNIVERSITY OF CALIFORNIA

Los Angeles

Structure-Technology Fit:
An Exploration of Two Perspectives

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy
in Management

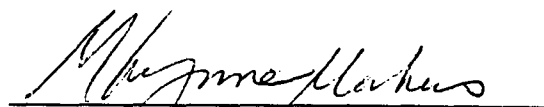
by

Catherine Cecile Sammons

1988

The dissertation of Catherine Cecile Sammons is approved.

Richard A. Goodman



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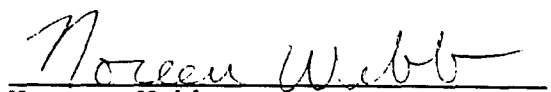

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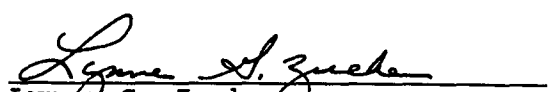

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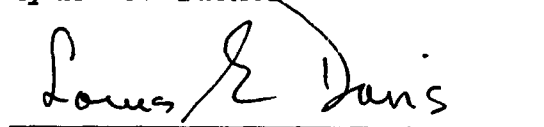

Louis E. Davis, Committee Chair

University of California, Los Angeles

1988

This dissertation is dedicated to

my husband,

Charles L. LeCroy, III

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ACKNOWLEDGMENTS

Even essentially solitary pursuits such as research and writing involve group effort, and this dissertation is no exception. I am grateful to my committee for their guidance. Lou Davis's contributions to organization theory as well as the enhancement of countless working people's lives continue to inspire me as an example of humanistic science at its finest.

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Caitlin herself provided joyful moments when I most needed them.

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Cruz, V., Andron, L., and Sammons, C. (1984). Cookie Monster Is Autistic. Children Today, 13(4):18-20.

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ABSTRACT OF THE DISSERTATION

Structure-Technology Fit:
An Exploration of Two Perspectives

by

Catherine Cecile Sammons
Doctor of Philosophy in Management
University of California, Los Angeles, 1988
Professor Louis E. Davis, Chair

Technology-structure fit theories argue that effectiveness will be enhanced when an organizational subunit's social structure is congruent with its technology. Contingency theory argues that structure depends upon technology, so that when technological uncertainty is high, a highly decentralized and destandardized structure will enhance effectiveness. Conversely, when technological uncertainty is low, a centralized and standardized structure will enhance effectiveness. Alternatively, sociotechnical theory argues that a highly centralized and standardized structure suboptimizes both the technical and social systems of a work unit, thus impairing effectiveness as well as decreasing employee commitment.

This study addresses both contingency and socio-technical theory structure-technology fit hypotheses in a sample of thirty-nine nursing units from three hospitals. Two hundred thirty-eight nurses and thirty-six head nurse supervisors completed questionnaires.

Results supported sociotechnical theory for the relationship between decentralization and commitment, and standardization and effectiveness. Contingency theory was supported for the relationship between decentralization and effectiveness.

An unanticipated finding of the study was the low level of agreement between staff and supervising nurses on perceived unit effectiveness. Agreement was higher for productivity than adaptability. Supervisors' effectiveness ratings were correlated with standardization and technological certainty.

I. INTRODUCTION

A. Problem Statement

While the constructs of technology and structure enjoy widespread recognition as central and critical components of organization theory (Rousseau & Cooke, 1984), nearly three decades of extensive study have yielded neither conceptual nor methodological consensus on the relationship between these important constructs. However, studies in this area are linked by a prominent theoretical thread: the concept of technology-structure "fit." Technology-structure fit theories argue that when an organization's structure fits (i.e., is congruent with, is consistent with, matches, aligns with) the technology of that organization, then effectiveness is enhanced.

Structure-technology fit studies have produced inconsistent results (Fry & Slocum, 1984) and generated much criticism, but it has been difficult to determine whether the primary weakness has been in theory or methods or both. Four problems are frequently identified: (1) the implication of structure-technology fit for effectiveness is rarely assessed because most studies omit performance measures; (2) data are often overaggregated from individuals to the organizational

level of analysis when the work unit level appears to be more appropriate; (3) data analysis methods are often not explicitly linked to hypotheses (Schoonhoven, 1981), and when they are, there is often a fundamental question about the appropriateness or suitability of the methods traditionally employed; (Van de Ven and Drazin, 1985) (4) all studies have defined "fit"--conceptually and statistically--in a single way rather than taking multiple approaches, either theoretical or methodological.

Two intellectual streams--classical contingency theory and sociotechnical systems theory--have significantly contributed to the clarification and empirical investigation of structure-technology fit concepts. The relationship between technology and structure, especially at the work unit level, has been examined in studies from both traditions, but there have been few empirical efforts toward theory testing and only one published attempt (Drazin and Van de Ven, 1985) at comparison of these theories. And yet, both approaches share a common concern regarding the structural influences on effectiveness under varying conditions of technological uncertainty. Contingency theory asks, is the effect of structure upon effectiveness mediated by technology? Do structure and technology jointly influence effectiveness? Sociotechnical theory

asks, are there certain structural features which, under most technological conditions, facilitate effectiveness?

Further knowledge about possible technology-structure fit requirements for effectiveness would be important in at least three applications. First, contingency theory enjoys a prominence in management education that far exceeds the evidence to date, (Pfeffer, 1982) whereas sociotechnical theory is given minimal attention. A refinement of our understanding in this area could serve as a basis for revising this management education curriculum imbalance, resulting in either a change in emphasis or better evidence and justification for the current emphasis. It has been suggested that fit theories have an innate appeal or face validity (Van de Ven & Drazin, 1985, etc.) both to managers and management scholars, but that is not sufficient basis for their incorporation as management tenets.

Second, if technology-structure "misfit" is indeed associated with poor effectiveness, results of studies like this one could be used to guide managers in identifying, assessing, and changing the salient structural and/or technological characteristics of their work units.

Third, the concept of fit is central to a number of organization theories, such as the congruence between

organization and environment described in the institutional isomorphism approach (Meyer & Rowan, 1977; Zucker, 1985) and the population perspective's concept of fitness of organizational forms to particular environments (Aldrich, 1979, p.109). Methodological advances in structure-technology fit studies may have value when applied to these other areas.

B. Purpose and Nature of the Study

The present study proposes to contribute to the organization theory knowledge base in two ways:

1. Theory comparison This study will attempt to improve the precision with which contingency and sociotechnical systems theories of structure-technology fit are individually translated into testable hypotheses. In contingency literature, precision and clarity of hypotheses have been inconsistent, and data analysis methods have often been not well suited to the hypotheses. In sociotechnical systems literature, little of the published work has incorporated hypothesis-testing.

In addition, contingency and sociotechnical systems theories will be compared through competitive hypothesis testing. This unique juxtaposition of frameworks has only recently been suggested by Van de Ven and Drazin (1985) and Drazin and Van de Ven (1985), and heretofore not recorded in the literature. The

present study does not propose to test the comprehensive sociotechnical systems theoretical framework, but rather to focus on one piece of the framework that conceptually overlaps into traditional contingency theory.

2. Theory Enhancement In the exploratory component of this study, an attempt will be made to apply an alternative method of analysis whose potential has been suggested but not explored. In addition, results from traditional and alternative analysis methods will be reviewed and interpreted for their possibly greater combined value. Relative merits and limitations of the techniques will be discussed, with an emphasis on their ability to address the key concepts of structure-technology fit.

The broad constructs of technology (techniques, tools, and processes for transforming inputs to outputs) and structure (arrangement of roles; pattern of social system events required to transform inputs to outputs), cannot be tested comprehensively in the present study, and there is a persuasive argument favoring the dimensional analysis approach. Stanfield (1976) has argued that "conceptual disaggregation" offers some protection against the dangers of "unrationalized" broad categories.

Therefore, specific dimensions have been selected

as the focus here. Three factors were considered in selecting key dimensions: (1) promising results from previous structure-technology fit research, (2) relevance to both theoretical perspectives (sociotechnical systems theory and contingency theory), and (3) relevance to the selected research setting.

Consequently, the interactive relationship between technological uncertainty (difficulty and variability in transformation activities) and two structural dimensions: decentralization of decision-making (participativeness), and destandardization of rules and procedures (extent to which they are not explicit) will be examined in relation to their impact upon work unit effectiveness and commitment to unit in a sample of nursing care units in three private hospitals.

II. LITERATURE REVIEW

A. Contingency Theory Background

Although Lawrence and Lorsch (1967a) are credited with having coined the term, "contingency theory," at least two other groups of colleagues had been developing broadly consonant theories in research programs in Britain (Woodward, 1965; Burns and Stalker, 1961) and seminal theoretical works in the U.S. (Thompson, 1967; Perrow, 1967). At the most abstract level, all of these scholars accepted Galbraith's fundamental premises that there are multiple ways of organizing, and the best way varies with the context; there is no universal best way (Galbraith, 1973, p.2).

These premises may appear almost common-sensical when considered in the 1980's, but twenty-five years ago, the field of organization theory was dominated by a perspective known variously as classical administrative theory, or the rational goal model. Its proponents, such as R.C. Davis (1951), advocated what is now characterized as the "one best way" approach. Universal rules and prescriptions for effective organizing were articulated most commonly from the experience of participation in daily corporate life (Mooney and Riley, 1939; Fayol, 1949).

More than the limitations of their data or the

normative prescribing of their "theories," the major weakness of this school of thought was its "failure to develop conditional generalizations--statements that specify the limits of their applicability to particular situations or types of organizations. This is the major insight that underlies the 'contingency theory' of organizations..." (Scott, 1981, p.67).

Evidence for the conditional basis of organization structure principles was presented by Burns and Stalker (1961) following an in depth case study comparing firms in engineering versus rayon milling. Their conclusion was that structure depended upon the environmental rate of change, which varied along a continuum of certainty, (defined as rate of technology change and rate of market change), and which--at the high uncertainty pole--required an "organic" structure and at the low uncertainty pole, a "mechanistic" structure. The latter structure type was deemed most appropriate in stable conditions and was characterized by attributes such as the following:

* specialized differentiation of functional tasks
* reconciliation of these distinct performances by a hierarchy of supervisors
* precise definition of rights, obligations, and methods
* hierarchic structure of control, authority, and communication

* reinforcement of hierarchic structure by knowledge concentrated at the top

* predominantly vertical interactions (supervisor-subordinate)

* work behavior governed by instructions and decisions issued by supervisors

In contrast, the organic form of organization structure (observed by Burns and Stalker in the engineering firms) was most suited to "changing conditions which give rise to fresh problems and unforeseen requirements for action which cannot be broken down or distributed automatically....in functional, hierarchic roles" (Burns and Stalker, 1961). They described the organic form as follows:

> Individuals have to perform their special tasks in the light of their knowledge of the tasks of the firm as a whole. Jobs lose much of their formal definition in terms of methods, duties, and powers, which have to be redefined continually by interaction with others participating in a task. Interaction runs laterally as much as vertically. Communication between people of different ranks tends to resemble lateral consultation rather than vertical command.
>
> Burns and Stalker, 1961, pp.5,6

Woodward (1965) advanced the exploration of the technology-structure relationship in a more quantified study of ninety-two industrial organizations, resulting in a typology of technological complexity organized along a continuum from lower complexity (unit and small

batch production) to higher complexity (process production) with large-batch and mass-production at a midpoint. Evidence from these case studies lent support to the technology-structure link by suggesting that firms with similar production systems appear to have similar organization structures, and more specifically (for example) that "there was more delegation and decentralization in process industries than in large batch and mass production industries" (Woodward, 1965, p.50).

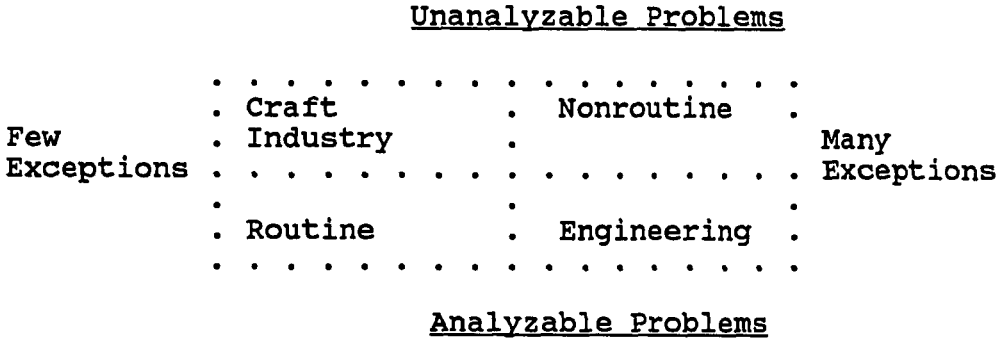
While Woodward's creative contribution seemed more focussed on the technology side of the technology-structure relationship, Lawrence and Lorsch's unique contribution was weighted more toward the structural side. Lawrence and Lorsch proposed that as an open system an organization's success and survival depends upon how well it adapts to environmental demands, which vary in their level of uncertainty. A key component of this adaptation, they argued, was the effective management of two opposing forces in organization structure: differentiation (the division/segmentation into specialized parts which increases with complexity of task) and integration (the collaboration among parts to achieve a unity of effort). Lawrence and Lorsch asked how integration could be facilitated without sacrificing needed differentiation, and they answered that there is no one best way, but rather there are particular types

of integrative mechanisms suited to particular types of environmental conditions. Their answer to the question of how to organize for effectiveness began with "it depends." That is, it is contingent upon the technological and economic conditions of the organization. Implicit in this point of view was the consonance hypothesis, which stated that those organizations that have structures that more closely match the requirements of their context are more effective than those that do not (Pfeffer, 1982, p.148).

Additional landmark works in contingency theory were published by Thompson (1967), Perrow (1967, 1970), and Galbraith (1973). Thompson's contribution meshed nicely with Lawrence and Lorsch's work in that it provided a detailed theoretical framework for the understanding of the organization's technical core, with special attention to its coordination, control, and buffering from environmental uncertainty. Thompson's technology typology was similar to Woodward's, but at a level of abstraction that allowed for generalization beyond production settings. He identified three technology categories: long-linked, mediating, and intensive. He further identified three increasingly complex (and therefore more costly) types of internal interdependence and their corresponding "appropriate" coordination mechanisms: pooled interdependence (co-

ordination by rules and standardization), sequential interdependence (coordination by plans and hierarchy), and reciprocal interdependence (coordination by mutual adjustment).

Perrow (1967) identified two dimensions of technology that are important in determining organizational structure: (1) the number of exceptions encountered in the work (the variability of the material in the various process stages) or the degree to which stimuli can be perceived as familiar and uniform, and (2) the nature of the search process undertaken when exceptions do occur: either logical-analytic or intuitive-unanalyzable. An adaptation of his schematic representation is presented below:



Perrow's Typology of Technology Types. Perrow, 1967, p.196.

Perrow acknowledged that Woodward's findings were consistent with his (e.g., nonroutine was equivalent to small batch and unit, etc.) except for Woodward's category of continuous processing, which was not incorporated (Perrow, 1967, p.207). Like Thompson, Perrow emphasized control (discretion and power) and coordination as two key structural dimensions, but he also differentiated these "task structure" factors from "social structure" factors, which were defined as non-task-related but organizationally relevant interactions of people (Perrow, 1967, P. 200). He classified those into four organizational types corresponding to the technology types: social identity, goal identification, work or task identification, and instrumental identity.

Perrow emphasized, though, that the important contribution of his work was not the specifics, but the perspective:

> This view holds that organizations are not all alike and that the way in which they may vary is in terms of their technology. Two aspects of technology--exceptions and search--are abstracted and analyzed independently and concurrently... (Perrow, 1970, p.85)

> ...But the main point stressed...is not whether there are three or four or more types of firms or how technology is conceptualized or measured, but that firms differ according to the kind of work they do, and thus in their structure. (Perrow, 1970, p.91)

Although information was implicit in many aspects of contingency theorists' formulations (e.g., Lawrence and Lorsch's environmental uncertainty, Perrow's analyzability of search procedures), Galbraith (1973) explicitly developed an information processing model. He conceived of organizations as "information-processing networks...[and thereby] explains why and through what mechanisms uncertainty and information relate to structure" (p.8). As the diversity, uncertainty, and interdependence of workflows increase, so do information requirements. However, specific structural arrangements may be introduced to offset these demands by either reducing the information necessary to coordinate activities or increasing the system's capacity to process more information (p.14).

Creation of slack resources or creation of self-contained tasks reduce the need for information processing. Investment in vertical information systems or creation of lateral relations increase the capacity to process information. These four structural or design strategies are in addition to the traditional "mechanistic" responses of rules and programs, hierarchical referral, and goal setting.

B. Recent Contingency Theory Literature

Numerous studies have addressed the technology-

structure relationship. However, only a fraction of these studies addressed the question at the work unit level of analysis. Although level of analysis has been a widely debated issue in the literature (Roberts, Hulin, & Rousseau, 1978), there is growing support for the work unit as the focal level (Fry and Slocum, 1984). Studies at the organizational level of analysis have not dealt with the factor of intraorganizational technical and structural heterogeneity. "Efforts to relate technology and structure measures at the organizational level are extremely hazardous because organizations tend to employ a variety of technologies and to be structurally complex" (Scott, 1982, p.226). This diversity across units and levels is typically averaged for a single organizational score.

While all three levels (individual, work unit, and organization) need to be explored, at this point in time it would seem most productive to focus on the concrete processes at the work unit level, rather than the more abstract level of the organization, or the more atomized level of the individual. Clearly, constructs conceptualized at one level should be operationalized and measured at that same level.

A simple tabulation of results arrayed in Fry's (1982) review of thirty-seven technology-structure studies revealed that when the organization was the unit

of analysis, nonsignificant results occurred at about the same rate as significant results. When the individual was the level of analysis, nonsignificant results were twice as likely to occur. However, the work unit level of analysis yielded the highest rate of significant findings (five times more than nonsignificant results). And yet, only seven of these technology-structure studies (prior to 1981) addressed these phenomena at the work unit level.

Furthermore, it was significant that while all seven studies employed key concepts from contingency theory (most notably, Perrow's routine/nonroutine technology continuum and Thompson's modes of coordination), none of them tested contingency theory per se because performance measures were omitted. To reiterate from the previous background discussion, technology-structure patterns or combinations may be categorized as congruent or not congruent, and contingency theory stated not that congruent patterns were more prevalent, but that when they existed, they were associated with better performance/effectiveness levels than noncongruent combinations. This notion of "fit" is central to the contingency model. In the absence of this technology-structure-performance fit assessment, these studies may have provided "rich conceptual insights concerning the problems confronting the field" (Fry and

Slocum, 1984, p.222), but they did not provide evidence to support, refute, or modify this core management theory.

For example, a consistent finding among the work unit technology-structure studies was the negative relationship between technological uncertainty and formalization: as uncertainty increased, formalization decreased (Hrebiniak, 1974; Van de Ven, et.al., 1976; Comstock and Scott, 1977). The same studies also showed that as the work of the unit increased in uncertainty, centralization decreased; that is, work unit structure became more participative and less hierarchical. However, we cannot employ these studies to answer the question of what difference it makes to the organization, in terms of unit effectiveness, that this particular pattern of work unit technological influence upon structure seemed to exist.

Three studies have tested contingency theory at the work unit level[1]: Schoonhoven (1981), Argote (1982), and Fry and Slocum (1984). Each of these studies will be briefly summarized.

Schoonhoven's (1981) primary purpose was the elucidation of methodological problems in contingency theory data analysis. Her elegant tests of several of

---

[1] These studies were not included in the review by Fry, which covered the period 1965-1980.

Galbraith's (1973) hypotheses have value both for content as well as methodological design. Schoonhoven presented the contingency theory argument that uncertainty was presumed to undermine organizational effectiveness unless it was met by structural features designed to absorb the information uncertainty (Schoonhoven, 1981, p.357).

In a study of operating rooms (OR's) in seventeen hospitals, Schoonhoven tested the interaction between workflow uncertainty and structural destandardization of rules and procedures and decentralization of decisionmaking. Her outcome variables included rates of morbidity and mortality.

Schoonhoven extrapolated from Galbraith's work the general form of the contingency hypotheses, assuming a multiplicative relationship between uncertainty and structure: the greater the task uncertainty, the greater the impact of a dimension of structure on effectiveness (Schoonhoven, 1981, p.353).

Schoonhoven concluded from her data that:

> ...traditional versions of contingency theory like Galbraith's (1973) underrepresent the complexity of relations between technological uncertainty, structure, and organizational effectiveness. We found multiplicative forms of interaction between technology and structure... Destandardization [and] decentralization had different influences on effectiveness, which depended on the level of workflow uncertainty (1981, p.369).

Like Schoonhoven, Argote's (1982) hospital emergency room study employed the technological dimension of workflow uncertainty (specifically, input uncertainty), On the structural side, Argote focussed on the dimension of coordination, measured by nurses' perceptions and categorized as programmed (rules, authority) or unprogrammed (autonomy, policies). (Note that Argote's coordination resembled Schoonhoven's destandardization.) The conceptual links to Thompson (1967) were clear.

Effectiveness was operationalized as promptness of care and quality of medical care, both measured perceptually. Her results did not support a direct correlation between input uncertainty and the use of non-programmed coordination methods, but there was a significant interaction, such that programmed means of coordination made a greater contribution to organizational effectiveness under conditions of low uncertainty than under conditions of high uncertainty (Argote, 1982, p.425). Conversely, nonprogrammed coordination mechanisms had a greater influence on work unit effectiveness when uncertainty was high.

In the most recent test of contingency theory at the work unit level, Fry and Slocum's (1984) police department study drew from the theory of Perrow and Thompson to create perceptual measures of three technology dimensions: exceptions, analyzability of search

procedures, and task interdependencies. Structural measures of complexity (specialization), formalization, and centralization (hierarchy of authority and participation in decision-making) were also perceptual, with the exception of specialization, which was measured by the number of occupational specialties and their distribution within the work unit. Effectiveness variables were operationalized as perceptual measures of performance and commitment.

Unfortunately, Fry and Slocum did not meticulously link analysis methods, results, and hypotheses in the manner of Schoonhoven, but it appeared that both noncontingent, or universal findings, as well as contingency-based findings are present in their results. For example, main effects of specialization (more specialized units were lower performers) were documented. However, contingency findings included the observation that narrow spans of control led to higher commitment under conditions of low analyzability. That is, structure and technology had a joint effect on the outcome of commitment. Also, commitment was highest in workgroups in which span of control is narrow, under conditions of analyzable search.

C. Contingency Theory Summary

While bits and pieces of contingency theory have

yielded evidence to support them, this area is still poorly understood. The results of contingency theory studies suggest trends which are strong enough to pursue and yet unrefined enough to require much more work before conclusions can be formulated. The relationships between work unit structure, technology, and effectiveness are dynamic, and traditional contingency theory "underrepresents the complexity among dimensions" (Fry and Slocum, 1984, p.239). Studies by Schoonhoven, Argote, and Fry and Slocum were good steps forward in exploring "which elements of structure, under what conditions" (Pfeffer, 1982, p.162), affect which elements of effectiveness (Tosi and Slocum, 1984, p.12), but further work needs to be done.

While it is not difficult to achieve a consensus that technology and structure are multi-dimensional constructs, there is less agreement on the dimensions themselves. There are two problems regarding construct dimensions: precision in dimension naming and selection of key dimensions. For example, technological "uncertainty" has also been called "routineness," "manageability," and "variability." Terms are not used consistently across research studies. The second problem has been selection of the key dimensions within a construct. For example, if technological dimensions include input uniformity, input predictability, uncertainty, com-

plexity, specialization, multiplicity of outputs, and many others, the possible combinations of technology dimensions plus structure and outcome dimensions are large. Individual researchers' selections of particular combinations of dimensions have varied quite a bit, thus reducing consistency and comparability in the results (Pfeffer, 1982). This area of inquiry is still in the developmental stage of achieving consensus on terminology and focus regarding structure-technology dimensions.

Controversy also exists regarding operationalization of variables, especially on the issue of perceptual versus objective measures. Most studies have included a mixture of objective and perceptual measures, with a tendency toward perceptual measures of structure and objective measures of technology. Fry's (1982) review of studies showed no significant differences in results, when objective measures were compared to subjective measures.

Guidelines for new research in this area can be extrapolated from the tradition of both the management classics and recent studies: (1) "fit" research requires an outcome measure to adequately test the model; (2) dimensions of technology should be related to dimensions of structure and dimensions of the outcome construct; (3) the group, or work unit, level of analysis is the most appropriate single level of analysis (of course,

across-level studies are always useful); (4) data analysis should be linked specifically to hypotheses; and (5) multiple methods for statistically determining fit should be employed.

D. Sociotechnical Systems Overview

While contingency theory acknowledged some influence from systems theory, sociotechnical theory is very strongly rooted in the early general systems thinking of (among others) Angyal (1941) and von Bertalanffy (1959), as well as the elaborated organization-specific applications of Katz and Kahn (1966) and Kast and Rozenzweig (1979).

General dynamics of systems are presented in an early paper by Angyal (1941), whose emphasis was on the system as a distribution of members in a dimensional domain, rather than a group of linear relationships or an aggregate. "In aggregates, it is significant that parts are added: in a system it is significant that parts are arranged" (p.26). From a physics and biology perspective, von Bertalanffly (1959) elucidated the characteristics of open systems, which maintain themselves through a process of materials import and export with their environment. Despite this continuous exchange process, which involves change of system components, the system remains constant, in a "dynamic

equilibrium." "A closed system in equilibrium does not need energy for its preservation, nor can energy be obtained from it. To perform work, however, the system must be not in equilibrium, but tending to attain it" (p.71).

Another major difference between closed and open systems is that in most physical systems, the final state is determined by the initial conditions, but in open systems the final state may be reached from different initial conditions and in different ways, due to the principle of equifinality (von Bertalanffly, p.76).

Emery and Trist's (1960) application of open systems theory to the problems of organizing emphasized the need for "flexibility of technical productive apparatus" to adjust to input and output variations and maintain a steady state despite "mutual permeation of an organization and its environment" (p.28). The role of technology, from this view, was neither passive (as in the human relations school of management theory) nor dominant (as in the industrial engineering approach), but rather a critical component of the work unit, to be studied in detail and in relation to the social system.

Technology does exert influence on work unit structure, but because of the equifinality principle, more than one structure may be fitted to a particular

task. Emery and Trist did not argue that any structure A accomplishing task X was as good as structure B or C or D. Because their definition of effectiveness was the joint optimization of both the social and the technical systems, Emery and Trist took the position that even when a particular technology lends itself to a rigid division of labor (or a mechanistic structure, in Burns and Stalker's terms), that structure suboptimizes the social system to such an extent that technological advantages may be significantly offset.

In addition, a mechanistic structure is fraught with technical disadvantages resulting from structured rigidity (described in detail by Emery, 1966 and 1977). Although they focussed in detail on the innovative work unit design first documented by Trist and Bamforth (1951), Emery and Trist insisted they were not prescribing semi-autonomous work groups for all work settings (p.288).

More recent work in this area emphasized several key points about technology. First of all, technology--defined as "the application of science to invent technique and its supportive artifacts (machines) to accomplish transformations of objects (materials, information, people) in support of certain objectives" (Davis and Taylor, 1976, p.105)--itself embodies the psychosocial values and assumptions of its designer.

That is, sociotechnical systems theorists have emphasized the mutual influence of larger social system environmental contexts and particular organizational technologies. This is in contrast to the contingency theory perspective of technology as a more immutable given.

The second major point about technology emphasized in sociotechnical theory was the historical, evolutionary development of technology. Davis and Taylor (1976) described three roles for the worker vis-a-vis his/her technology: energy supplier, guider of tools, and finally, diagnoser and adjuster of difficulties (See also Amber, 1962). The post-industrial era new technologies such as microprocessor electronic processing settings are stochastic rather than deterministic systems (Davis and Taylor, 1976, p.108). They do not require the simple physical power of the worker, for example, carrying boxes; nor the control of the worker operating a forklift; but the more complex and cognitive maintenance function of the worker regulating highly automated transformation processes.

In discussing the unique technical system attributes of service organizations, Mills and Moberg (1982) described in detail why the mechanistic models common to manufacturing settings are rarely appropriate in service settings. They noted that the service

recipient and service worker must interact to produce the service, and the nature of the recipient's reactivity is often not predictable. Therefore, service workers are continually faced with novel situations that require unique methods--not the reliance on past procedures.

Mills and Moberg elaborated on the dysfunctional nature of highly centralized and standardized social structures, because:

> Moving toward closed systems of logic in the conversion process implies restricting the exchange of information between [recipient] and service worker. Less customization is permitted; instead, the transaction has a take-it-or-leave-it character. The social nature of the interaction between the two parties becomes more formal, allowing the client/customer little support in the social construction of service utilities. In effect, the client/customer is reduced to a symbol which is at best processed rather than changed. (Hasenfeld, 1972)

It is unclear whether Mills and Moberg argued against mechanistic structures in service settings, but for them in industrial settings, thereby implicitly supporting contingency theory. Or, as this reader interpreted, there open-systems analysis of service settings has a great deal of applicability to industrial settings, thus supporting sociotechnical theory.

For sociotechnical systems theorists, contingency theory dimensions of technology such as exceptions and analyzability have not been of central interest (though

Perrow and Thompson are referenced widely in the sociotechnical literature) as variables discriminating work units. Rather, the sociotechnical perspective identified the macro-environmental technological trends described above and observed that those trends required new work unit structures if system needs for maintenance and long-term survival are to be met.

Social structure concepts seem less extensively and precisely developed than technological concepts in this school of thought. The central construct is roles, or activities which individuals perform in patterns which are "complementary or interdependent with respect to some common output or outcome; they are repeated, relatively enduring, and bounded in space and in time" (Katz and Kahn, 1966, p.89). Sociotechnical theory concerns itself with the configuration of roles composing a work unit, with special attention to the boundaries of that unit (which roles are included/excluded). The unit is itself an open sociotechnical system with the same basic characteristics as the larger, more complex whole-organization system. Of central interest is also the division of labor, the setting of job boundaries, and the discretion permitted those jobholders. These are social system choices influenced by technology, not a given attribute of the technology itself, as tends to be the view in contingency theory.

On the specific question of technology influencing structure, a key point in sociotechnical theory is that the purpose of people in a work system is their discretion. Unlike industrial era conceptions of people as extensions of machines, the sociotechnical conception is that effective work structures in the current era are those that capture their members' learnings and put them to use in the critical function of variance control. Machines increasingly do work better than people, but people's unique skill is their ability to adapt. Workers' effectiveness as diagnosers and adjusters now may depend more on how conducive their context is to problem-solving than how well they have mastered the technical steps of the throughput process under stable or ideal conditions, which rarely seem to exist.

Jelinek has described the characteristics of effective structures as supporting organizational learning; providing the means to transfer individual and subjective knowledge into the organizational or objective realm; enabling or encouraging members to do new things over time to maintain and improve performance, although individual organization members change.

Work unit structures congruent with new technology requirements cannot be specified a priori and without regard to the details of the specific setting, but certain factors have consistently appeared in the socio-

technical literature. These can be broadly summarized under the category "organic structure," as described by Burns and Stalker (1961). Recalling contingency theory structure dimensions, we could say that--in general--a de-emphasis on hierarchy and standardization, and an emphasis on participation in decision-making would be characteristics of effective work unit structures, regardless of the technological dimensions characterized by Perrow. Information and feedback (without resorting to tall hierarchies of information flow) available at the work unit level, combined with the decision-making process at this level, are conducive to effective unit functioning because employees' learning is more efficiently and effectively captured and applied.

We have seen how sociotechnical theory argues that work structures conducive to high levels of organization commitment in workers are a necessity for effective functioning because of the new technology, in which supervisors decreasingly can serve as technical experts and controllers of workers performing the technical process. However, there is a second reason for designing high discretion and participation work structures: the social environment.

Specific changes noted in sociocultural norms regarding work in America today include an increasing emphasis on personal self-fulfillment (Kerr, 1979), and

"full enjoyment as well as full employment" (Yankelovich, 1979). Also, there is growing adherence to norms of entitlement; the importance of autonomy, responsibility, and achievement at work (Katzell, 1979). There is more challenging of the principle of deferred gratification (Etzioni, 1979). Employees today seek more voice in their work setting and more of the conditions associated with the construct of "quality of working life," as described in detail by Davis and Cherns (1975).

In an era where massive demographic and cultural shifts have altered the values and expectations of the workforce, industrial era work structures a la scientific management will not be conducive to high commitment and high performance. A workforce with a high average level of education and the values of the 1970's and 80's will not function effectively under a mechanistic structure, according to sociotechnical theory. Thus, the new technology and the "New Breed" (Yankelovich, 1981) of worker both require work structures which maximize both variance management and quality of work life needs.

These structures encourage workers to do what is appropriate, when it is appropriate, because: (1) workers <u>cannot</u> be closely supervised (by persons or policy manuals), and (2) they will <u>refuse</u> to be closely

supervised (or subvert manifestations of close supervision). It is therefore imperative, says this theory, that organizations develop in their members some level of spontaneous and innovative behavior that goes beyond routine prescribed behavior (Katz, 1964).

Sociotechnical system conceptions of organizational or work unit effectiveness are markedly different from traditional American management approaches. While efficiency (output in relation to resource investment) and effectiveness (goal achievement) are important, an open systems viewpoint emphasizes the value of flexibility and adaptability to the outside context or environment, so that long-term effectiveness may be enhanced. Under conditions of environmental turbulence, narrowly-defined efficiency and effectiveness of the output at one point in time do not ensure the system's ongoing survival.

The question then becomes, do certain structural characteristics promote or facilitate adaptability and flexibility as well as productivity? And do these structural characteristics have a direct influence upon these outcomes, or is structure mediated by technological characteristics? This question will be addressed in the present study.

E. Discussion

Sociotechnical theory does share commonalities with contingency theory, including the U.S.-U.K. parallel development during the same period of time, the past three decades. Both approaches have reacted against limitations of classical management theory. Sociotechnical theory also specifically addressed the inadequacies of the exclusively social-system models, such as the human relations school, which neglected to invest adequate attention to the technological side of work units.

More importantly, both streams of thought are structuralist, in that the complex total social and technical system is their focus, and they are "concerned less with individual differences in actors than with the situationally shaped roles they perform" (Gouldner, 1955). These are both theories of contextual dynamics in organizational structure and process.

These are also both theories of congruence: contingency theory technology-structure "fit" is echoed in Trist's remarks about "the best match between technical and social components" and "goodness of fit between the substantive factors" (1981, p.10). Davis and Canter spoke of "work systems requiring a fit among the organization, the technology, and the requirements of individuals" (1955, p.3). However, the "fit" sought

in contingency theory is one of prediction resulting from patterns observed repeatedly in empirical, highly quantified studies, whereas the sociotechnical fit has not been described in terms of matching a priori and abstract technology and structure dimensions. Socio-technical fit has usually been discovered through intensive case study in either an action research or participative organization design/redesign process.

Contingency theory has strived for a kind of technological determinism (Van de Ven and Joyce, 1981; Lawrence, 1981), whereas sociotechnical theory has tried to articulate general structure-effectiveness principles.

Moreover, their respective ways of knowing are quite different. Attempts to summarize published accounts of sociotechnical work unit restructuring programs, and to extrapolate essential evidence to support or refute structure-effectiveness hypotheses, suffer from severe problems such as a dearth of published reports (in proportion to the actual number of field studies), lack of quantification of variables, lack of comparability of variables across studies, and the full array of threats to causation conclusions accompanying non-experimental field study designs (See Kelley, 1983).

While the consistency of the contingency theory

literature is conducive to incremental, hypothesis-testing progress in theory-building, the richness of theory in the systems literature seems to capture more aspects of organizational life. Perhaps there is some potential for a synergistic blending of the two perspectives.

F. Theoretical Models and Hypotheses of This Study

The present study is an attempt to incrementally contribute to the literature from both sociotechnical theory (STS) and contingency theory (CT) perspectives. Diagrams of key theoretical elements of this study are presented in Figures II-1 through II-5. The nature of structure-technology fit and misfit for the variables of interest in this study are illustrated in Figure II-1. A four-celled matrix illustrates the CT argument that under low uncertainty conditions (i.e., predictable work), STANDARDIZATION and CENTRALIZATION are possible due to low information requirements at the point of worker task performance (Hrebiniak, 1974). The rationale is that since these structural attributes, or methods of employee control (Pfeffer, 1982, p.154) are cheaper for the organization, they should be used whenever a low-uncertainty technology is employed.

Cell 4 shows that under conditions of high technical uncertainty, preprogramming is not possible because exceptions in the task are so frequent, and the worker

has more relevant information for problem solving, than higher roles in the hierarchy (Van de Ven and Delbecq, 1974, p.184; Hage and Aiken, 1969).

Cells 1 and 4 illustrate conditions of structure-technology "fit," and CT predicts higher effectiveness for units exhibiting this fit.

The "misfit" of Cell 2 is commonly discussed in the literature. That is, under high uncertainty conditions, inflexible application of preprogrammed rules and/or referral of many task-related decisions up the hierarchy (and the consequent condensation or distortion of information that involves) result in less effective work outcomes.

The misfit of cell 3 is rarely mentioned in the literature. Regarding the desired outcome of employee commitment, Fry and Slocum (1984) argued that "Participants will be more committed if their time is not wasted by involvement in decisions with obvious solutions" (p.228). (See also, Strauss, 1982.)

Researchers have not typically argued that this type of misfit is <u>dysfunctional</u>. Rather, the argument seems to be one of <u>efficiency</u> (i.e., standardization and centralization are less expensive because lower-skilled persons can perform the tasks). The STS literature has taken an alternative view, however, criticizing work system designers' attempts to disaggregate and overly

rationalize tasks in order to create the "technical certainty" that ostensibly lends itself to highly mechanized structures. As Davis has pointed out, this is a short-sighted view:

> Thus the costs of items such as labor turnover, absenteeism, amount of learning time, lack of flexibility in work skills, and product quality deficiencies are not considered in designing jobs conventionally [i.e., highly fractionated]....The philosophy of designing jobs was built upon the concept that still persists of minimizing <u>immediate</u> financial costs with little operational consideration given to the concept of minimizing <u>total</u> costs.
>
> Davis, 1977, p.85-102

Looking across the top half of the matrix (highly standardized and centralized structure), we are reminded of Burns and Stalker's (1961) characterization of the "mechanistic" work unit. Van de Ven and Drazin (1974) called it "the systematized mode." The lower half of the matrix (low standardization and centralization) was characterized as the "organic" structural type by Burns and Stalker, and the "discretionary" or "developmental" mode by Van de Ven and Drazin.

Figure II-2 presents an idealized graphed form of the statistical relationship predicted by CT. It shows a joint effect of structure and technology, in that the effect of structure upon effectiveness varies with the level of technology.

The STS concept of fit does not lend itself to a

neat two-by-two matrix, but Figure II-3 is an attempt to capture the key theoretical elements. We see that technology and social structure are components of larger technical and social systems that both contain elements of choice by organization designers. While the social system may offer more choice than the technical system, both are still social inventions. The STS view of technological uncertainty emphasizes the more-or-less omnipresent variances which all work involves; these are deviations from the predicted norm which must be handled by the worker. They must be managed: identified, prevented, minimized, etc.

STS argues that social systems characterized by high levels of discretion and flexibility, coupled with high participation in decision-making, at the point of task performance (low in the hierarchy), will promote better quality outcomes. Moreover, these structural attributes are more consistent with the expectations of today's educated workforce, and thus more enhancing of their quality of work life. The combination of these two factors should enhance effectiveness and commitment.

The structure-technology statistical relationship, a simple main effect of structure upon effectiveness, is illustrated in Figure II-4.

Figure II-5 presents both models: the CT joint effect of structure and technology upon effectiveness,

and the STS main effect. These are the models to be tested in the current study. The specific hypotheses associated with these models are presented below.

Contingency Theory Hypotheses

H1a. The greater the technological uncertainty, the greater the positive impact of destandardization on effectiveness.

H1b. The greater the technological uncertainty, the greater the positive impact of destandardization on commitment.

H2a. The greater the technological uncertainty, the greater the positive impact of decentralization on effectiveness.

H2b. The greater the technological uncertainty, the greater the positive impact of decentralization on commitment.

Sociotechnical Theory Hypotheses

H3a. Destandardization will positively influence effectiveness.

H3b. Destandardization will positively influence commitment.

H4a. Decentralization will positively influence effectiveness.

H4b. Decentralization will positively influence commitment.

This study employs two methods of assessing structure-technology fit. The first and more traditional method involves a statistical interaction produced by a multiple regression procedure. While this method is established and appropriate, some potential problems

have been identified. For example, there is the difficulty of decomposing and assessing the effects of interactions versus the effects of intercorrelations, when correlations among structure and technology are high (Green, 1978). Also, there are theoretic limitations of this more reductionist view which attempts to generalize from discrete variable pairs to whole-unit processes.

In response to these concerns, Van de Ven and Drazin (1985, and Drazin and Van de Ven, 1985) have developed an innovative approach to testing structure-technology fit hypotheses. Beginning with the concept of equifinality, they interpret fit as

> "feasible sets of equally effective alternative designs, with each design internally consistent in its structural pattern and with each set matched to a configuration of contingencies facing the organization. However, because analytical procedures for examining equifinality in organization design remain to be developed, only the pattern-analysis approach is discussed [here]."
>
> Drazin and Van de Ven, 1985, p.520.

These two forms of fit (statistical interaction and pattern analysis) are not mutually exclusive and can provide unique and complementary information (Drazin and Van de Ven, 1985, p.522). Yet, it appears that no one except Van de Ven has published work that employs more than one fit analysis method.

Figure II-1
DIAGRAM OF STRUCTURE-TECHNOLOGY FIT FROM
CONTINGENCY THEORY PERSPECTIVE

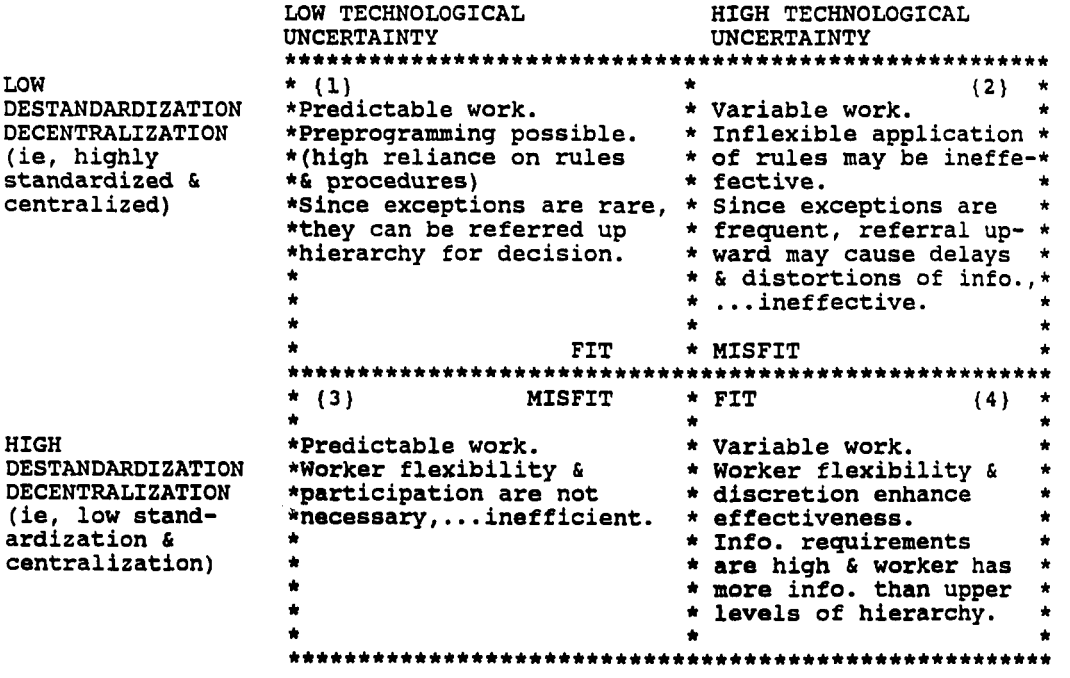


Figure II-2
DIAGRAM OF STRUCTURE-TECHNOLOGY INTERACTION
FROM CONTINGENCY THEORY PERSPECTIVE

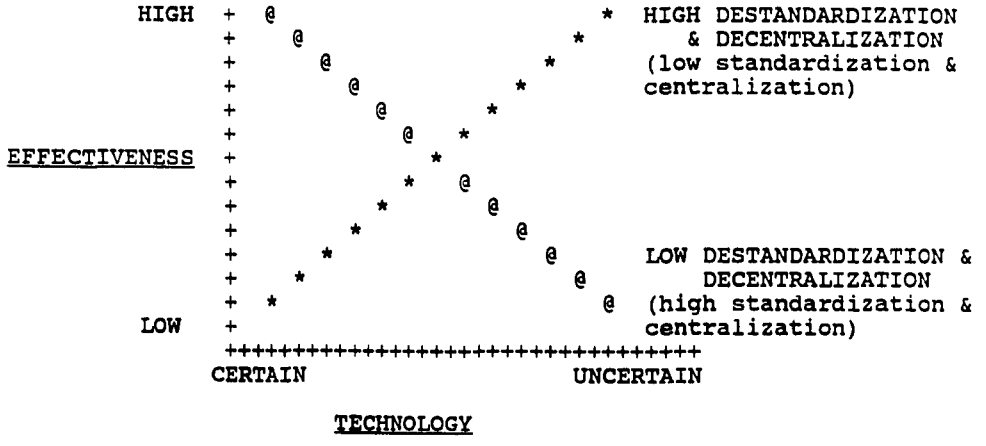


Figure II-3
STRUCTURE-TECHNOLOGY FIT FROM
SOCIOTECHNICAL THEORY PERSPECTIVE

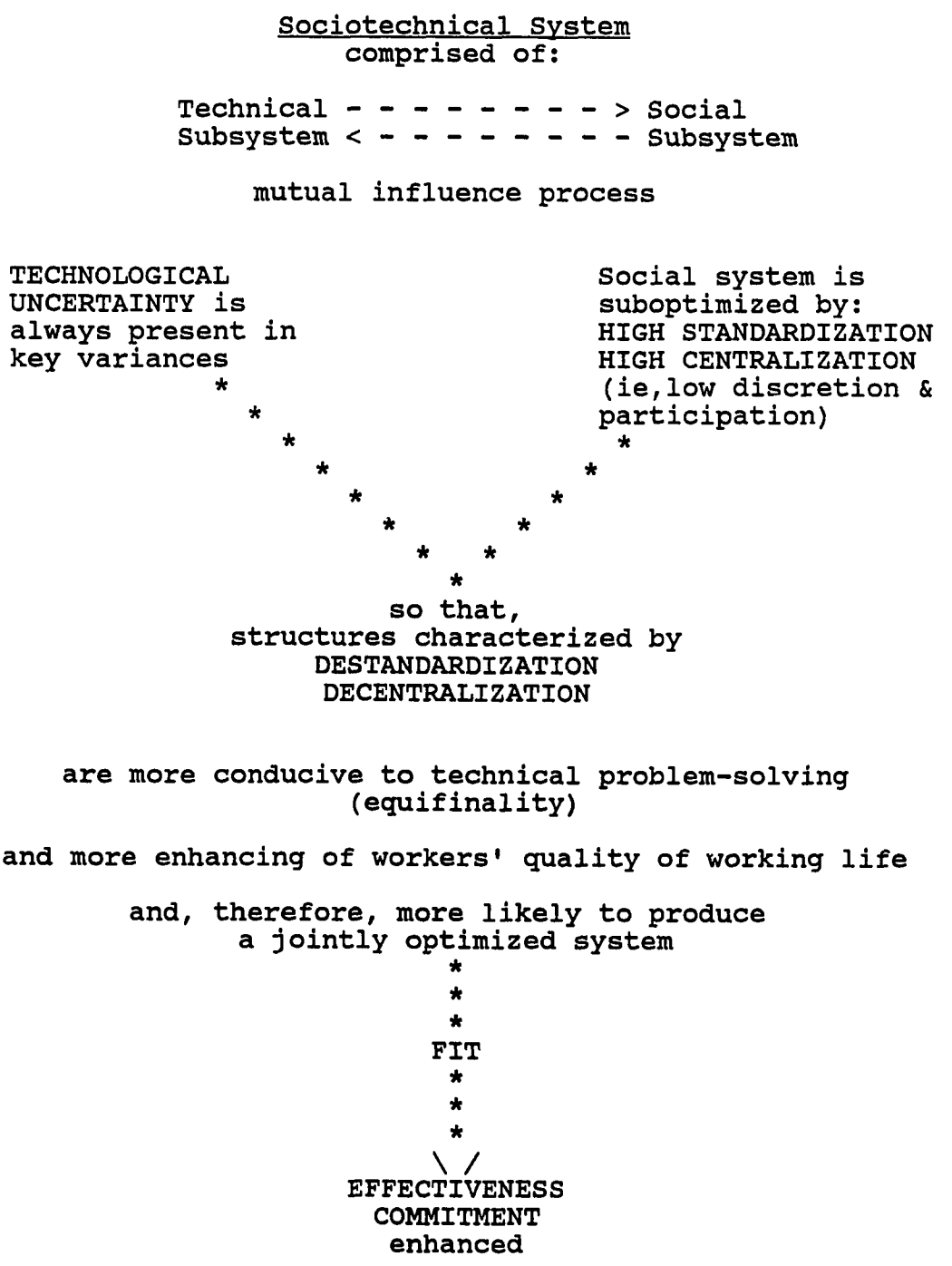


Figure II-4
DIAGRAM OF STRUCTURE-TECHNOLOGY RELATIONSHIP
FROM SOCIOTECHNICAL THEORY PERSPECTIVE

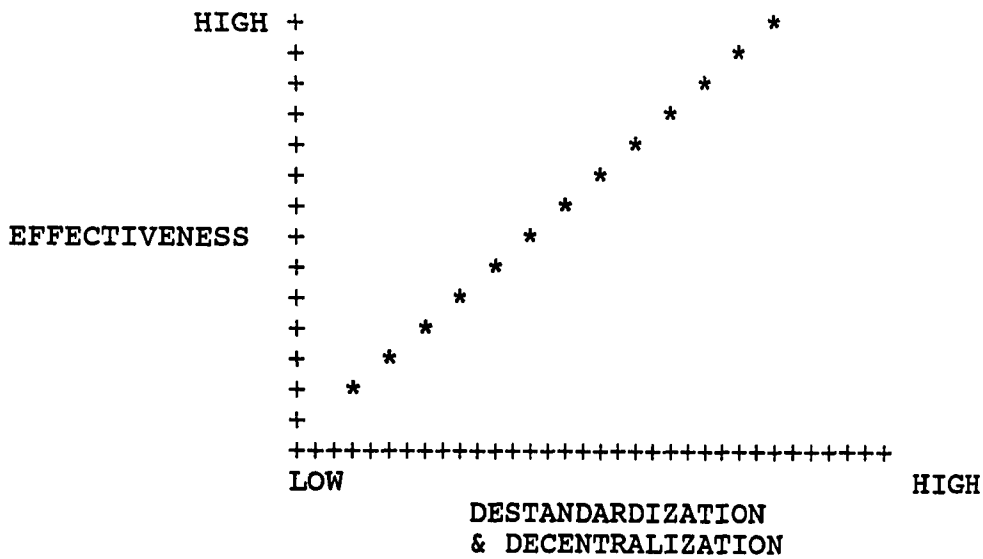
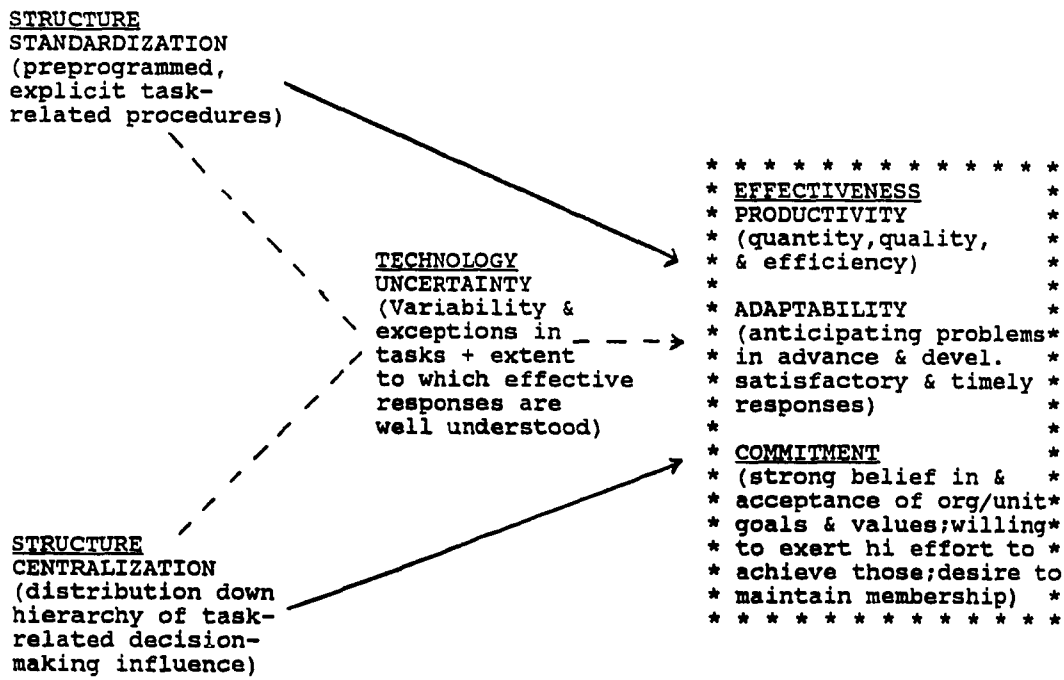


Figure II-5
DIAGRAM OF MODELS TO BE TESTED



Contingency Theory Model: - - - - Influence of structure depends upon technological uncertainty.

Sociotechnical Theory Model: ——— Influence of structure is direct, under most levels of technological uncertainty.

III. RESEARCH METHODOLOGY

A. Setting, Work Units, and Participants

SETTING. The hospital setting was selected for this study for three reasons. First, technology-structure relationships have been most carefully examined in hospital studies (Bell, 1967; Hrebiniak, 1974; Comstock and Scott, 1977). Two of the three published studies focusing on tests of contingency theory at the work unit level, are hospital studies. (The third is a service but non-medical setting.)

Secondly, since this writer has had over ten years of experience in hospitals, such a setting makes intuitive sense as an initial focus of a larger research program.

However, the hospital setting presents unique challenges to the organization researcher. For example, service organization outputs tend to be abstract or intangible (Fuchs, 1968; Sabolo, 1975), thus creating measurement difficulties in assessing output or productivity (Fuchs, 1969; Glisson and Martin, 1980). Also, personal service or people-processing technologies are "knowledge technologies" (Perrow, 1967; Thompson, 1967) and require a high capacity for information processing at the point of service delivery (Galbraith, 1973).

Employees in these types of service industries are continually faced with novel situations that require unique responses, and so cannot rely on past procedures (Emery and Trist, 1965; Terreberry, 1968). This is partially a function of the reactive nature of the throughput (i.e., persons who are service recipients) as well as the often poorly understood cause-effect relationships in people-processing technologies. It is the latter factor--technological or task uncertainty--that is of special interest in the present study.

While hospitals employ a variety of non people-processing supportive technologies (such as food services, building maintenance, accounting, and pharmacy), the "core" or primary technologies of medical and nursing care, as well as the supportive technologies such as radiology, inhalation therapy, and physical therapy, are personal service technologies.

Three hospital sites were selected for this study: two private general hospitals and one tax-supported public hospital. Two are located in California, and one is in the Midwest. All three hospitals are roughly equivalent in size with approximately 300 beds each. (See Appendix 1 for a discussion of unit size issues.) Although not a randomly selected or stratified representative sample of all hospitals, this is a fairly homogeneous sample appropriate for a study of unit-level

characteristics.

WORK UNITS. The present study focuses on the nursing unit level of analysis, rather than the hospital as a whole, or individuals within units. As discussed in the literature review, until recently, the organization level of analysis was most favored in technology-structure studies. This approach either assumes a single technology and structure or, in the case of Woodward (1965) and Khandwalla (1974), fails to specify the influence of the "core technology" upon the various work units.

Efforts to relate technology and structure measures at the organizational level are extremely hazardous because organizations tend to employ a variety of technologies and to assign parts of the technology to different groups or members. The "solution" of averaging certain measures across the whole organization tends to mask information of interest and relevance to technology-structure fit theories. Even the macro-organizational researchers concluded that technology appears to have a greater impact at the unit level or in small organizations (Hickson, et.al., 1969; Reimann, 1980).

A more recent trend, and less influential, according to Gerwin (1976), has dealt with organizational

components or work groups. Statistical findings are strongest at the work unit level (Fry, 1982). Pfeffer (1982) and Scott (1981) both agree that failure to find results in so many technology-structure fit studies may be in part the result of conducting studies at the incorrect level of analysis.

While selection of the work unit level of analysis seems appropriate, it is not without problems. First, it is essential in operationalization of constructs that the variable of interest is able or likely to vary across work units. Powell and Dimaggio (1983) caution: "At any level of the organization, there usually exists a more macro level that imposes, at least in part, uniform practices and prescriptions upon more micro units." Van de Ven & Drazin (1985) reiterate:

> In the case of organizations, there are many structural characteristics of subunits that do not reflect their immediate task environment, technology, resource dependence, or size, but instead reflect the uniform policies and rules of the overall organization. [i.e., are a consequence of prior design decisions] Performance variations among organizational subunits should only be expected to result from <u>those context and design factors that vary and are at the discretion of the people within the subunits</u>."
>
> Drazin and Van de Ven (1985, p.5) (emphasis added.)

Secondly, measures developed for work unit level hypotheses must be consistent with this level of focus. Unit technology measures based on tasks performed by

individuals assumes homogeneity within the subunit. This has been a problem in previous work unit level studies, in which work groups contained employees utilizing very diverse technologies (e.g., Mohr, 1971; Meadows, 1980).

Intraunit homogeneity is not problematic in the present study, because it can be argued that nursing care is the core or primary technology of nursing units, and that the functions of other unit member roles (such as a single unit clerk and a small part-time maintenance crew) may be omitted without harm to hypothesis testing. It is true that patients undergo a variety of treatment procedures which are performed by hospital employees who are not viewed by nurses as unit team members, but rather as consultants or specialists who visit the unit (or the patient may be transported off unit) by specific request of a physician or nurse to perform specific technical activities. These supportive technologies are undertaken by social workers, intravenous technicians, radiation personnel, chaplains, nutritionists, and many others. Physicians themselves may be seen as unit members in absentia, wielding power but not intimately part of the day-to-day social community of the unit.

Clearly, alternative organization research methodologies such as ethnographic study and action research would more readily accommodate these complex role rela-

tionships and capture the complexity and nuance of the various interactions among unit members and unit specialist visitors. However, in the present study, a more narrow definition of work unit task and structure characteristics is required for a feasible test of the hypotheses.

PARTICIPANTS. In three hospitals, all registered (R.N.) and licensed (L.V.N.) nurses[1] and their supervisors (head nurses) from all inpatient[2] units were asked to complete a brief questionnaire. (See Appendix 2.) Nurses were selected as respondents because there is consistently strong support in the literature for the view of nurses as clearly identified members of well-bounded sociotechnical units, whereas physicians occupy roles which tend to span unit boundaries and perform transformation processes in a variety of off-unit locations (Heydebrand, 1973). Also, a number of research findings have shown that the judgments of nurses are often highly correlated with those of physicians (Georgopoulos and Mann, 1962; Schoonhoven,

---

[1] Only dayshift nurses were available as respondents in Hospital 1.

[2] Although labor and delivery, post anesthesia care (also known as recovery), dialysis, and emergency units have an ambiguous status regarding the in/outpatient dichotomy, these types of units were also included in the study.

et.al., 1980).

Because the survey questionnaire was an anonymous document whose content is not generally regarded as "sensitive" material, nor potentially damaging to the respondent's welfare should her/his responses become known outside of the research, this study was designated as exempt from review by the UCLA Human Subject Protection Committee.

B. Variables and Measures

Data for all variables were gathered via questionnaire. The questionnaire is reproduced in Appendix 1.

TECHNOLOGY. As discussed in earlier sections, technology is a broad category or "metaconstruct" defined as the organizational process of transforming inputs to outputs (Perrow, 1967, 1970; Fry and Slocum, 1984, p.221). More specifically, it is defined as "the application of science to invent technique and its supportive artifacts (machines and tools) to accomplish transformation of objects (materials, information, people), in support of certain objectives" (Davis and Taylor, 1976, p.105). Organization theorists have focused on many different aspects of technology, such as characteristics of the inputs, characteristics of the outputs, and characteristics of the operations or

techniques used to perform the work. These varied conceptualizations and their concomitant operationalizations have led to inconsistency in research results (Pfeffer, 1982, p.152).

Most technology-structure studies have focused on characteristics of the transformation process, and technological or task uncertainty has been a key dimension in recent studies. There is no clear consensus about the construct of technological uncertainty. It usually refers to the extent to which work activities or materials are variable or unpredictable (Schoonhoven, et. al., 1980). A second component of the construct is the extent to which there is knowledge about how to effect desired outcomes (Perrow's analyzability concept; 1967, p.196). The frequency of exceptions (unexpected or novel events) (Mills and Moberg, 1982) combined with the extent to which effective responses to the uncertainty are poorly understood constitute the key aspects of technological uncertainty.

TECHNOLOGICAL UNCERTAINTY was measured in this study by a modified version of the Withey, Daft, and Cooper scale, which is a brief, ten-item questionnaire initially developed on a sample of work units in a large Canadian government agency. It combines the strongest items from a pool of all items from seven previous

studies of measures for technological uncertainty (Van de Ven & Delbecq, 1974; Van de Ven & Ferry, 1980; Sims, Szilagyi, & Keller, 1976; Daft & Macintosh, 1981; Lynch, 1974; Hage & Aiken, 1969; Glisson, 1978).

Examples of items in the Withey, et. al. scale are, "To what extent is there an understandable sequence of steps that can be followed in doing your work?" and "Nurses on this unit depend more on experience than on formal knowledge from courses or books."

Criteria for item inclusion in the final scale included face validity, factor structure, and ability to differentiate among work units. Factor analysis by Withey, et. al. (1983) revealed two factors that corresponded to Perrow's dimensions of exceptions and analyzability (1967, p.196), plus the dimension of routine-nonroutine calculated from the overall scale. There is a strong case for employing the routine dimension as an operationalization of the technological uncertainty construct (Comstock and Scott, 1977, p.180).

The internal reliability coefficient was calculated at .83.

STRUCTURE. Organization structure has been defined as the arrangement of roles for carrying out the tasks required to translate inputs to outputs (Perrow, 1979, p.166). Like technology, structure has been termed a

"metaconstruct" aimed at capturing the pattern of events in the social system (Fry and Slocum, 1984), including both role content and role relationships.

The dimensions of structure most frequently addressed in technology-structure work unit studies are centralization and formalization. While these specific terms are more commonly seen in contingency theory literature, the constructs they represent are also very central to the concerns of sociotechnical theorists.

As described in the literature review, the strongest technology-structure relationships have been of the following type: under conditions of high technological uncertainty, decentralized structures will be more effective. An often-studied component of centralization is span of control, but in the present study this dimension is not expected to vary across units because in hospital nursing units, span of control is determined at the hierarchic level above the unit.

A unit's level of decentralization of decision-making (also described as participativeness) is expected to vary across medical units, however. Decentralization in this study refers to the level of participation staff nurses have in work-related decisions on their unit. It is sometimes equated with "distribution of power" (Price and Mueller, 1986, p.51) and the degree to which power is differentially distributed within an organization

(Hall, 1982, pp.114-115).

Two measures of DECENTRALIZATION of decision-making were initially employed in the present study:

(a) Schoonhoven (1981) and Comstock & Scott (1977) measured decentralization of decision-making in hospital operating rooms in a two-step procedure. First, influence scores for the social position of staff nurse and the social position of unit head nurse are calculated (from a context of several hospital positions); then the centralization of influence is determined by subtracting the score of the staff nurses from the score of the head nurse. The scale is then reversed.

Influence is sometimes viewed as synonymous with constructs such as power and control. Influence here is defined as the ability of organization members "to affect organizational decisions, for example, decisions about goals, policies, personnel, or work" (Comstock and Scott, p.189). In Comstock and Scott's study, after pretesting of a sample of twenty different decisions, four emerged as central. In the interest of limited survey space, one has been selected and adapted for the present study: the decision to supplement existing nursing staff through overtime, borrowing across units, or registry. This is a decision which occurs daily, has a great influence upon the quality and quantity of

nursing work accomplished, and there is considerable variability in how nursing units make this decision. This is a resource distribution decision as opposed to a task performance decision (Hage and Aiken, 1967, pp.510-511; 1970, p.38).

(b) In a 1975 dissertation, Ford developed a questionnaire measure of decentralization of decision-making/participativeness which--although never published--continues to be employed in recent technology-structure fit studies (Fry and Slocum, 1984).

During initial coding of data in this study, a number of questionnaires contained written-in comments on the Ford scale items. Question 19, "Decisions related to my job are made without my involvement," was unclear to some respondents in that the kind of decision and social position of decision-maker were not specified. Given this study's commitment to level-of-analysis precision, this question is poor because the decision-maker is not specified as a unit member, but may be construed as a supra-unit social position, such as a nursing manager or hospital administrator. Question 20 is the most specific since it specifies the head nurse as focal decision-maker. ("The head nurse on this unit makes decisions related to my job without consulting me.") However, the type of decision could be

construed variously and inconsistently by respondents.

Because of these ambiguities, the Ford index was eliminated from data analysis in this study.

Formalization, operationalized here as standardization of rules and procedures, is also a dimension of structure of interest in technology-structure fit studies, and one which is expected to vary across units.

DESTANDARDIZATION of rules and procedures was measured following Comstock and Scott (1977). Their questionnaire items ask nurses how explicit procedures are under specific circumstances, including (1) dress or attire on the unit, (2) returning to work after an illness, (3) conditions under which overtime is requested, (4) arrangements under which nurses may accept verbal orders from physicians, (5) time by which patients' baths must be completed, and (6) personal break time during shift. A seventh item was added for the present study: exchanging/sharing duties with fellow nurses.

These items were combined to provide a single index measure of an individual's perceived destandardization of rules and procedures on her unit. The reliability coefficient (internal consistency) in prior research (using the 6-item scale) was calculated at .827, indicating a highly reliable measure.

These index items were originally selected because they relate specifically to unit work activities, governing areas of behavior likely to be influenced by task uncertainty in the unit, rather than by administrative and policy mandates from above the unit's hierarchical level. These items related to the flexibility and autonomy of unit nurses in adjusting the timing and coordination of their work activities to meet the changing patient care requirements. On a highly standardized unit, specific pre-existing rules would be applied uniformly to these circumstances. On destandardized units, a process of mutual adjustment by staff members as group (or subgroups) would govern nurses' behavior regarding these situations.

Comstock and Scott defend their selection of a perceptual measure of destandardization:

> We believe our approach, which focuses on participants' perceptions of explicitness, provides a more accurate reflection of standardization than the more commonly used measures based on the extent to which rules and regulations are written. There may be a discrepancy between such written codes and the effective determination of staff members' behavior. By focusing on the extent to which participants perceive that rules have been explicitly formulated to govern specified areas of conduct, we hoped to assess more accurately the degree to which rules, written or unwritten, guided behavior (1977, p.199).

Schoonhoven (1976, p.89) emphasized the relevance of "unwritten but collectively understood" rules and proce-

dures. Price and Mueller concur:

> Uniformity of operating procedures is formally established by most organizations. Sets of explicit rules and regulations, generally written, are typically issued to establish the preferred uniformity. This is not always the case, however. Uniformity can emerge within an organization informally, usually over a period of time, without the support of a set of explicit and written rules and regulations. Since standardization can emerge formally or informally, it must not be confused with formalization.
>
> Price and Mueller, 1986, p.237

Another, more sociotechnical systems approach to measuring destandardization is to elicit nurses' descriptions of key variances they experience, as well as descriptions of their techniques for managing those variances. Their responses could then be content-analyzed for the tendency to use preprogrammed or standardized means of variance management (e.g., referring to written policies and procedures) versus unstandardized means (e.g., discussion with peers on nursing team).

EFFECTIVENESS. As discussed earlier in this section, measures of effectiveness are particularly problematic in service settings (Glisson and Martin, 1980). Nursing outputs are primarily "abstract and intangible" (Mills and Moberg, 1982, p.469). In a

hospital setting, there are no well-established methods of measuring effectiveness of nursing units, that is, the unit's "ability to create acceptable outcomes and actions" (Pfeffer and Salancik, 1978, p.11).

Quality of care is of primary interest in hospitals, but there is no consensus in health care literature regarding appropriate ways to assess this dimension. Recent efforts to operationalize quality of care have required extensive human resources in the form of multiple trained registered nurse raters (Hegyvary, et. al., 1979; Alexander and Rudolph, 1985).

Other effectiveness measures focus on patient outcome, such as morbidity and mortality rates, which are more appropriately applied to studies of homogeneous types of units, such as post-operative units (Schoonhoven, 1981), whereas in this study the intent is to maximize interunit heterogeneity.

Most technology-structure hospital studies have avoided this measurement problem by simply not addressing <u>fit</u> (contingency) hypotheses, and therefore omitting effectiveness measures as beyond the scope of their hypotheses.

A compromise position that while not ideal, still has merit, is to employ measures of <u>perceived</u> effectiveness. Argote (1982) used perceptual ratings by unit members on factors such as promptness-of-care and

quality-of-nursing-care (on both absolute and comparative scales) in an emergency room setting.

Similarly, Fry and Slocum (1984) responded to the effectiveness measurement problem in their police department study by selecting a generic perceptual effectiveness instrument developed by Mott (1972). This 8-item index measures overall effectiveness as well as the component factors of productivity (quality and quantity of patient care) and adaptability (anticipating and preventing problems; prompt and widespread adjustment to change).

The internal reliability rating for the effectiveness factor was calculated at alpha=.96 by Fry and Slocum. A previous study by Fulk and Wendler (1982) reported an alpha value of .84 in their study of managerial and clerical employees.

In an earlier effort, on a smaller and narrower scale, Georgopoulos and Mann (1962) used a survey item for physicians to rate quality of patient care. The measure was significantly correlated with outside physicians with knowledge of the hospital and to ratings (by doctors) of nursing care; it was inversely correlated to infant mortality rates at each hospital. In this study of fifty-one hospitals, it was found that the judgements of key hospital employees (nurses, laboratory technicians, and managers) were significantly related to

those of physicians, suggesting that multiple groups in the hospitals made evaluations by essentially the same criteria as physicians (p.198-264).

The Mott scale has several advantages as an outcome instrument for the present study. First, it allows expert raters (unit supervisors) to apply their formal and informal standards and knowledge of unit members' collective performance. Secondly, it goes beyond the short-term effectiveness dimension of productivity to the longer term effectiveness dimensions of adaptability and flexibility, which from a sociotechnical systems point of view are critical outcomes to ensure long-term effectiveness of the unit system. Sociotechnical theory predicts that a decentralized, destandardized work unit structure will promote adaptation and flexibility. Thirdly, the reliability and validity of the Mott scale need to be tested in various industries.

In two consecutive studies of twelve divisions within the Office of Administration of the National Aeronautics and Space Administration (NASA), the Mott Effectiveness Scale correlated highly with top management's ratings (r=.72) and moderately well with external division ratings (r=.55). The division effectiveness scores of the first round were correlated (r=.68) with the second round scores collected 1 1/2 years later. The authors concluded that the effectiveness index is a

valid and inexpensive measure.

In the present study, both staff nurse and supervisor responses to the Mott scale were examined.

Sample Mott questions include, "What is the quality of services provided on your unit?" "Do nurses on your unit seem to get the most out of the resources (people, materials and equipment, etc.) they have available?" "How well do the nurses on your unit anticipate problems in order to prevent or minimize them?"

COMMITMENT. Organization commitment may be defined as the strength of an individual's identification with and involvement in a particular organization.

> Such commitment can generally be characterized by at least three factors: (a) a strong belief in and acceptance of the organization's goals and values; (b) a willingness to exert considerable effort on behalf of the organization; (c) a definite desire to maintain organizational membership."
>
> Porter, et. al., 1974, p.604

Organizational commitment has been an outcome of interest in both contingency and sociotechnical theories, although it is more central to the theoretical framework of the latter. While contingency theorists may focus on the value of commitment as a predictor of turnover and absenteeism, the sociotechnical theorists see commitment as a fundamental outcome of a work system designed along the principles of this school of thought.

As discussed in the literature review, the socio-technical perspective posits that because of macrotechnological trends, specifically the transition from deterministic to stochastic technologies, employee control mechanisms of the past are no longer suitable. Because the nature of contemporary work precludes supervision as we have traditionally known it, commitment is the vehicle by which managers can expect employees to do what is appropriate, when it is appropriate. That is, the discretion to manage key variances as the employee/team see fit (discretion afforded by structural arrangements of the workgroup such as decentralization and destandardization) is necessary but not sufficient for output effectiveness, because the discretion must be applied consistently toward the organization's goals. Commitment of individual employees to those goals provides the link between the enabling conditions of the work group structure, and the improved performance outcomes.

The most prominent measure of organizational commitment was selected (and modified from a 7 to a 5-point scale) for this study. Porter, Steers, Mowday, and Boulian's (1974) 15-item scale has been used to measure the individual's commitment to the organization. This scale combines attitudes and behavioral intentions, two important aspects of commitment, into a summative

index of commitment. Mowday, et. al. (1979) and Ferris and Aranya (1983) have reviewed the psychometric properties of the original scale. Internal consistency reliabilities range from .82 to .93. In Van Maanen's (1975) police department study, internal consistency reliability was reported at .73. In Fry and Slocum (1974), the reliability was alpha=.89.

The literature on commitment is concerned with the individual-organization link rather than the individual-unit link. Like the question of over-aggregation in technology construct measures, commitment may be a construct with a very different meaning at the unit or group level versus the organization level. For this study, data were collected on both unit and organization commitment. The former is more appropriate to the study hypotheses, while the latter is included for comparative purposes.

Sample commitment items include, "I feel very little loyalty to this unit" (reverse scored). "I would accept almost any shift or assignment in order to keep working for this unit." "I really care about the fate of this unit." "This unit really inspires me to do my best."

INTERDEPENDENCE. A second exploratory variable included in this study is interdependence. Van de Ven,

Delbecq, and Koenig (1976) defined it as follows:

> Interdependence at the work unit level of analysis is the extent to which unit personnel are dependent upon one another to perform their individual jobs (p.324).

Fry and Slocum (1984) said interdependence occurs "when performance of one or more discrete operations has consequences for the completion of others" (p.225). However, elsewhere in the same paper, they also said interdependence was, "the degree to which individuals are dependent on and support others in task accomplishment" (p.225). It is unclear whether they understand the construct to mean task-generated or social system-generated working together. Mohr (1971) measured interdependence with this survey item, "Mine is pretty much a one-person job; there is little necessity for checking or working with others." Here, the level of analysis has shifted from the task to the job.

Interdependence traditionally has been considered a technology dimension (March and Simon, 1958; Thompson, 1967; Galbraith, 1972). However, it could also be categorized as a structure dimension (See Rousseau, 1984, p.348; Lynch, 1974; Stanfield, 1976) because in most contexts there is a range of choice in the division and organization of labor for a particular technology. Here is a construct in which boundaries among technology, technical system, and social structure seem to

blur.

Sociotechnical theorists would argue that "jobs" are social role constructions, not technological givens. Interdependence results from the allocation of tasks to roles, which in STS theory is a process laden with "social system choices made intentionally or included accidentally" (Davis, 1977). For example, if a hospital follows the "primary care" model of nursing practice, all units are characterized by low interdependence. However, if the hospital employs "team nursing" there is high interdependence among nurses. Technology is probably a secondary influence after social system design factors.

Nevertheless, interdependence is a construct widely discussed and relevant to technology-structure fit issues, so it was operationalized and included in this study for exploratory purposes.

Two types of interdependence were identified and measured: nurse-to-nurse and nurse-to-doctor. A single questionnaire item tapped each construct; the items were borrowed from Overton, Schneck, and Hazlett (1977). The items were, "What percentage of the time do you highly depend upon other nurses in your unit for help and/or they depend upon you?" "How many patients on your unit

have more than one attending physician prescribing care?"

C. Data Collection

In each of the three sites, the Vice President for Patient Care (i.e., the highest ranking nurse) was the contact person who provided access to staff nurses and head nurses of nursing care units. In Hospital 1, the Vice President for Patient Care notified head nurses that a university researcher would conduct a survey of interest to the hospital. The investigator then contacted each head nurse, described the study in broad terms ("Nurses' perceptions of their work and their units"), and delivered a packet of questionnaires which the head nurses than distributed either in mailboxes or at a unit meeting.

In Hospitals 2 and 3, face-to-face contact with individual head nurses was not feasible; questionnaires packets were distributed to head nurses at a meeting. Method of distribution is probably not a significant variable in this study, since Hospitals 1 and 3 have response rates that are not significantly different (41% and 38% respectively).

Staff nurses and head nurses completed their respective versions of the questionnaire. (See

Appendix 1.) For purposes of this study, only the effectiveness variables of the head nurse sample are relevant and included in the analysis.

Table III-1

List of Variables and Questionnaire Location

A. Key Variables

ACRONYM	VARIABLE	LOCATION (question #)
UNCERTN	technological uncertainty	9 - 15
DESTAND	destandardization	23a - 23g
DECENT	decentralization	24
COMUNIT	unit commitment	49 - 63
	effectiveness	25 - 33

Staff	Head RN	Combined	
EFFECT	EFFHD	EFFECALL	overall effectiveness
PRODUCT	PRODHD	PRODALL	productivity
ADAPT	ADAPHD	ADAPALL	adaptability
PRODQUAN	QUANHD	QUAN	quantity of output
PRODQUAL	QUALHD	QUAL	quality of output
PRODEFF	EFFHD	EFFIC	efficiency
ADAPANTI	ANTIHD	ANTIC	anticipatintg & preventing problems
ADAPAWAR	AWARHD	AWARE	awareness of technical innovations
ADAPRMP	PRMPHD	PROMPT	prompt adjustment to those innovations
ADAPREV	PREVHD	PREV	proportion of staff who do so
FLEX	FLEXHD	FLEXIB	handling emergencies

B. Demographics

ACRONYM	VARIABLE	LOCATION (question #)
AGE	age in years	1
SEX	sex	2
RACE	race/ethnicity	3
STATUS	employment on salary or per diem basis	4a
TENUNIT	tenure on this unit	4b
TENHOSP	tenure at this hospital	4c
EDUC	level of college education	5
LICENSE	level of nursing license	6
TENPROF	tenure in the profession (years since licensed)	6
LANGUAGE	native language	7
HOURS	length of usual work week (ordinal categories)	8

C. Exploratory Variables

Acronym	Variable	Location (question #)
INTERRN	interdependence among nurses	21
INTERMD	interdependence between nurses and physicians	22
---	key variances and responses	16
COMORG	organization commitment	34 - 48

IV. DATA ANALYSIS AND RESULTS

A. Response Rate and Sample Demographics

1. RESPONSE RATE. Questionnaires were distributed to 16 units in Hospital 1; one unit declined to participate. Fifteen units were approached in Hospital 2, and one also declined to participate at this site. Ten units participated from Hospital 3. A total of thirty nine units were surveyed. All completed questionnaires were usable.

The sample of units included a variety of specializations, such as obstetrics, medical-surgical, and intensive care. Units varied in size, with a mean of twenty-six beds and eighteen nursing staff. (See Appendix 2 for a detailed discussion of unit size.)

The mean response rate for all respondents was 33%, and for the three hospitals, it was 41%, 28%, and 37% respectively. While not excellent, the overall response rate in this study may probably be considered adequate in relation to other mailed survey studies. Response rates of 10 - 20% are common (Bailey, 1978). Response rates by hospital, unit, and individuals overall are presented in Appendix 3.

The response rate within units varied widely from 8% to 75%, with a mean of 36%. Many reasons for not

responding may exist, including random factors such as unavailability of nurses on vacation. Non-random factors were difficult to identify in this study because since it was anonymous, characteristics of non-responders were not known. Potential biases of non-responders were examined for two demographic characteristics: shift (day, evening, or night) and employment status (per diem versus salary).

Shift did not correlate significantly with effectiveness or commitment. Status correlated negatively and weakly (-.21) with one structure variable, DESTANDARDIZATION. There was a slight tendency for salaried nurses to perceive their units as lower on DESTANDARDIZATION of rules and procedures (that is, high explicitness of rules and procedures). Because per diem nurses have lower levels of unit tenure, and because they often work part-time at more than one hospital, they may not be as aware of written and unwritten procedures on a specific unit. Also, per diem nurses may perceive unit policies and procedures as less salient, because these nurses are not striving for high evaluations and promotions within the unit. Appendix 4 displays details regarding shift and status factors.

2. DEMOGRAPHICS. The nurse respondents as a group were primarily white (83%), female (97%), registered nurses (97%), whose native language was English (90%).

Age range was wide (21 - 63 years), with a mean close to 38 years. The educational background of approximately two-thirds of the registered nurses was at the level of Associate of Arts degree or nursing diploma (two to three year programs), and approximately 30% had a Bachelor's degree. Only 22% had a Master's degree.

Tenure in the profession ranged from less than one year to forty years, with a mean of approximately thirteen years; the mean organization tenure was about eight years; the mean unit tenure was about six years.

The respondents as a whole (88%) were employed on a salary basis as opposed to per diem. A 40-hour work week (or longer) was typical of 55% of the respondents, with 41% working 20-39 hours per week and 4% working less than 19. Thirty-nine per cent of the nurses worked on the day shift; 14% on evenings, and 6% at night. Only dayshift nurses were available for survey participation at Hospital 1, which accounts for the imbalance across shifts in this sample. Forty per cent, all at Hospital 2, work on rotating shifts according to a hospital-wide policy.

Demographic characteristics were reviewed to identify potentially significant interhospital variation, but none was found. Therefore, the hospitals were considered demographically homogeneous for purposes of this study. Details of demographic findings are

presented in Appendix 5.

B. Preliminary Analysis and Results

1. EFFECTIVENESS VARIABLE. The first preliminary finding was that the operationalization of EFFECTIVENESS was more complex than originally predicted.

Unit EFFECTIVENESS was measured perceptually from the perspectives of both nursing staff and head nurse of each unit. It could be argued that the staff nurses, being closer to the phenomena, had a more accurate picture of unit effectiveness. It could also be argued that using perceptions from a single group-- staff nurses-- for both predictor and outcome variable measurement was methodologically weak, whereas the independent assessment of unit effectiveness (by head nurses) was preferable.

The correlation between staff nurses' unit mean scores and supervisors' scores was unexpectedly very low, with r=.03 {[1]}, suggesting little convergent validity in the measure. In other applications of the Mott scale, supervisor-staff correlations were much higher, such as .72 (Mott, 1972, p.193) and .33 (Fry and Slocum, 1984, p.231).

To better understand this low rate of agreement

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[1] In section B4 below, the study sample is revised, and this correlation increases to .11.

between staff and supervisor RN's, the effectiveness index was decomposed into its two main factors and then into the eight actual questionnaire items, for closer inspection. Table IV-1 displays the correlations between staff and head nurse ratings on the productivity factor, the adaptability factor, and the overall effectiveness index. Means were very similar for productivity, but more divergent for adaptability. The supervisor-staff correlation for productivity was .26 but only .04 for adaptability. This might be explained by the fact that adaptability is a less concrete construct and open to more individual interpretation. Staff nurses perceive their units as less adaptive compared to head nurse ratings. Both staff and supervisors rated their units as lower on adaptability than productivity.

To further explore this issue, a new variable was created by subtracting the supervisor score on effectiveness, productivity, and adaptability from the unit mean of each. A discrepancy score was obtained and then graphed in a horizontal bar chart. (See Appendix 6.) Hospital 3 had a noticeable pattern of head nurses scoring their units higher than staff nurses (6 out of 8 units), but no other obvious patterns were evident.

Because the low EFFECTIVENESS staff-supervisor correlation did not necessarily mean a consistent

pattern of high disagreement, (as a high negative correlation would suggest), it was possible that there were areas of agreement and disagreement which "cancelled out" each other when aggregated to the overall index level. Responses on the eight index items were examined, comparing head nurse to staff mean for each unit, and tabulating the number of times staff mean scores were equal to, higher than, or lower than the head nurses' rating. These results are displayed in Table IV-2. Caution should be exercised in interpreting this table because it does not convey the strength of disagreement, only the direction.

A notable finding was that for productivity quantity and quality, staff nurse ratings were neither consistently higher nor lower than head nurses. But for anticipating problems and handling emergencies, staff nurses were more likely to rate their units lower than head nurses.

For purposes of hypothesis testing, a decision was required: whose ratings would constitute the outcome measure for this study? This was not a study of differing roles in a unit hierarchy, but the nurse-supervisor discrepancy was too great to ignore. Data were therefore analyzed in three parallel processes: staff ratings, head nurse ratings, and combined ratings with staff mean and supervisor weighted equally. Drazin and

Van de Ven (1985) chose this last method for unit variables (not unit effectiveness), but they did not report on the correlation between staff and supervisor scores before merging the two.

A second decision was made to analyze the EFFECTIVENESS variable three separate ways: overall effectiveness and its components of productivity and adaptability. This seemed reasonable given the discrepant ratings of these two factors.

2. CORRELATIONS. The intercorrelations of key study variables are presented in Table IV-3 and Figure IV-1. We note relatively high means (approximately 4 on a 5-point scale) for both outcome variables. Nurses in this sample perceived their units as very effective; the nurses also had relatively high commitment to their units.

We see that as technological uncertainty increases, decentralization and destandardization also increase. This is consistent with contingency theory (that is, under conditions of uncertainty, decision-making will be more local and less rule-oriented). However, the specific hypotheses of contingency theory involve linking these structure-technology patterns with outcomes, and the correlations here are insufficient to address the specific hypotheses.

While technological UNCERTAINTY and EFFECTIVENESS

did not significantly correlate as rated by staff (and this is consistent with our theories), head nurses did view higher UNCERTAINTY units as significantly less EFFECTIVE than lower UNCERTAINTY units (r=-.362).

EFFECTIVENESS and COMMITMENT were highly correlated (r=.527). It would be difficult to infer directionality of influence from this statistic, since it is plausible that highly committed RN's become more effective (or perceive their unit as more effective) from a "halo effect," or highly effective RN's feel more committed to their unit as a result of this instrumental competence.

The finding of a significant but negative correlation between COMMITMENT and DESTANDARDIZATION is striking and contrary to theory.

Before proceeding with regression analysis, the issue of multicollinearity was addressed. Multicollinearity is a statistical condition that occurs when predictor variables are highly correlated with each other; because the variables overlap in their contribution to the outcome(s), reliability of the regression coefficient is reduced. In this data, DECENTRALIZATION and DESTANDARDIZATION were significantly correlated (r=.46), but the hypotheses do not incorporate both structural variables simultaneously, so their influence on EFFECTIVENESS and COMMITMENT could be considered separately, without statistical problem.

A second multicollinearity issue in this study was the correlation between technological UNCERTAINTY and each of the two structure variables: r=.54 for DESTANDARDIZATION, and r=.48 for DECENTRALIZATION. This is consistent with the literature that has examined the technology-structure relationship, which predated contingency theory research (reviewed in Fry, 1982). Since neither of the two interventions to ameliorate multicollinearity (combine the variables or delete one) is appropriate here, we proceeded with the regression analysis, realizing that this condition would reduce the statistical effects of the technology-structure interaction contribution over and above the contribution of technology or structure alone.

3. REGRESSION ASSUMPTIONS. The data were reviewed to determine if the assumptions underlying linear regression were indeed fulfilled. Results of this review are summarized below.

(a) Linearity. Scatterplots of each outcome variable (EFFECTIVENESS, HEAD RN EFFECTIVENESS, COMMITMENT) regressed on each predictor variable (UNCERTAINTY, DECENTRALIZATION, DESTANDARDIZATION) were visually inspected for linearity. Scatterplots were suggestive of linear relationships (with notable outliers) in the DECENTRALIZATION plots, but the HEAD RN EFFECTIVENESS version was negative in direction, while EFFECTIVENESS

was positive. Stronger, but negative, linear relationships were indicated in COMMITMENT regressed on UNCERTAINTY and on DESTAND, and EFFECTIVENESS and HEAD RN EFFECTIVENESS regressed on DESTANDARDIZATION. The EFFECTIVENESS/UNCERTAINTY plots did not appear linear, which is consistent with theory.

(b) Normality. Univariate distributions were obtained and examined. They were all moderately normal, with slight positive or negative skewness. Regression statistics are robust to moderate skewness in the distributions.

(c) Homoscedasticity, or homogeneity of variances, was ascertained by inspection of the residuals plots. Residuals are the calculated deviation of observed values from predicted values in the regression equation. Sufficiently symmetric scatter of points above and below the residual mean of zero was observed in all plots.

(d) Independence. This assumption requires values of the variables to be statistically independent of each other. Two potential threats to independence are a self-selected sample (where the self-selection factors influence key variables) and respondents influencing each others' questionnaire answers. Any voluntary, mailed questionnaire data collection procedure is vulnerable to these problems. In this study,

self-selection factors related to a range of demographic variables were reviewed in the earlier section on demographics. Discussion among respondents, while clearly possible, was not believed to be a major factor here, given that most nurses completed the questionnaires at home (this information was gleaned informally by the investigator). Also, nurses were specifically instructed on the cover sheet and in verbal instructions from their head nurse, to not discuss the questionnaire until after answering the questions.

4. SAMPLE REVISION. Scatter plots revealed an outlier unit (Unit 5) that was markedly and uniquely deviant in all plots of structure and outcome variables (both staff and supervisor outcomes). Examination of residuals plots also showed this unit to lay two or three standard deviations from the mean of residuals for most of the key variables. Raw data were reviewed for coding errors, but none were identified. This unit and its head nurse responded in a unique and deviant manner. Unit 5 had a respondent sample size of one; perhaps if more than one staff nurse had responded from Unit 5, the extreme responses of this nurse would have been tempered by responses of her coworkers. Since the survey was anonymous, it was not possible to interview this respondent or further explore her interpretation of the questions.

The decision was made to eliminate Unit 5 from the sample, yielding a revised sample size of 38 units. Revised correlations are presented in Table IV-4 and Figure IV-2. Notable changes included an increase in the DECENTRALIZATION-COMMITMENT correlation from a non-significant value to .35. The correlation between DESTANDARDIZATION and both COMMITMENT and EFFECTIVENESS decreased, with the latter no longer significant. However, the DESTANDARDIZATION-HEAD RN EFFECTIVENESS correlation increased and became significant. Finally, the multicollinearity problem decreased but still remained in the UNCERTAINTY-DESTANDARDIZATION, UNCERTAINTY-DECENTRALIZATION, and DESTANDARDIZATION-DECENTRALIZATION correlations.

C. Hypothesis Testing

1. REVIEW OF HYPOTHESES. The data analysis for this study was a process of competitive theory testing. Two sets of hypotheses were tested:

Contingency Theory Hypotheses

H.1a. The greater the technological UNCERTAINTY, the greater the positive impact of DESTANDARDIZATION on EFFECTIVENESS.

H.1b. The greater the technological UNCERTAINTY, the greater the positive impact of DESTANDARDIZATION on COMMITMENT.

H.2a. The greater the technological UNCERTAINTY, the greater the positive impact of DECENTRALIZATION on

EFFECTIVENESS.

H.2b. The greater the technological UNCERTAINTY, the greater the positive impact of DECENTRALIZATION on COMMITMENT.

Sociotechnical Theory Hypotheses

H.3a. DESTANDARDIZATION will positively influence EFFECTIVENESS.

H.3b. DESTANDARDIZATION will positively influence COMMITMENT.

H.4a. DECENTRALIZATION will positively influence EFFECTIVENESS.

H.4b. DECENTRALIZATION will positively influence COMMITMENT.

In statistical terms, we were comparing significant main effects predicted by STS to significant interaction effects predicted by CT. Posed as research questions, CT asked, does technological uncertainty mediate the effects of structure upon effectiveness and commitment? STS asked, are certain structural features conducive to effectiveness and commitment under most technological conditions?

2. EXPLANATION OF STATISTICAL CRITERIA. Each of the eight hypotheses were tested in three separate stepwise regression analyses with forced entry and predetermined order of variables. The first analysis was conducted using staff effectiveness ratings. The second analysis employed supervisor ratings, and the third analysis employed effectiveness ratings combining

and equally weighting staff mean and supervisor scores.

Our theories predicted two kinds of effects of predictor variables (technological uncertainty and structure) upon outcome variables (effectiveness and commitment to unit). STS predicted main effects (Hypotheses 3a-4b), while contingency theory predicted joint effects (Hypotheses 1a-2b).

Therefore, each stepwise regression procedure entered variables in this fashion:

Step 1. Structure variable.

Step 2. Technology variable.

Step 3. Product term for structure and technology variables.

A standardized regression coefficient was generated for each step. An incremental increase in the proportion of variance explained (R Square) in the outcome variable was also generated for each step. R Square at Step 1 reflected the main or direct influence of structure. R Square at Step 2 reflected the incremental increase in influence of technology, controlling for structure, (that is, statistically holding it constant). At Step 3, R Square reflected the incremental increase that the product term (structure-technology interaction) had over and above the contribution of Steps 1 and 2.

A regression term (or step) was deemed significant if either the R Square alone or the regression coeffi-

cient and the R Square were statistically significant at the .10 level or less. Ideally, both figures should be significant. However, since we know that multicollinearity across predictor variables tends to reduce incremental R Square values (Pedhazur, 1982, p.63 and p.181), the use of incremental R Square increase as a criterion will be more rigorous than the regression coefficient alone.

In reference to interaction terms, three cautions regarding interpretation are in order:

> a. When an interaction is significant, it is difficult to comment on main effects because different levels of one predictor differ in effect on the outcome depending upon that predictor's combination with the second predictor (Pedhazur, 1982, p.350; Kirk, 1968).
>
> b. It is difficult to interpret the regression coefficient of an interaction term because two vectors of data are represented. It "poses logical problems in that one attempts to make a statement about the expected change in Y as a result of a unit change in X, while holding X and Z constant" (Pedhazur, 1982, pp.413, 428).
>
> c. "Because of high multicollinearity [between interaction variable and its component variables], increments in the proportion of variance accounted for [R Square] by product terms [interactions] are generally very meager" (Pedhazur, 1982, p.428).

Another cautionary point is that since each step in the procedure represents a different type of effect upon

the outcome variable, "it is inappropriate to compare [the R Square values] for purposes of determining relative importance of variables [from different steps]" (Pedhazur, 1982, p.183).

For each stepwise regression, there were four possible outcomes relevant to the competitive theory hypotheses. These outcomes and hypotheses are as follows:

	Significant Main Effect (Step 1)	Significant Interaction (Step 3)
a. Evidence for STS hypothesis	YES	NO
b. Evidence for CT hypothesis	NO	YES
c. Evidence for CT hypothesis	YES	YES
d. No evidence for either hypothesis	NO	NO

3. REGRESSION ANALYSIS RESULTS

To facilitate understanding of statistics presented in Tables IV-5 through IV-8, two summary tables have been constructed. Beginning with Table IV-9, we see that one of the four contingency theory interaction hypotheses is supported (H.2a.) based on the staff effectiveness data. There is also <u>partial</u> support for that hypothesis based on the combined supervisor-staff data. (Table IV-10 shows that this CT hypothesis is

supported for productivity but not adaptability.)

Regarding the sociotechnical main effects hypotheses (H.3a. - H.4b.), there are both positive and negative significant results. Table IV-9 shows that for H.3a., there is partial support based on the staff data but contradictory evidence based on the supervisor data. That is, DESTANDARDIZATION had a significant main effect on PRODUCTIVITY as rated by staff, but a significant negative effect on all components of EFFECTIVENESS as rated by supervisors. For the combined supervisor-staff data, H.3a. was supported. (See also Table IV-10.)

For the other STS hypotheses, there was evidence against H.3b but supportive of H.4b. H.4a. was not supported.

D. Exploratory Analysis

1. PATTERN ANALYSIS. One of the objectives of this study was to employ multiple methods of data analysis. The first and more traditional method involves a statistical interaction produced by a multiple regression procedure. While this method is established and appropriate, some potential problems have been identified. For example, there is the difficulty of decomposing and assessing the effects of interactions versus the effects of intercorrelations, when correlations among structure and technology are high (Green,

1978). Also, there are theoretic limitations of this more reductionist view which attempts to generalize from discrete variable pairs to whole-unit processes.

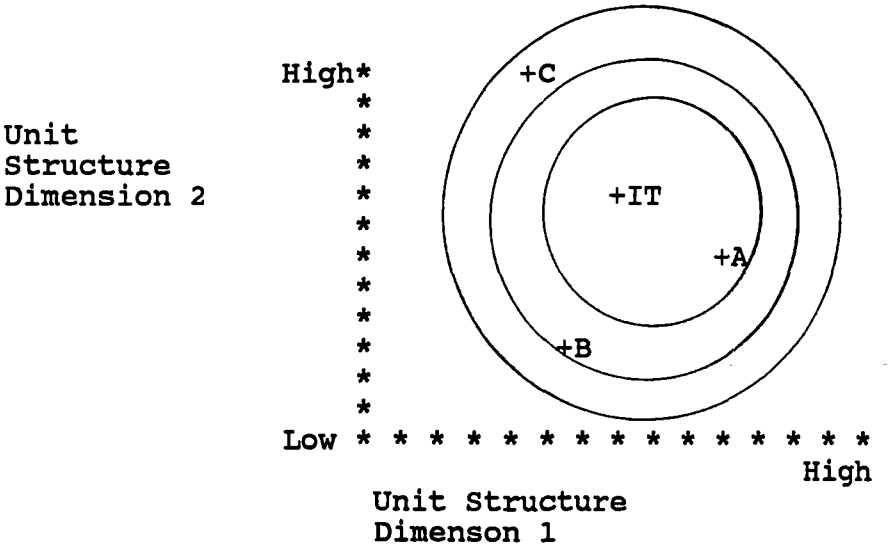
In response to these concerns, Van de Ven and Drazin (1985, and Drazin and Van de Ven, 1985) developed an innovative approach to testing structure-technology fit hypotheses. Beginning with the concept of equifinality, they interpreted fit as,

> "feasible sets of equally effective alternative designs, with each design internally consistent in its structural pattern and with each set matched to a configuration of contingencies facing the organization. However, because analytical procedures for examining equifinality in organization design remain to be developed, only the pattern-analysis approach is discussed [here]."
>
> Drazin and Van de Ven, 1985, p.520

These two forms of it (statistical interaction and pattern analysis) are not mutually exclusive and can provide unique and complementary information (Drazin and Van de Ven, 1985, p.522). Yet, it appears that no one except Van de Ven has published work that employs more than one fit analysis method.

In pattern analysis, specific patterns of organization structure are constructed as ideal types, given specific contextual variables, such as technological uncertainty. Then actual organization patterns are compared to this ideal type, and organization outcomes

are expected to decrease as distance from the ideal type increases. An adaptation of Drazin and Van de Ven's explanatory figure is shown below:



IT = Ideal Type
A = Highest Performing Unit
B = Moderately Performing Unit
C = Lowest Performing Unit
Circles = Contours of Decreasing Performance

Unfortunately, pattern analysis could not successfully be applied to this study's data, so the method was abandoned. Details regarding the pattern analysis procedures and problems in this dataset are presented in Appendix 7.

2. QUALITATIVE DATA. In an attempt to obtain a richer picture of the problems and problem-solving processes in this sample of nursing units, page two (Question 16) of the questionnaire was devoted to

eliciting a description of key variances that nurses encounter, the causes as they see them, and the types of actions they take that usually are successful.

Upon reviewing this qualitative data, it became clear to the investigator that the survey questions certainly did not substitute for a thorough technical system investigation and key variance analysis. However, since such an inquiry was beyond the scope of this study, the gathered data were studied, coded according to major themes, and presented here as a composite picture that hopefully captures key issues for most of the units but does not have the comprehensiveness or depth of an action research case study for a particular unit.

Nurses defined "not getting your work done the way you feel it should be done" as performing procedures in a poor-quality way (because of time pressures, inexperience, or lack of help), ignoring less critical (but professionally highly valued) patient needs such as comfort and education, and ignoring less critical patients while attending to emergency situations. They described two "layers" of causes: intrahospital and extrahospital. Within the hospital, five major themes emerged as contributors to poor quality of care:

(a) Inadequate staffing included management's staffing by census instead of acuity (patient numbers

instead of patient needs), counting a nurse's aide as a full-time-equivalent equal to an RN (and yet duties and skills are dramatically less), and no coverage for sick-calls and vacations. On some units, one RN cared for 6-8 patients on days or 8-10 patients on evenings. In other units, one RN plus one aide covered 10-12 or 12-20 patients. Part of inadequate staffing is not by hospital plan, but due to environmental issues such as a nationwide nursing shortage, which in 1986 was estimated at 13.6% (rate of unfilled nursing positions) nationwide and 9% in California (Shiver, 1987).

Fluctuating staffing needs during a shift were also described, with admissions and physician rounds making mornings especially busy. On all units, but especially intensive care units, the sudden deterioration in a patient demands the nurse's full attention, leaving care, procedures, and medications for other patients unattended.

(b) Inadequate support services. A major change in nursing units in the past few years has been the reorganization of and cutbacks in ancillary services. These days, nurses often transport their patients to other departments (such as X-ray, EKG), carry specimens to the lab, go to a central storeroom to pick up supplies, run (literally) to the pharmacy for STAT medicines, etc. Nurses frequently must go off-unit for

resources that formerly were delivered to them. Moreover, the role of unit clerk/secretary is now considered optional by nursing management, such that when a patient census drops below a certain point, the clerk is removed from the unit, or one is not assigned to begin with, or no clerk is on the evening shift. This results in nurses handling a large volume of phone calls with families, doctors, and other hospital departments.

(c) Peer Nurses. The primary issue in this category is the extensive needs of new nurses for orientation and training by more experienced nurses, at a time when there is a high proportion of new nurses on most units. In this sample, nurses complained of peer inexperience and lack of skill, and some respondents described their own inadequacies and the anxiety this caused.

A similar drain on experienced nurses was identified as the registry RN's (temporary staff from a private agency) and float RN's (temporarily floated, or reassigned, from other units within the hospital). Both groups tended to be inexperienced (in their temporary duties) and not especially invested in learning because of the short-term assignment. It is easy to imagine the hardship to all staff of psychiatry nurses floated to medical-surgical units, or oncology nurses floated to

intensive care, and this was reportedly a frequent occurrence.

Within the nursing profession itself, there is debate about "non-professional" (basic care & monitoring, such as bathing, bed changing, feeding, vital signs) versus "skilled nursing" (IV, specialized procedures, monitoring of electronic equipment, counseling and teaching patients) duties, and how division of labor should address these two areas of patient need. There are two prevailing approaches. Team nursing (the older approach) groups a number of patients under the care of one RN and 1-3 nurse aides. The RN acts as team leader and assigns duties to the aides. In this sample, team nurses complained of having to supervise aides closely (due to inexperience or "laziness") and feeling the pressure of responsibility for so many patients. They also said that in this system, the nonprofessional aides often performed professional tasks, which the RNs resented. The label "team" is misleading because this is actually a highly fractionated 1 person:1 task work system.

Under primary care nursing, the more recent model, an RN is assigned to a few patients and provides "total care," that is, all of the patient's nursing needs are met by her. Primary care RNs complained of their time "wasted" doing "aide-type" tasks such as changing

bedpans and filling water pitchers.

Other peer group issues occasionally mentioned by survey respondents were:

i. poor intershift communication

ii. lack of cooperation, team-work, and mutual support; laziness among some peers

iii. low morale and "burn-out"

iv. lack of support from the head nurse

(d) Paper work. The perennial problem of paper work has gotten even worse, according to nurses in this sample. Not only has quantity increased, but redundancy was a frequent complaint, and many nurses perceived that quality of charting was valued over quality of care in the contemporary socio-cultural climate of medical lawsuits. Nurses have a hard enough time just completing tasks, much less documenting every action they take on every patient. According to these respondents, few professions are subject to this requirement, and the expectations for accurate and thorough charting are unfortunately maintained through a negative-feedback system in which errors are identified by chart reviewers or lawsuits.

(e) RN-MD issues. In about 35% of the units in this sample, nurses cited problems with physicians as interfering with quality of patient care. Nurses

reported that they are faced with inexperienced residents, overly interventionist doctors (such as in labor and delivery), or condescending doctors. The last group was characterized by attributes described as "treating us like servants," "not letting us act on our own judgement," and "not approachable with new ideas."

In addition to the five major themes, other issues emerged infrequently but warrant mention:

(f) inadequate, broken-down, outdated, or unavailable equipment

(g) technical disagreements on procedures: RN versus the hospital, RN versus the doctor, RN versus the head nurse

(h) patient characteristics: too demanding, non-English speaking, demanding or interfering families, too noisy, too litigious, unappreciative (taking medical miracles for granted)

(i) a nursing department that is top-heavy on management while hurting for staff in the trenches; "too many chiefs and too few followers"

(j) the general hospital climate of budget cutbacks, costcutting, layoffs, decreasing ancillary services while increasing nurses' duties; administration valuing quantity over quality

(k) some physical design of unit problems and inadequate (and/or very noisy) nursing station space

It is notable how few times pay, benefits, hours, continuing education, and promotion were mentioned. The mandatory rotating shift policy of Hospital 2 seemed universally disliked. Nurses typically cited these areas not as causes of quality of care problems, but as reasons why there is a nursing shortage, and also why the poor working conditions (five problem areas) combined with the poor pay and hours would eventually make them leave nursing.

A graphic overview of the staff nurses' issues is presented in Figure IV-3.

Head nurse responses to this open-ended questionnaire item are summarized by parentheses overlaid on staff nurses' star symbols in Table IV-11. Interestingly, less than half of the units identified by staff as understaffed are labeled as such by head nurses; and at times they defined the issue differently-- "heavy patient load" instead of "not enough staff." A similar proportion of head nurses acknowledged the interdepartmental tasks problem.

Regarding the nursing peer group, head nurses greatly emphasized this area. Unfortunately, in addition to the inexperience problem acknowledged by staff nurses (due to use of registry, floats, and recent graduates), head nurses labelled numerous attitudinal and personality characteristics of their staff which

they believed to be the major cause of decreased quality of care: low self-confidence, improperly set priorities, lack of commitment to service, lack of motivation to learn, burn-out, negative attitude, personal problems, and interpersonal relationships and communication.

Another area head nurses listed more than staff nurses might be called "the nature of the work," including the types of patients and their treatments. Staff nurses rarely identified patient attributes as causal in care problems, and when they did it was patient attributes that directly interfered with care (such as language barrier, noisiness, family interventions, etc.). Head nurses, however, seemed to have a cognitive set of, "caring for sick people is difficult because these are sick people," or "it goes with the territory." Head nurses also seemed to underestimate the effect of paper work on their staff, or staff perceptions of paper work.

Head nurses also emphasized hospital fiscal policies and costcutting measures. But instead of making a negative attribution about these policies (such as staff nurses' comments about "quantity counts more than quality here"), head nurses stated them in neutral, explanatory ways, as a given reality of hospital life today ("budgetary constraints").

Although the work itself can be very emotionally

difficult, nurses focused on the social organization aspects of their work as most problematic. With the exception of paper work, the major themes all related to division of labor, role definition (and conflict), group cohesion and cooperation, and the effect of insufficient human resources on all these aspects of nursing care. Head nurses tended to focus on individual attributes and inadequacies and the high demands of the work itself, and how these two factors can coexist in a context of low resource availability.

Regarding coping strategies and variance management actions taken by nurses to alleviate some of the problems they described, it is difficult to identify or summarize any patterns. This questionnaire item asked respondents to choose which action (from a list) they took "that worked best" to overcome the problem. Typically, nurses took more than one action, which made quantitative analysis of this question cumbersome. Also, the word "overcome" was a poor choice because it was unrealistically optimistic; "cope with" or "improve" would have been better descriptors. Thirdly, since the overarching problem for nurses in this sample was understaffing, the most common action was no action because:

> "Nothing could be done."
> "The problem is not something I can change alone, and the resource persons are not interested."
> "cannot effect a change"

"doesn't do any good to complain"
"I am unable to regulate staffing in my position as a staff nurse."
"hospital policy"

While realistic, these comments have a note of hopelessness that probably would be maladaptive for nurses and hospitals in the long-term (e.g., contributing to burnout, absenteeism, exiting the organization, etc.). The second type of "no action" response was a "hang in there" approach, resigned but dutiful:

"keep moving--stay overtime as needed--work extra shift for adequate coverage"
"just worked with what I had"
"I decided to try to change my attitude, be more positive"
"just keep working, doing my best"

The survey identified four types of actions in addition to "other action" and "no action." The objective was to capture some key generic response modes, rather than elicit the details of a particular solution to a particular problem. These response modes loosely formed a continuum (from 2 through 4) of highly programmed (rules and authority) to less programmed (autonomous) methods of problem-solving (after Argote, 1982):

1. I made a decision without doing any of the below.
2. I referred to the policy manual.
3. I asked the head nurse how to proceed.
4. I talked it over with other nurses.

The frequency with which each action was endorsed

by respondents is presented in Table IV-12. The most frequently employed action was talking with peers (30%), followed by "other action" (24%), with no action and asking supervisor at similar frequencies (17.24% and 16.75% respectively), and lone deciding (10.34%) and policy manual (1.46%) being the least frequent actions.

These data suggested that in this sample, nurses did not tend to cope in isolation or by referring to formalized procedural references. They identified peer consultation as their most-likely-to-succeed intervention.

The "other action" category deserves closer inspection to generate examples of the responses:

> "I made a formal letter of concern about the staffing conditions."
> "I called OT to see if they could do the pt's bathing and dressing in his room, which they did."
> "I work through my break/lunch time 95% of time."
> "I asked the head nurse and supervisor to help."
> "I try to set priorities and be organized."
> "I asked supervisor why staffing was so low- refused to work alone in this situation (1 RN and 1 aide for 30 patients."
> "wrote memo to supervisor about how unsafe it is at times on floor due to understaffing"
> "went to director of nursing asking for more staff to be hired"
> "Action was taken per policy manual but policy is broken by administration when it suits their purpose. All efforts to discuss and change with immediate supervisors was discounted and nurses have no available recourse. We are puppets."
> "I joined the lab task force."

"Other actions" were primarily attempts by nurses to have a voice in the decision-making process regarding

staffing. Although occasionally these were individual resolutions to cope better, primarily these actions were protests, feeding back unit realities to the higher echelons of nursing management, and enforcing professional standards (such as not assuming responsibility in an unsafe staffing situation). None of these write-in comments was associated with positive statements about results of the nurses' actions.

One way to further analyze these data was to explore possible relationships between answers to this question and unit characteristics. Was the overall pattern of variance management strategies for all nurses reflected in patterns for subgroups of units, such as high scorers on key study variables? Is peer consultation used more frequently on high decentralization units? Also, did coping patterns vary with unit effectiveness or commitment?

Table IV-13 presents frequency data (expressed in proportion of variance management actions for a subsample of units) that addresses these questions. Looking across the rows, it appears that generally, the pattern for all units <u>is</u> reflected in the patterns for subsamples of units. One exception is the proportionately higher use of "no action" by high uncertainty units and lower use of peer consultation. Respondents' comments from high uncertainty units were reviewed

again. Many times when "no action" was endorsed, there were no additional comments, but when comments did appear, they seemed to be of two types: futility and resignation. The former type are exemplified by these answers:

> "It wouldn't do any good."
> "It's an administrative problem that I can't do anything about."
> "I don't feel that you can do much about this except maybe making it (the nursing profession) more attractive to work in."
> "I have tried before to initiate changes etc. and it usually gets me into trouble (labelled a complainer or troublemaker) with my immediate supervisor."
> "We were told that this was the way it was."
> "Hospital not willing to listen."

Examples of resignation answers are the following:

> "I do the best I can giving most time to the most critical or the ones who need the extra time."
> "I try to adjust my care to the resources available."
> "Just worked with what I had."
> "You can only do your best in a given situation; nursing administration knows the problem exists."
> "I pray a lot."

Looking vertically down the columns of Table IV-6, we note that high uncertainty units have the highest rate of "no action" responses. Perhaps when unit technology is highly complex and unpredictable, so much energy must be devoted to the tasks at hand, that coping strategies involving peer and supervisor consultation are perceived as too time-consuming; perhaps peers are less available than on less intensive units; perhaps the

risks of autonomous or peer problem-solving are greater on these units, so inaction is a safer alternative.

Looking down the other columns, we note that the only manual users are in the high destandardization units. Regarding peer consultation, the highest rate was in the high commitment units, followed closely by the high adaptive and high effective subsamples of units. It is difficult to infer directionality here: do nurses in highly peer-collaborative units therefore feel more committed? Or do high-commitment units create an atmosphere conducive to peer collaboration? A similar correlation existed for the high adaptability units. Sociotechnical theory would argue that heavier reliance upon peer collaboration problem-solving would contribute to unit adaptability.

3. Commitment to organization vs. unit As discussed in earlier sections, commitment has traditionally and almost universally been defined and operationalized at the organization level. This approach was not suited to this particular study for two reasons: first of all because of the study's focus on unit characteristics and outcomes, and secondly because in some settings (such as hospitals), the primary connection and identification for the employee (especially professional staff) is the work unit. Except for the extensive

reliance on a hospital-wide float pool in Hospital 2, nurses in this sample worked exclusively in one unit. They are probably more likely to change hospitals before changing units, because nursing specialization differentiates along unit boundaries. For example, an obstetrics nurse, is not likely to remain at her hospital if the obstetrics unit closes; nor is she likely to accept a transfer to oncology or ICU. There are exceptions, such as the situation of a nurse nearing retirement who might decide to make a change in specialty rather than jeopardize retirement benefits from her longtime employing hospital.

In this study, therefore, to explore this area a further, commitment was measured at <u>both</u> the unit and the hospital level. Unit commitment (COMUNIT) was employed throughout the data analysis because it was most appropriate to this study's hypotheses. A brief discussion of organization commitment (COMORG) findings, compared to unit commitment findings, will be presented.

The correlations for both commitment variables and the other key variables of this study are arrayed in Table IV-14. COMORG and COMUNIT correlated with each other very highly (r=.672, p=.0001). An interesting finding was that COMUNIT correlated moderately and significantly with DECENTRALIZATION, while COMORG correlated with DECENTRALIZATION at only -.05. If this

study had employed organization commitment instead of unit commitment, one of the few significant findings of the study (the significant main effect of decentralization upon commitment) would not have emerged. Comparing the regressions of both commitment variables on DECENTRALIZATION (Table IV-15, lines 1 and 7), we see that the proportion of variance in COMUNIT explained by DECENTRALIZATION is 12%, but only .03% for COMORG.

COMORG correlated higher with DESTANDARDIZATION (r=-.427) than COMUNIT did (r=-.344), though both were significant. Although DESTANDARDIZATION had a negative effect on unit commitment, there was greater negative effect upon hospital commitment, perhaps because of the perception that the hospital had not fulfilled its obligation to create and enforce explicit rules and procedures for these situations, across all units.

Regression results in Table IV-15 show the significant <u>negative</u> main effect of DESTANDARDIZATION upon COMORG and COMUNIT, though it is stronger for the former (R Square=.18 vs. R Square=.12).

It was interesting to note the very significant correlations between COMUNIT and the staff-rated outcome variables, versus the low correlations with supervisor-rated outcomes. Both types of outcomes correlated weakly with COMORG, but none were significant. We might say that staff nurses' perceptions of unit effectiveness are

quite related to the strength of their identification with their unit (whichever variable is causal), but that when external raters such as supervisors are utilized, this relationship drops dramatically.

c. Interdependence As discussed in the earlier section on methodology and variables, interdependence is a problematic construct for structure-technology fit studies because it has traditionally been categorized as a technology variable, but more recently suggested as a structure variable (Lynch, 1974; Stanfield, 1976).

Two types of interdependence were measured in this study: interdependence among nurses (INTERRN) and interdependence between nurses and doctors (INTERMD). To be meaningful in the current study, interdependence had to be explicitly categorized as either technology or structure. For purposes of contingency theory exploration, INTERRN was deemed a social structure variable because nurse-to-nurse interdependence is primarily a consequence of division-of-labor formal decisions by management or informally emerging patterns within the work unit, regardless of the particular nursing technical specialty.

For example, as discussed in the qualitative analysis section above, two very different models of patient care are employed in nursing today: team care,

with high INTERRN, and primary care, with low INTERRN. The approach is selected by nursing administration at the hospital level and usually, although not always, employed consistently throughout the hospital. This is not a very appropriate variable to test unit-level contingency hypotheses, because it will vary primarily by hospital rather than unit. However, we did proceed with exploratory analysis since the model of nursing is only one contributing factor in nurses' answers to the INTERRN question, and even within one model, interdependence could vary.

INTERMD was considered a technology variable because its operationalization (proportion of patients with more than one attending physician) is less influenced by social system decisions and is more directly a function of nursing specialty. For example, we know that obstetrics patients tend to have only one physician, whereas intensive care patients tend to have more than one.

Furthermore, an a priori ordinal rating of unit type, based on Comstock (1977), was found to correlate with INTERMD at $r=.4$ ($p=.01$). This ranking of unit type was developed by Comstock as a measure of workflow predictability, with intensive care units at the high end, medical-surgical units in the middle, and obstetric and psychiatric units at the lowest end. Perhaps nurse-

doctor interdependence reflects this increased workflow unpredictability. It also capture the task coordination and complexity problems that increase when a nurse has to communicate with several physicians regarding a single patient's care.

Correlations for both interdependence variables and other key study variables are presented in Table IV-16. The low correlation between INTERMD and UNCERTN might at first appear to be evidence against conceptualizing INTERMD as a technology variable. However, UNCERTN is a measure of exceptions and analyzability in work activities and materials, and INTERMD might be tapping a different element of technology, such as workflow predictability or task complexity.

Significant correlations were found in three areas: (1) Negative correlations between staff outcome ratings and INTERMD: Staff nurses in units with high INTERMD (that is, where a high proportion of patients had more than one attending physician), perceived their units as less effective; (2) Positive correlations between supervisor outcome ratings and INTERRN: Units with high nurse-nurse interdependence were viewed by head nurses as more effective; (3) Negative correlation between COMMITMENT and INTERMD: Nurses in high INTERMD units had lower levels of commitment.

Regression analysis was performed in these three

areas where significant correlations were found. Figure IV-4 illustrates the contingency theory relationships that were tested via stepwise regression procedures. Results are presented in Tables IV-17 through IV-20. Regression procedures followed those used for hypothesis testing in an earlier section.

Table IV-17 shows INTERMD incorporated as the technology variable, along with a structural variable, and an interaction term comprised of the product of the two. By looking at lines 3, 6, 9, and 12, we consider if INTERMD interacted with structure (either DECENTRALIZATION or DESTANDARDIZATION), to produce a significant change in the proportion of variance explained in each of the outcomes. We see that none of the interaction terms were significant.

We note that the INTERMD technology variable contributed to increases in R Square much more than the structure variables did (In Table IV-17, compare line 2 to 1, 5 to 4, 8 to 7, and 11 to 10). INTERMD appeared to be a strong predictor of <u>negative</u> unit effectiveness outcomes, when the effect of structure was held constant.

In the analysis of supervisors' ratings of unit outcomes, INTERRN was incorporated as a structure variable. We see a significant main effect of this variable (Table IV-19, lines 1, 4, and 7). However, the

interaction terms added nothing to the strength of the equation.

In the analysis of COMMITMENT to unit, RN-MD interdependence was entered as a technology variable. (See Table IV-20.) There was a significant regression coefficient and R Square change for the interaction term, meaning that INTERMD mediated the effect of DECENTRALIZATION upon COMMITMENT.

Further discussion of these results and their implications for contingency and sociotechnical theories will be presented in Chapter V.

Table IV-1

CORRELATION BETWEEN STAFF AND HEAD NURSE RATINGS OF UNIT EFFECTIVENESS

Variable	$\bar{X}$	sd	2.	3.	4.	5.	6.
1.PRODUCT	4.22	.41	.26	.67***	.18	.86***	.13
2.PRODHD	4.18	.51		.02	.60***	.11	.74
3.ADAPT	3.67	.40			.04	.93***	-.06
4.ADAPHD	3.81	.74				.16	.92***
5.EFFECT	3.96	.35					.03
6.EFFHD	4.03	.59					

N=39 for 1., 3., 5.
N=37 for 2., 4., 6.

Table IV-2

ITEM ANALYSIS OF EFFECTIVENESS INDEX

Key:

= Number of units with staff mean equalling head nurse score.
> Number of units with staff mean score greater than head nurse score.
< Number of units with staff mean score less than head nurse score.

ITEM	=	>	<
quantity of output	7	14	16
quality of output	7	14	16
efficiency	7	18	12
anticipating & preventing or minimizing problems	4	12	20
awareness of new developments in the field	6	14	17
promptness of adjustment to changes	3	19	15
proportion of unit members who readily adjust to these changes	3	16	18
handling emergencies	4	12	21

Table IV-3

CORRELATION MATRIX FOR KEY STUDY VARIABLES

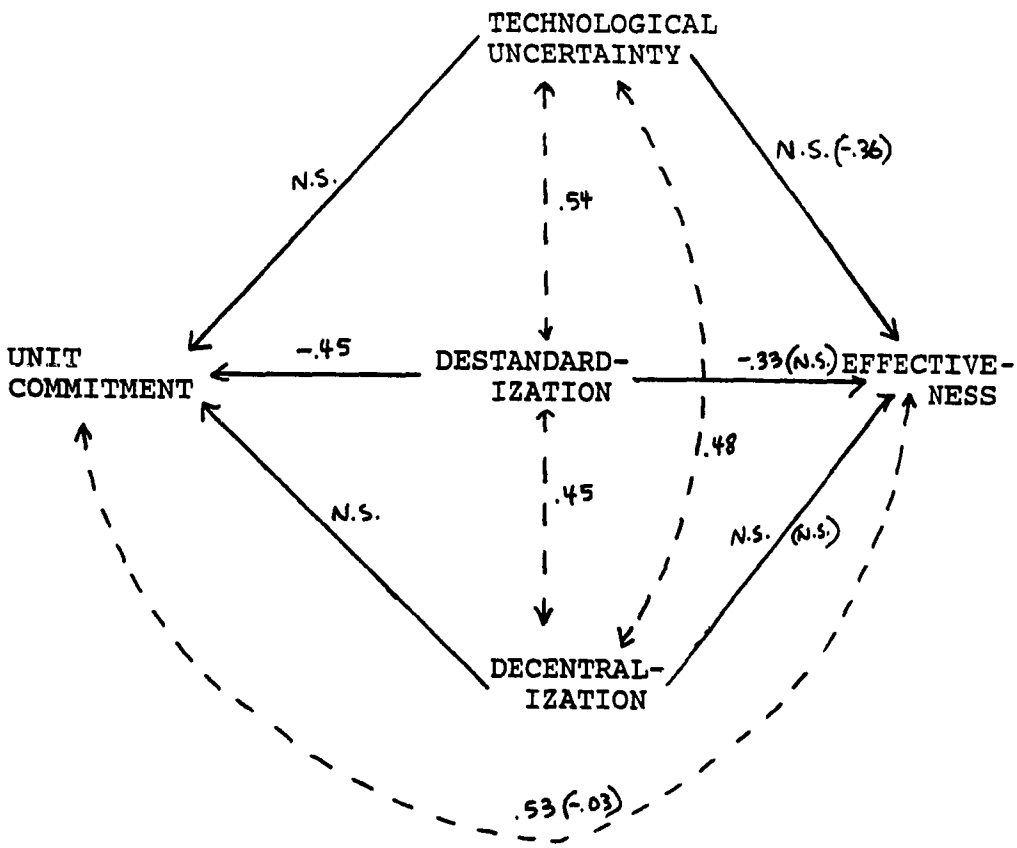
N=39	$\bar{X}$	sd	2.	3.	4.	4a.	4b.	5.
Unit Technology								
1.UNCERTN	2.68	.44	.478**	.542***	-.046	-.362*	-.247	-.154
Unit Structure								
2. DECENT	3.93	.98		.452**	-.007	-.111	-.014	.101
3. DESTAND	2.50	.51			-.334*	-.173	-.308+	-.449**
Unit Outcomes								
4. EFFECT	3.96	.35				.034	.78***	.527***
4a. EFFHD (N=37)	4.03	.59					.571***	-.03
4b. EFFECALL	3.95	.30						.36*
5. COMUNIT	3.94	.41						

+p<.10, *p<.05, **p<.01, ***p<.001

EFFECT = staff nurse ratings of effectiveness
EFFHD = head nurse ratings of effectiveness
EFFECALL = combined staff and head nurse effectiveness ratings
COMUNIT = commitment to unit

Figure IV-1

DIAGRAM OF CORRELATIONS AMONG KEY VARIABLES



Notes: Head nurse values in parentheses.
Solid lines are relationships addressed in hypotheses.

Table IV-4

CORRELATION MATRIX FOR KEY STUDY VARIABLES
WITH REVISED SAMPLE:
OUTLIER REMOVED

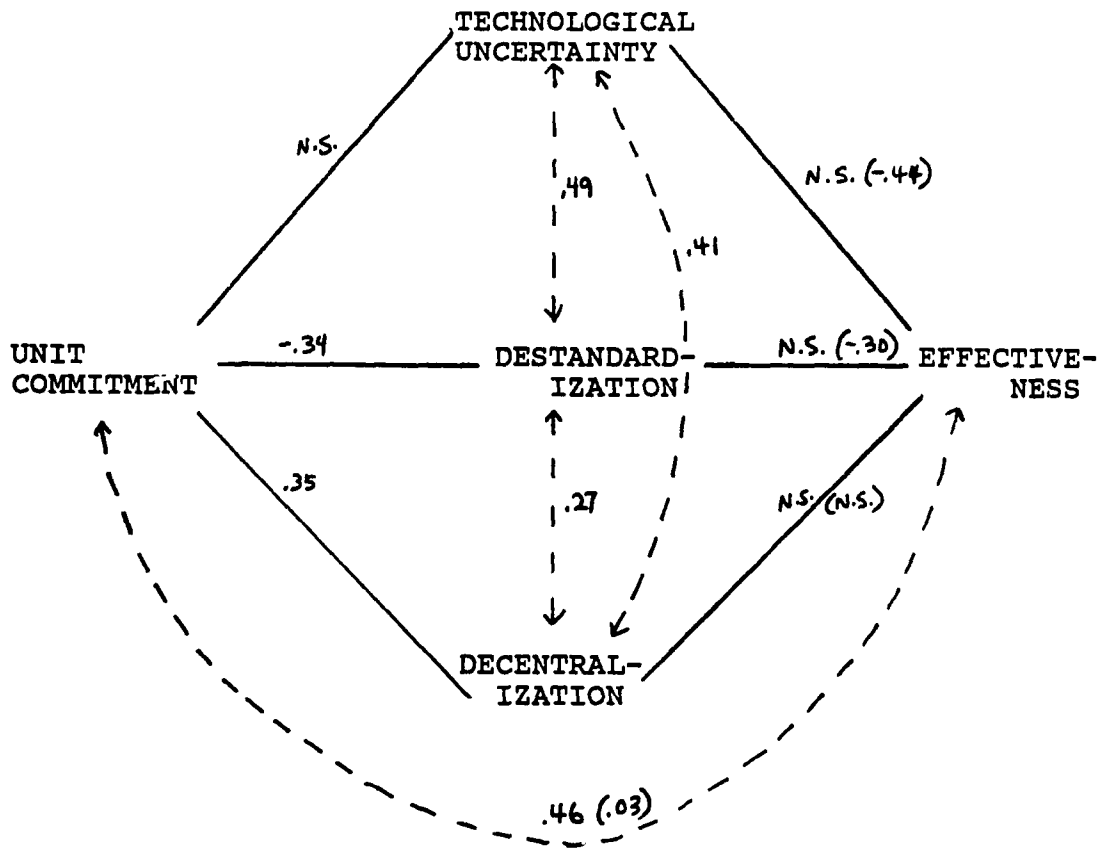
N=38	$\bar{X}$	sd	2.	3.	4.	4a.	4b.	5.
Unit Technology								
1.UNCERTN	2.67	.43	.406*	.485**	.07	-.44**	-.225	-.065
Unit Structure								
2. DECENT	3.85	.85		.271+	.245	-.236	.051	.346*
3. DESTAND	2.46	.45			-.181	-.298+	-.292+	-.344*
Unit Outcomes								
4. EFFECT	3.98	.33				.111	.805****	.455**
4a. EFFHD (N=36)	4.02	.59					.60****	.031
4b. EFFECALL	3.96	.30						.349*
5. COMUNIT	3.96	.39						

+p<.10, *p<.05, **p<.01, ***p<.001, ****p<.0001

EFFECT = staff nurse ratings of effectiveness
EFFHD = head nurse ratings of effectiveness
EFFECALL = combined staff and head nurse effectiveness ratings
COMUNIT = commitment to unit

Figure IV-2

DIAGRAM OF CORRELATIONS AMONG KEY VARIABLES
REVISED SAMPLE, OUTLIER REMOVED



Notes: Head nurse values in parentheses.
Solid lines are relationships addressed in hypotheses.

Table IV-5

SUMMARY OF REGRESSION ANALYSIS RESULTS, I.

Outcome: Unit Effectiveness (overall)

Predictor	Reg.[1] Coeff.	R Sq.[2] Change	Reg. Coeff.	R Sq. Change	Reg. Coeff.	R Sq. Change
	--STAFF[3]--		--SUPERVISOR[4]--		---COMBINED[5]---	
1.DECENTRALIZATION	2.46*	.06	-.45	.06	1.65	.003
2.TECH. UNCERTAINTY	1.30+	.001	-.62	.14*	.60	.07
3.DECENT. x UNCERTN.	-3.02*	.12*	.53	.004	-2.03	.05
4.DESTANDARDIZATION	.17	.03	-.08	.09+	.57	.09+
5.TECH. UNCERTAINTY	.58	.03	-.34	.12*	.57	.009
6.DESTD. x UNCERTN.	-.72	.007	-.08	.0001	-1.29	.02

+p<.10, *p<.05

[1] Standardized Regression Coefficient.

[2] Unadjusted R Square Change.

[3] N=38 units

[4] N=36 units; two unit head nurses did not respond to survey.

[5] N=38 units; complete sample.

Table IV-6

SUMMARY OF REGRESSION ANALYSIS RESULTS, II.

Outcome: Unit Productivity (component of effectiveness)

Predictor	Reg.[1] Coeff.	R Sq.[2] Change	Reg. Coeff.	R Sq. Change	Reg. Coeff.	R Sq. Change
	----STAFF[3]----		--SUPERVISOR[4]--		---COMBINED[5]---	
1.DECENTRALIZATION	2.28*	.03	.74	.05	2.17*	.004
2.TECH. UNCERTAINTY	1.17+	.005	- .03	.15*	.94	.06
3.DECENT. x UNCERTN.	-2.83*	.10*	-1.03	.01	-2.75+	.10+
4.DESTANDARDIZATION	.12	.10*	-.03	.13*	.29	.16**
5.TECH. UNCERTAINTY	.67	.04	-.23	.11*	.55	.0002
6.DESTD. x UNCERTN.	-.87	.01	-.26	.0008	-1.08	.02

+p<.10, *p<.05, **p<.01

[1] Standardized Regression Coefficient.

[2] Unadjusted R Square Change.

[3] N=38 units

[4] N=36 units; two unit head nurses did not respond to survey.

[5] N=38 units; complete sample.

Table IV-7

SUMMARY OF REGRESSION ANALYSIS RESULTS, III.

Outcome: Unit Adaptability (component of effectiveness)

Predictor	Reg.[1] Coeff.	R Sq.[2] Change	Reg. Coeff.	R Sq. Change	Reg. Coeff.	R Sq. Change
	----STAFF[3]----		-SUPERVISOR[4]--		---COMBINED[5]---	
1.DECENTRALIZATION	2.71**	.05	-.70	.03	1.47	.002
2.TECH. UNCERTAINTY	1.43*	.002	-.82	.16*	.46	.09+
3.DECENT. x UNCERTN.	-3.37*	.14*	.94	.01	-1.78	.04
4.DESTANDARDIZATION	.10	.02	-.08	.14*	.58	.07+
5.TECH. UNCERTAINTY	.43	.02	-.24	.09*	.49	.02
6.DESTD. x UNCERTN.	-.51	.003	-.20*	.0005	-1.23	.02

+p<.10, *p<.05

[1] Standardized Regression Coefficient.

[2] Unadjusted R Square Change.

[3] N=38 units

[4] N=36 units; two unit head nurses did not respond to survey.

[5] N=38 units; complete sample.

Table IV-8

SUMMARY OF REGRESSION ANALYSIS RESULTS, IV.

Outcome: Commitment to Unit

Predictor	Reg.[1] Coeff.	R Sq.[2] Change
	-----STAFF[3]-----	
1.DECENTRALIZATION	.77	.12*
2.TECH. UNCERTAINTY	-.05	.05
3.DECENT. x UNCERTN.	-.44	.003
4.DESTANDARDIZATION	-1.62+	.12*
5.TECH. UNCERTAINTY	- .88	.01
6.DESTD. x UNCERTN.	1.93+	.05

+p<.10, *p<.05, **p<.01

[1] Standardized Regression Coefficient.

[2] Unadjusted R Square Change.

[3] N=38 units; one outlier eliminated. Only staff ratings of their own commitment are relevant to this study.

Table IV-9

SUMMARY OF REGRESSION ANALYIS EVIDENCE FOR HYPOTHESES

Hypothesis	Staff Data	Supervisor Data	Combined Data
CONTINGENCY THEORY			
1a. Interaction of DESTANDARDIZATION & UNCERTAINTY influences EFFECTIVENESS			
1b. Interaction of DESTANDARDIZATION & UNCERTAINTY influences COMMITMENT			
2a. Interaction of DECENTRALIZATION & UNCERTAINTY influences EFFECTIVENESS	+		(+)
2b. Interaction of DECENTRALIZATION & UNCERTAINTY influences COMMITMENT			
CONTINGENCY THEORY HYPOTHESES			
3a. DESTANDARDIZATION influences EFFECTIVENESS	(+)	-	+
3b. DESTANDARDIZATION influences COMMITMENT	-		
4a. DECENTRALIZATION influences EFFECTIVENESS			
4b. DECENTRALIZATION influences COMMITMENT	+		

Notes: + = support for hypothesis
(+)= partial support for hypothesis
- = evidence against the hypothesis

Table IV-10

SUMMARY OF REGRESSION ANALYSIS EVIDENCE FOR HYPOTHESES WITH DISAGGREGATED EFFECTIVENESS VARIABLE

Hypothesis	Staff Data	Supervisor Data	Combined Data
CONTINGENCY THEORY			
1a. UNCERTN x DESTAND = EFFECTIVENESS	———	———	———
(PRODUCTIVITY)	———	———	———
(ADAPTABILITY)	———	———	———
2a. UNCERTN x DECENT = EFFECTIVENESS	+	———	———
(PRODUCTIVITY)	+	———	+
(ADAPTABILITY)	———	———	———
	+	———	———
SOCIOTECHNICAL THEORY			
3a. DESTAND = EFFECTIVENESS	———	-	+
(PRODUCTIVITY)	+	-	+
(ADAPTABILITY)	———	———	———
	———	-	+
4a. DECENT = EFFECTIVENESS	———	———	———
(PRODUCTIVITY)	———	———	———
(ADAPTABILITY)	———	———	———

Notes: + = support for hypothesis
- = evidence against the hypothesis

Figure IV-3

SOURCES & OUTCOMES OF KEY VARIANCES

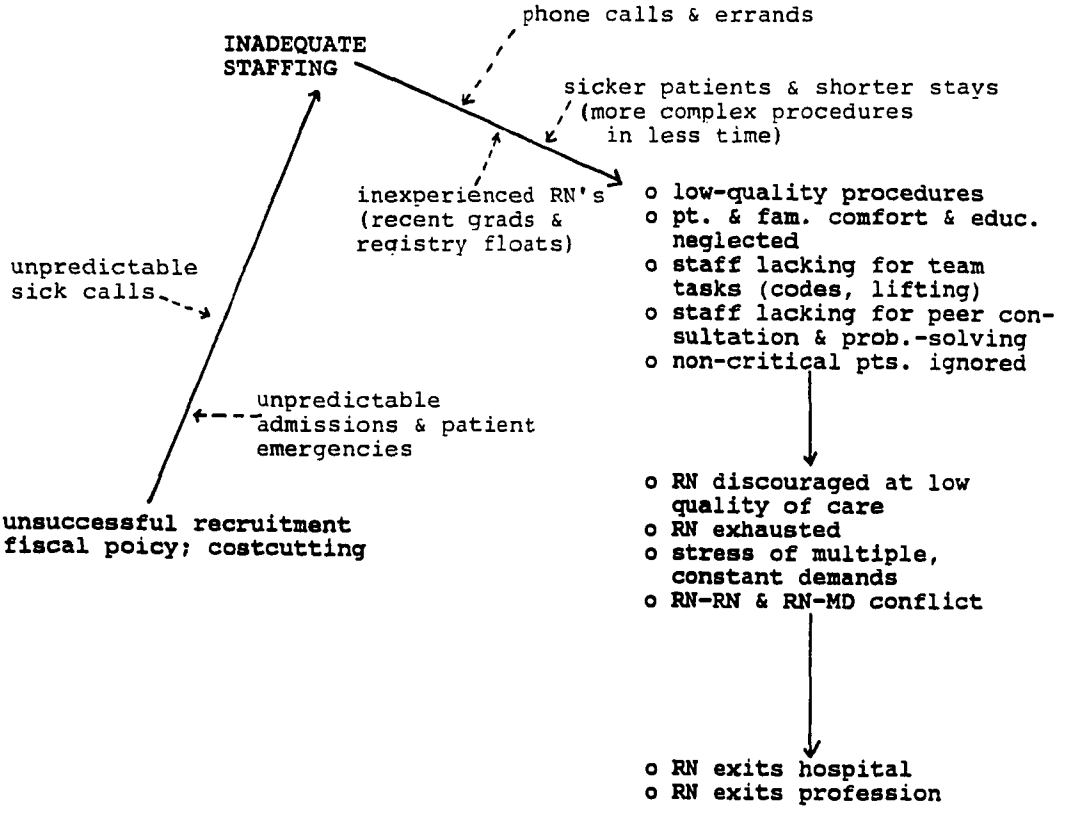


Table IV-11

OVERVIEW OF KEY VARIANCE SOURCES

Unit	Staffing	Support Serv.	Peer RNs	Paperwork	MDs
1	(*)	(*)			
2	(*)	*			
3					
4	*		(*)	*	
5	*	*	( )		
6	(*)	(*)	*		
7	(*)	(*)	*	*	( )
8	*	(*)	( )		
9	(*)	*			
10	(*)			*	
11	*	*	*		
12	*	*		*	*
13	(*)	(*)	(*)		*
14	*	(*)	(*)	*	*
15	*	*	*	*	*
16	*	*	( )	*	
17	*	(*)	*		*
18	(*)	*	(*)	(*)	*
19	*		*		
20	(*)	(*)	*	*	*
21	(*)	*	(*)	*	
22		*	(*)	*	
23	*	*	(*)	*	
24	(*)		( )	(*)	( )
25	(*)	*	( )		
26	*		( )		
27	*		(*)	*	
28	(*)		*	*	(*)
29	*	( )	(*)	*	( )
30	(*)	*	*	*	(*)
31	*	*			*
32	*	(*)	(*)	*	
33	*	*	*		*
34	*			*	
35	(*)	*	*	*	(*)
36	*	*	*	*	
37	*	( )	( )		*
38	*	(*)		*	*
39	*	*			

* = Sources identified by staff nurses.
()= Sources identified by head nurses.

Table IV-12

FREQUENCY OF VARIANCE MANAGEMENT ACTIONS

Action	Number	Per Cent
0. No action	35	17.24
1. Decided alone	21	10.35
2. Referred to manual	3	1.47
3. Asked supervisor	34	16.75
4. Discussed with peers	61	30.05
5. Other	49	24.14
	203	100%

Table IV-13

FREQUENCY OF VARIANCE MANAGEMENT ACTIONS
FOR HIGH-SCORING UNITS ON KEY VARIABLES

Numbers are percentages within subset of units (row).
Percentages have been rounded to nearest whole number.

Subset of Units	Category of Action					
	0 None	1 Alone	2 Manual	3 Supervisor	4 Peers	5 Other
UNCERTN[1] n=13	29	10	0	15	21	25
DECENT n=11	20	11	0	20	29	22
DESTAND n=12	21	14	3	13	24	24
PRODUCT n=13	16	11	0	21	25	27
ADAPT n=13	15	10	0	23	31	21
EFFECT n=13	14	13	0	23	29	21
COMUNIT n=13	15	7	0	17	35	26
ALL UNITS	17	10	1	17	30	24

[1] For example, the 13 units with highest technological uncertainty scores.

Table IV-14

CORRELATIONS FOR UNIT AND ORGANIZATION COMMITMENT

N=38 units for all variables except supervisor outcomes, which have a sample size of 36.

	COMUNIT	COMORG
	$\bar{X}$= 3.95 sd=.39	$\bar{X}$= 3.52 sd=.47
1. UNCERTN	-.065	-.115
2. DECENT	.346*	-.05
3. DESTAND	-.344*	-.427**
4. PRODUCT (SUP)	.439** (.114)	.267 (-.027)
5. ADAPT (SUP)	.397** (.125)	.207 (-.026)
6. EFFECT (SUP)	.455** (-.031)	.232 (-.115)
7. PRODUCT (ALL)	.394**	.186
8. ADAPT (ALL)	.339*	.031
9. EFFECT (ALL)	.349*	.056

+p<.10, *p<.05, **p<.01

Note: Supervisor ratings are in parentheses.

Table IV-15

SUMMARY OF REGRESSION ANALYSIS RESULTS
UNIT VERSUS ORGANIZATION COMMITMENT

Outcome: Commitment to Unit		$\bar{X}$: 3.96 sd: .30
Predictor	Reg.[1] Coeff.	R Sq.[2] Change
1. DECENTRALIZATION	.77	.12*
2. TECH. UNCERTAINTY	- .05	.05
3. DECENT. x UNCERTN.	- .44	.003
4. DESTANDARDIZATION	-1.62+	.12*
5. TECH. UNCERTAINTY	- .88	.01
6. DESTD. x UNCERTN.	1.93	.05
Outcome: Commitment to Organization		**$\bar{X}$: 3.52 sd: .48**
Predictor	Reg. Coeff.	R Sq. Change
7. DECENTRALIZATION	- .48	.003
8. TECH. UNCERTAINTY	- .40	.01
9. DECENT. x UNCERTN.	.65	.005
10. DESTANDARDIZATION	- .85	.18**
11. TECH. UNCERTAINTY	- .18	.01
12. DESTD. x UNCERTN.	.58	.004

+p<.10, *p<.05, **p<.01

[1] Standardized Regression Coefficient.

[2] Unadjusted R Square Change.

Table IV-16

CORRELATIONS FOR INTERDEPENDENCE VARIABLES

N=38 for all variables except supervisor outcomes, in which sample size is 36 units.

INTERRN and INTERMD are correlated at .285+

	INTERRN	INTERMD
	$\bar{X}$= 3.086 sd= .77	$\bar{X}$= 3.294 sd= 1.25
UNCERTN	-.072	.068
DECENT	.189	-.164
DESTAND	.06	.186
PRODUCT (SUPVSR.)	.053 (.352*)	-.428** (-.23)
ADAPT (SUPVSR.)	-.047 (.366*)	-.426** (-.109)
EFFECT (SUPVSR.)	.021 (.426**)	-.457** (-.151)
PRODUCT, STAFF+SUP.	.229	-.396*
ADAPT, STAFF+SUP.	.23	-.317*
EFFECT, STAFF+SUP.	.298+	-.376*
COMUNIT	.063	-.293+
COMORG	-.111	-.164

+p<.10, *p<.05, **p<.01

Note: Supervisor ratings are in parentheses.

Figure IV-4

FIG.IV-4a: DIAGRAM OF STRUCTURE-TECHNOLOGY INTERACTION FROM CONTINGENCY THEORY PERSPECTIVE USING RN-RN INTERDEPENDENCE

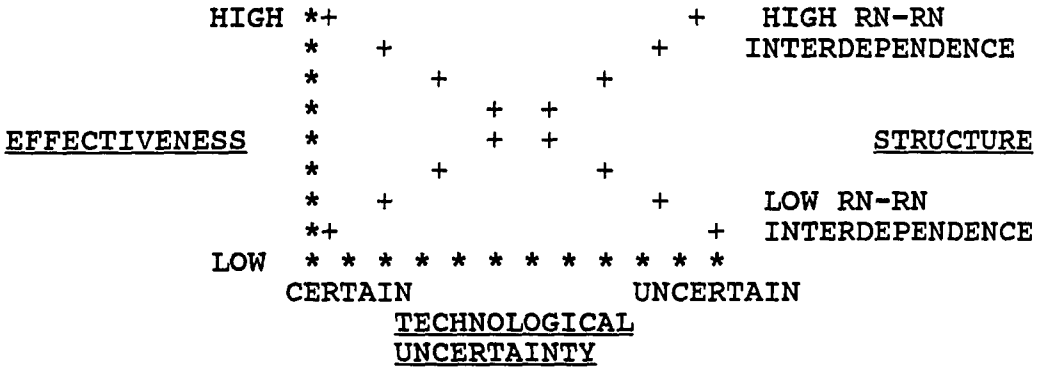


FIG.IV-4b: DIAGRAM OF STRUCTURE-TECHNOLOGY INTERACTION FROM CONTINGENCY THEORY PERSPECTIVE USING RN-MD INTERDEPENDENCE

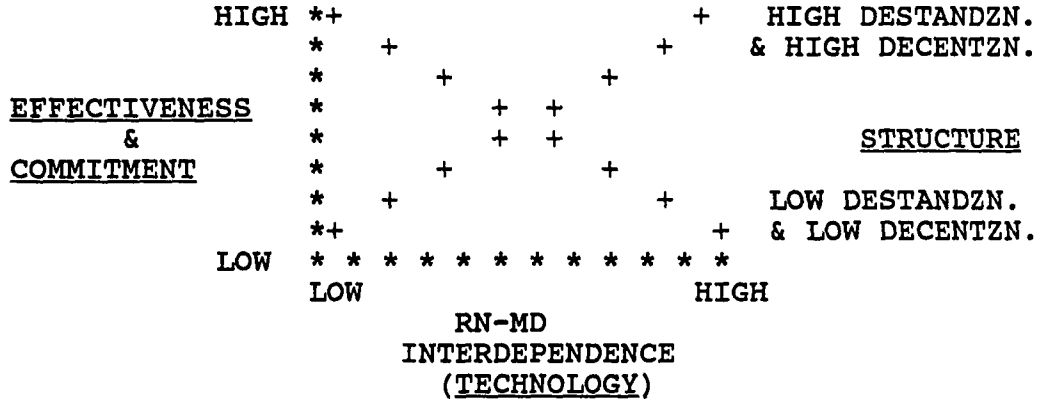


Table IV-17

SUMMARY OF REGRESSION ANALYSIS RESULTS
FOR NURSE-DOCTOR INTERDEPENDENCE, I.

Outcome: Unit productivity, rated by staff

Predictor	Reg.[1] Coeff.	R Sq.[2] Change
1. DECENTRALIZATION	.009	.033
2. RN-MD INTERDEPENDENCE	-.558	.163**
3. DECENT. x INTERMD	.168	.001
4. DESTANDARDIZATION	-.489	.103*
5. RN-MD INTERDEPENDENCE	-.842	.141*
6. DESTAND. x INTERMD	.561	.004

Outcome: Unit adaptability, rated by staff

Predictor	Reg. Coeff.	R Sq. Change
7. DECENTRALIZATION	.819	.054
8. RN-MD INTERDEPENDENCE	.527	.155*
9. DECENT. x INTERMD	-1.052	.022
10. DESTANDARDIZATION	.124	.022
11. RN-MD INTERDEPENDENCE	-.037	.165**
12. DESTAND. x INTERMD	-.457	.003

Note: +p<.10, *p<.05, **p<.01, N=38

[1] Standardized Regression Coefficient.

[2] Unadjusted R Square Change.

Table IV-18

SUMMARY OF REGRESSION ANALYSIS RESULTS
FOR NURSE-DOCTOR INTERDEPENDENCE, II.

Outcome: Unit effectiveness, rated by staff

Predictor	Reg.[1] Coeff.	R Sq.[2] Change
1. DECENTRALIZATION	.573	.06
2. RN-MD INTERDEPENDENCE	.137	.179**
3. DECENT. x INTERMD	-.643	.008
4. DESTANDARDIZATION	-.118	.033
5. RN-MD INTERDEPENDENCE	-.473	.186**
6. DESTAND. x INTERMD	.043	.000

*p<.05, **p<.01, N=38

[1] Standardized Regression Coefficient.

[2] Unadjusted R Square Change.

Table IV-19

SUMMARY OF REGRESSION ANALYSIS RESULTS
FOR NURSE-NURSE INTERDEPENDENCE

Outcome: Unit productivity, rated by head nurses

Predictor	Reg.[1] Coeff.	R Sq.[2] Change
1. RN-RN INTERDEPENDENCE	.723	.124*
2. TECH. UNCERTAINTY	-.154	.177**
3. INTERRN x UNCERTN	-.475	.007

Outcome: Unit adaptability, rated by head nurses

Predictor	Reg. Coeff.	R Sq. Change
4. RN-RN INTERDEPENDENCE	.193	.133*
5. TECH. UNCERTAINTY	-.498	.165**
6. INTERRN x UNCERTN	.159	.001

Outcome: Unit effectiveness, rated by head nurses

Predictor	Reg. Coeff.	R Sq. Change
7. RN-RN INTERDEPENDENCE	.302	.182**
8. TECH. UNCERTAINTY	-.464	.163**
9. INTERRN x UNCERTN	.102	.000

*p<.05, **p<.01, N=36

[1] Standardized Regression Coefficient.

[2] Unadjusted R Square Change.

Table IV-20

SUMMARY OF REGRESSION ANALYSIS RESULTS
FOR NURSE-DOCTOR INTERDEPENDENCE
AND COMMITMENT OUTCOME

Outcome: Commitment to Unit, rated by staff; N=38 units

Predictor	Reg.[1] Coeff.	R Sq.[2] Change
1. DECENTRALIZATION	1.636*	.120*
2. RN-MD INTERDEPENDENCE	1.643+	.057
3. DECENT x INTERMD	-2.143*	.093*

+p<.10, *p<.05, N=38

[1] Standardized Regression Coefficient

[2] Unadjusted R Square Change.

V. SUMMARY, EVALUATION, AND IMPLICATIONS

A. Summary of Findings

The core focus of this study was the concept of "fit" as it relates to two aspects of organization: social structure and technology. The investigator questioned traditional contingency theory (CT), which argued that technology mediated the influence of structure upon effectiveness. This theory seemed to contradict elements of the sociotechnical systems (STS) theoretical perspective, which stated that certain dimensions of social structure, because of broad technological and sociological trends in the environment today, would tend to have a positive influence upon effectiveness, under most technology conditions. Specifically, STS theory argued that a mechanistic social structure was maladaptive in most settings, while contingency theory defended it as appropriate (due to efficiency arguments) under conditions of low technological uncertainty.

The key findings of this survey study of thirty-eight nursing units at three hospitals are summarized below:

Contingency Theory Findings

1. The effect of decentralization upon effectiveness does vary with level of technological uncertainty. The greater the uncertainty, the greater the positive impact of decentralization on effectiveness. (H.2a.) This is very evident in staff ratings of effectiveness and

somewhat evident in combined ratings.

2. The influence of decentralization upon commitment does vary with level of nurse-doctor interdependence. The greater this interdependence, the greater the positive impact of decentralization upon commitment.

Sociotechnical Theory Findings

3. Destandardization positively influences effectiveness, regardless of level of technological uncertainty. This is evident somewhat in staff and more strongly in combined ratings. (H.3a.)

4. Decentralization positively influences commitment to unit (not organization), regardless of level of technological uncertainty. (H.4b.) However, destandardization has the opposite effect, influencing unit (and organization) commitment in a negative direction.

5. The highest rates of peer consultation as a variance-management strategy appeared in the high-commitment, high-adaptability, and high-effectiveness units.

Other Findings

6. Nurses and supervisors exhibit little agreement on unit effectiveness ratings, but there is more agreement on productivity than adaptability.

7. Nurses' ratings of effectiveness are correlated with commitment to unit, but not with commitment to the organization.

B. Implications of Findings for Theory

CONTINGENCY THEORY. The contingency theory (CT) proposition that structure must "fit" technology was supported in this study only for the relationship between decentralization and technological uncertainty. Recalling the discussion of theoretical models in Chapter II, section F, we conclude that under conditions of variable, difficult work for a nursing unit, staff

nurse participation in decision-making increases unit effectiveness. The rationale for this "fit" requirement is that when work is more routine, exceptions are rare and can be referred up the hierarchy for decision-making. But when the work is more uncertain, the nurse performing the task has more relevant information for problem-solving than persons at higher levels in the hierarchy. Also, when the number of exceptions is high, it is impractical and ineffective to refer all decisions up the hierarchy, because condensation and distortion of information are likely to occur. This current of thought has been described in the literature from March and Simon (1957) and Galbraith (1972, 1973), to Van de Ven and Delbecq (1974) and Schoonhoven (1981). Our finding is consistent with Fry's (1982) review of technology-structure studies. However, Schoonhoven (1981) rejected the uncertainty-decentralization contingency hypothesis in her study.

When contingency theory hypotheses were tested with our exploratory measure of technological uncertainty, nurse-doctor interdependence, structure-technology fit was found to enhance commitment. Our measure of RN-MD interdependence was a rating of the percentage of patients having multiple doctors. This finding may indicate that when a nurse must cope with multiple physicians writing orders for a single patient (and the

consequent increased volume and complexity of her tasks), if the unit social structure allows her high participation in decision-making, then she will feel a stronger bond with her unit. Fry and Slocum (1984) were the only researchers to have previously studied inter-dependence and commitment from a CT perspective, and their data did not support contingency theory.

SOCIOTECHNICAL THEORY. Destandardized nursing units were found to be more effective, as STS theory predicted. Nurses' discretion and flexibility in organizing tasks, as opposed to strict adherence to explicit and preprogrammed rules and procedures, enhanced nursing unit effectiveness, as Trist and Bamforth (1951), Davis and Taylor (1976), and Mills and Moberg (1982) would have predicted. Schoonhoven (1981) also found this significant direct effect.

As predicted by STS theory, decentralized nursing units had higher levels of commitment to the unit. The STS quality-of-working-life premises about the employee alienation that results from highly centralized decision-making in work systems in America today are supported by this finding. However, the opposite result for destandardization was found. That is, STS theory predicted that because of certain sociocultural trends in the United States today (e.g., a more educated work force, changes in the meaning of work and expectations

within jobs), highly standardized work systems would yield low employee commitment.

Our interpretation of this negative finding was that in this research setting, hospitals, destandardization had a unique meaning for the nurse respondents. While nurses may make use of a destandardized structure to enhance their effectiveness (Finding 2.), they are uncomfortable with this context because unit destandardization conflicts with an organization that promotes standardization (both formally and informally, through the organization culture). Nurses in this sample may have equated lack of explicitness of rules and procedures (i.e., high destandardization) as lack of protection by their head nurse, who had failed to create a more secure, standardized context for task accomplishment.

In light of these results, it now seems unrealistic to have expected a significant relationship between this social structure feature and commitment, given this feature of nursing culture. It is understandable that in a social system that highly values rules and "standard operating procedure," and in the absence of support for alternative structures, destandardization would not enhance the employee-work unit bond of commitment.

Analysis of open-ended survey responses suggested that when peer-consultation is the primary method of

coping with variances in daily tasks, work units are more adaptable and have more committed members. We also learned that referring to written policies or procedure manuals is practically nonexistent as a variance management strategy. STS theory would have predicted both findings, since it emphasizes the variable nature of most work, which cannot be effectively captured in the more static medium of written, preprogrammed solutions. It also highlights the expertise of the nurses themselves, and the potential of the nursing team (as individuals and collectively) to problem-solve more effectively than a single nurse asking a single supervisor for a solution.

OTHER FINDINGS. The discrepancy between supervisor and staff nurse ratings of unit effectiveness was unexpected, based on the previous literature employing perceptual measures of effectiveness. We found that nurses and supervisors agreed more on productivity, which is a more concrete construct (quantity and quality of work), and agreed less on adaptability, which is somewhat more subjective (anticipating and minimizing problems, keeping up with innovations in the field, coping with emergencies).

It was interesting to find that both staff and supervisors rated their units lower on adaptability than productivity. This finding may signal a problem area

central to STS thinking: the concern for organizing work units to promote long-term effectiveness (i.e., adaptability), as well as short-term effectiveness (i.e., productivity). Nursing units may not be as successful at adapting over time as they are at producing adequate outcomes in the short-term.

The relationships between supervisor ratings and other variables were also notable. Head nurses viewed high uncertainty units as less effective. Perhaps they applied more "absolutist" standards of effectiveness than staff nurses, who may have adopted a more "relativist" stance. For example, staff nurses may have rated their unit's efficient use of resources with the implicit proviso, "given the limited resources, high patient load, and high patient acuity levels we have, we do a good job." Head nurses may have applied more universal standards, perhaps based on their experience in other units or hospitals, or the objective standards and measures promoted by hospital administrators.

Fry and Slocum (1984) found a negative correlation between level of professional specialization and performance of work units. That is, highly specialized unit were rated as the lowest performers by a panel of supervisors. This finding and ours seem consistent: to supervisors, the more difficult the work, the less successful the unit.

Head nurses also perceived destandardized units as less effective. In the cognitive set of head nurses, achieving high explicitness of rules and procedures may be tantamount to success for the unit. Assuming that "running a tight ship" is not merely a personal preference typical of head nurses, another explanation could be that head nurses realize that in the hospital culture, autonomous judgement and action on the part of nurses is always subject to second-guessing by the powerful constituency of physicians. Therefore, standardization, because it is a concrete and consensually based phenomenon (physicians do have influence on SOP's), serves to protect nurses.

This author has observed in nursing culture and practice the tenet that the best response to ambiguity in a nursing care situation is a host of policies and procedures which nurses are expected to memorize and follow. The reality is that nurses daily cope successfully with situations in which standardized procedures run counter to the needs of a specific patient with a unique set of circumstances. But if she intervenes with a patient and the outcome is poor, her only protection is that she followed SOP. The system does not officially encourage innovative problem-solving, and yet such behavior seems required (for effectiveness) in many situations nurses face.

Although commitment to unit was more suited to this study of unit-level phenomena than the construct of organization commitment, both were analyzed and compared. Nurses tended to be somewhat more committed to their unit than the hospital as a whole. Also, perceptions of unit effectiveness and ratings of commitment to unit are correlated, but causality is unclear. We could interpret that nurses' perceptions of effectiveness are a result of the strength of their identification with their unit. Or, we could interpret that highly committed nurses in fact perform more effectively as a unit. STS theory might support the latter interpretation.

C. Implications for Future Research

A number of implications for future research may be culled from the experience and results of this study. Probably the most important one is that larger scale studies are needed: not just in sample size, but in number of variables and complexity of hypotheses. While the literature has clearly stated that technology and structure are "metaconstructs" with multiple dimensions, and we have been warned of the dangers of overgeneralizing our results from one or two dimensions to the whole construct, most studies (including this one) have nevertheless included only one, two, or three dimensions

of each construct.

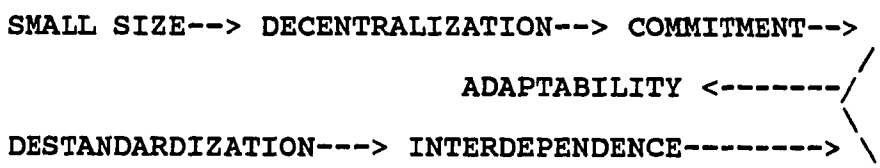
A productive mode of inquiry would be to incorporate several dimensions of each construct, as well as the outcome variable. In this study, disaggregation of the effectiveness variable did not affect hypothesis testing, but some additional insights were yielded regarding supervisor-staff discrepancies in perceptions of these phenomena. Regarding the predictor variables, a thorough understanding of unit technology should include operationalizations of input predictability, throughput materials and procedures characteristics (including exceptions, analyzability, instability, reactivity, complexity, etc.), and output predictability.

In a recent article, Campbell (1988) presented a typology of task complexity which disaggregates and operationalizes this one dimension of technology. He cites four sources of task complexity: multiple paths to a desired end-state, multiple desired end-states, conflicting interdependence, and uncertainty or probabilistic linkages (p.46). A task can be characterized by various combinations of these complexity sources. Campbell's typology and discussion of the literature are significant contributions in this area of inquiry, but they await empirical testing.

Another issue for future research is the dilemma of

how to resolve the trade-off between very internally valid measures firmly grounded in the particular setting, versus the more externally valid (or reliable) generic measures that enhance efficient research in multiple industries and capture the essence of key variables across settings. This study employed both kinds of measures. It could be argued that the technological uncertainty measure, a generic one, was too abstract and not explicitly grounded in nursing tasks and terms. However, if a generic measure <u>is</u> found to have meaning across settings, the field of inquiry will benefit by not having to reinvent measures in various settings, and by enhancing comparability across research studies.

With more variables and a larger sample, investigators could test more complex models via methods such as path analysis. For example, in this study commitment was an outcome variable, but commitment may also be conceptualized as a mediating variable. One possible model to pursue might look like this:



In a different vein, in-depth action research studies of nursing units are needed to get closer to the

complex sociotechnical processes at work. This approach would not only infuse quantitative studies with greater validity (in hypothesis formulation and variable operationalization), but would also be instructive in its own right. One research question to explore would be how nurses maintain task-adaptive behaviors within a social system that emphasizes compliance over excellence.

More research is needed in the construct of interdependence. In 1982, Fry referred to "the emerging importance of interdependence as a technology variable" (p.547). This study's exploration of nurse-nurse and nurse-doctor interdependence showed the construct to indeed be <u>still</u> emerging in both precision and importance. As employed in the contingency theory literature, this construct is still too broad and diffuse. The sociotechnical concepts of "technology" versus "technical system" should be applied to clarify interdependence. We might think of a hierarchy of constructs, each "nested" or subsumed as a subset within the one above it:

Sociotechnical system
Technical system
Technology
Science

Sociotechnical theory would argue that the influence of the organization designer increases as one moves up the

hierarchy. That is, managerial choices and options have a slim effect on the science of nursing, but more effect upon the technology of nursing (i.e., the techniques and artifacts to accomplish transformations in throughput materials).

Insights from this study suggest that task interdependence is a component of technology. For example, when a specific task requires the simultaneous or explicitly sequential intervention of more than one nurse, task interdependence is high. Various surgical or resuscitation procedures come to mind as being inherently multi-nurse tasks. (We should keep in mind that as technology develops, the interdependent nature of tasks usually evolves from higher to lower independence, as automation and electronics alter the nature of the task.)

Technical system interdependence, on the other hand, is quite a different construct, and subject to more management discretion. One example is when multiple tasks comprising "nursing care" are divided and assigned across multiple nurses, there is high nurse-nurse interdependence as a result of the high need for coordination due to task fractionation. A second type of high technical system interdependence arises when high rates of collaboration (i.e., mutual supporting, sharing, exchanging of tasks, etc.) occur either by

managerial plan or spontaneous, informal social processes. While the nature of the nursing technical specialty might influence levels of technical system interdependence, the primary influences seem clearly based in the social system (i.e., social structure characteristics resulting from management plan, style, or work unit culture).

Disentangling the social versus technological components of interdependence is an essential task if this construct is to be useful in studies of structure-technology fit.

D. Implications for Utilization

Management practice recommendations arising from interpretations of this study's data are necessarily tentative and offered with the understanding that our knowledge is impressionistic and uncertain.

If a nursing manager were to request recommendations based on this small study and the literature from which it developed, we could offer some suggestions. First, retention of skilled and experience nurses is an absolute priority because of their greater ability to self-manage and their higher commitment to unit and hospital. Less obviously, low retention levels have led to such maladaptive staffing strategies as registry and floaters, whose quality of care is markedly less than

permanent staff and whose presence adds intensely to their stress (as well as stress on the registry and floating nurses themselves).

The work of nurses has changed dramatically in the past two decades: hospitalized patients are sicker (thanks to outpatient surgery and insurance-mandated short stays), bedside technology is more prominent and ever-changing, and the proliferation of ancillary medical roles (e.g., intravenous and inhalation technicians) have fractionated and disaggregated the tasks traditionally performed by nurses. Nurses, like workers in numerous other industries, are less occupied with concrete, well-defined tasks (such as patient basic care feeding and bathing) and more involved as monitors, diagnosers, and adapters (gathering, processing, and acting on complex pieces of information in an attempt to recognize early or prevent negative outcomes from occurring.)

Furthermore, the profession has changed because more women have entered traditionally male fields such as medicine, and the women who do enter nursing have different values and expectations about work than their counterparts of twenty years ago. Nurses today are not comfortable with the traditional role of passively responding to physicians' orders. They expect to have more voice as a member of the treatment team, both

within the nursing hierarchy and with physicians and other departments of the hospital.

With these technological and social environmental shifts in mind, the second recommendation is that nurses need work environments which are conducive to commitment and adaptability, not just short-term productivity. Higher participation in decision-making (especially the crucial daily decisions about staffing levels) is one way to increase commitment, according to data in this study.

Moreover, increased staff participation in decision-making has a greater positive influence on unit effectiveness in nursing units with higher technical uncertainty. That is, improvements in productivity and adaptability would be greatest in high uncertainty units with high levels of staff participation.

In the area of standardization, our study showed that nurses do make use of unit structures encouraging staff discretion and flexibility in the timing and organizing of tasks. However, when there is little explicitness in rules, nurses have negative perceptions of their unit as far as their commitment to the social group. Destandardization of rules and procedures at this time has benefits for effectiveness but negative impact on commitment. Only through changes in the larger hospital social system, and especially tradition-

al patterns of inter-role relating, would nurses develop a positive view of destandardized work structures, despite their adaptive use of those structures now.

Lastly, over the long-term, fundamental changes in the social organization of nursing will need to occur to adapt to environmental influences. A few hospitals in this country are experimenting with new arrangements in nursing care, and one hospital in this study's sample is in the early stages of change in this new direction. These new work designs are similar to the sociotechnical redesign programs in place in a number of industrial settings. In nursing, the new system eliminates the layers of nursing management hierarchy between line nurses and the director of nursing (now called Vice President for Patient Care); it reassigns the former head nurse functions to the team as a group (for example, the team appoints a daily charge nurse on a rotating basis; she assigns patients and schedules breaks, but also pitches in to do bedside care when needed); it elicits and rewards nurse for creativity, responsibility, and commitment to excellence; and generally aims to create a context in which every nurse is her own manager. These new work environments not only yield higher retention rates, but over time may alter the nursing shortage situation by enhancing the professional image and working conditions of nurses.

E. Evaluation of Findings

This study was a modest attempt to contribute in an incremental fashion to the literature on structure-technology fit by meeting four conditions not previously met in a published study: (1) employ outcome measures, (2) focus on work unit, not organization level, (3) explicitly link hypotheses and data analysis, and (4) incorporate more than one definition of fit, conceptually and data analytically.

The first three objectives were met, but the fourth was not met. (An alternative data analysis method was attempted but not completed because of the weak strength of the results and small sample.) Other strengths of the study were its use of quantitative and qualitative data, its documented and systematic data collection and analysis procedures (conducive to replication), and the probable representativeness of the sample in relation to small general hospitals across the United States.

Shortcomings or limitations of the study include the small sample size, its lack of randomness or stratification in selection, and the low response rates within some of the units. Variance across units was not great within the metric of each measure; the range of technological uncertainty variation is necessarily more constricted for a within-industry or within-profession

study, but part of the investigator's original motivation was to enhance understanding of nursing and health care setting work unit organization, so a highly heterogeneous sample of settings was ruled out.

F. Concluding Remarks

The results of this study do not strongly point to either contingency theory or sociotechnical theory as significantly more "correct" or "true." This was not a comprehensive test of either theory, but a competitive juxtaposition of components of each theory.

We can tentatively conclude that, on balance, there was somewhat more positive evidence for sociotechnical theory. However, we can more confidently say that the prominent acceptance of contingency theory in management education and practice is unwarranted. The fit between structure and technology cannot be summarized by a four-celled matrix matching technological uncertainty levels to organic structure levels. While it is evident that certain aspects of structure may have a powerful influence across types of technology, it is also clear that we lack a thorough understanding of the dimensions subsumed under the broad constructs of technology and structure. We should continue to pursue the patterns of direct and joint effects these metaconstructs may have upon desired work unit outcomes.

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APPENDIX 1

Sample Questionnaire

INSTRUCTIONS FOR NURSING SURVEY

1. The blue forms are for all full-time and part-time RN's and LVN's, both salaried and per diem. The white forms are for head nurses.

2. If you need more forms, they are available from <NAME> in the Nursing Service Office. If you have extra forms, please return them to <NAME>.

3. Please ask staff members to complete the survey before discussing it with colleagues. The target return date for this survey is <DATE> Please ask staff to mail completed surveys by this date.

4. Keep in mind that if a high proportion of staff participate, the results will be more valid.

5. A note about confidentiality..... This is an anonymous survey whose results will be analyzed independently of <NAME> Hospital. Survey results will be reported back to the hospital on a group basis (nursing unit) only. The goal is to describe characteristics of each unit, not individuals. Head Nurses will receive results for their own units.

6. Thank you very much for investing your valuable time. If you have any questions, please contact <NAME>.

NURSING WORK CHARACTERISTICS

INSTRUCTION: For Items 9 through 15 in this section, please circle the number that best describes your opinion. Here is what the numbers in this section mean:

1	2	3	4	5
To a small extent		To some extent		To a great extent

	TO A SMALL EXTENT				TO A GREAT EXTENT
9. Nursing tasks on this unit are rarely the same from day to day	1	2	3	4	5
10. To what extent is there a clearly known way to do the major types of work you normally encounter?	1	2	3	4	5
11. To what extent would you say your work is routine?	1	2	3	4	5
12. Nurses on this unit depend more on experience than on formal knowledge from courses or books.	1	2	3	4	5
13. Nurses on this unit do about the same tasks in the same way most of the time.	1	2	3	4	5
14. To what extent is there an understandable sequence of steps that can be followed in doing your work?	1	2	3	4	5
15. Basically, nurses on this unit perform repetitive activities in doing their jobs.	1	2	3	4	5

16. A. BRIEFLY DESCRIBE THE THREE MOST SERIOUS PROBLEMS THAT PREVENT YOU FROM GETTING YOUR WORK DONE THE WAY YOU FEEL IT SHOULD BE DONE.

1 _____

_____

2 _____

_____

3 _____

_____

B. OF THE ABOVE, WHICH PROBLEM MOST INTERFERES WITH DOING YOUR WORK THE WAY YOU FEEL IT SHOULD BE DONE? Please circle the number.

C. PLEASE DESCRIBE (IN ORDER OF IMPORTANCE) THE THREE MAIN SOURCES (OR CAUSES) OF THE PROBLEM CIRCLED ABOVE.

Cause 1.(most important)_____

_____

Cause 2._____

_____

Cause 3._____

_____

D. CONSIDERING THE PROBLEM YOU CIRCLED IN PART A ABOVE, WHAT ACTION DID YOU TAKE THAT WORKED BEST TO OVERCOME THE SNAG?

[ ] I referred to a policy or procedure manual.

[ ] I asked the team leader or head nurse how to proceed.

[ ] I talked it over with other nurses.

[ ] Without doing any of the above, I made a decision.

[ ] Other action.(Please describe.)_____

_____

[ ] No action.(Why?)_____

NURSING TEAM CHARACTERISTICS

INSTRUCTION: For Items 17 through 20 in this section, circle the number that best describes your opinion.

1	2	3	4	5
ALMOST NEVER TRUE		SOMETIMES TRUE		ALMOST ALWAYS TRUE

		ALMOST NEVER TRUE				ALMOST ALWAYS TRUE
17.	I am asked to participate in decisions affecting my work.	1	2	3	4	5
18.	I am encouraged to give suggestions about decisions that relate to my job.	1	2	3	4	5
19.	Decisions related to my job are made without my involvement.	1	2	3	4	5
20.	The head nurse on this unit makes decisions related to my job without consulting me.	1	2	3	4	5

---

21. What percentage of the time do you highly depend upon other nurses in your unit for help and/or they depend upon you?

1	2	3	4	5
0-20%	21-40%	41-60%	61-80%	81-100%

22. How many patients on your unit have more than one attending physician prescribing care?

1	2	3	4	5
0-20%	21-40%	41-60%	61-80%	81-100%

23. Different kinds of situations call for different amounts of guidance from policies or from superiors. Sometimes policies are broad; sometimes they are specific.

Please indicate how explicit the policies are on your unit for each problem area, regardless of whether or not the policies are actually written down.

FOR EACH ITEM, CIRCLE APPROPRIATE NUMBER ON SCALE

	NOT AT ALL EXPLICIT				VERY EXPLICIT	Does Not Apply
a. Dress or attire on the unit.	1	2	3	4	5	0
b. Returning to work after an illness.	1	2	3	4	5	0
c. Conditions under which you may be requested to work overtime.	1	2	3	4	5	0
d. Arrangements under which nurses can accept verbal orders from physicians.	1	2	3	4	5	0
e. Time by which patients' baths must be completed.	1	2	3	4	5	0
f. Personal break time during shift.	1	2	3	4	5	0
g. Exchanging/sharing duties (not shifts) with fellow nurses.	1	2	3	4	5	0

24. When a decision must be made to call in additional nursing staff through overtime, registry, or borrowing staff, how much influence does each of the following individuals or groups usually exercise?

	AMOUNT OF INFLUENCE EXERCISED				
	NONE	LITTLE	MEDIUM	HIGH	VERY HIGH
Hospital Administrator. .	1	2	3	4	5
Director of Nursing Services.	1	2	3	4	5
Head Nurse.	1	2	3	4	5
Unit staff nurses as a group.	1	2	3	4	5
Physicians whose patients are on this unit	1	2	3	4	5

FOR ITEMS 25 THROUGH 33, CIRCLE THE NUMBER THAT BEST DESCRIBES YOUR OPINION.

25. How productive are the nurses on your unit?

1	2	3	4	5
VERY LOW PRODUCTIVITY				HIGHLY PRODUCTIVE

26. What is the quality of the services provided by the nurses on your unit?

1	2	3	4	5
POOR QUALITY				EXCELLENT QUALITY

27. Do the nurses on your unit seem to get the most out of the resources (people, materials & equipment, etc.) they have available? That is, how efficiently do they do their work?

1	2	3	4	5
NOT AT ALL EFFICIENTLY				VERY EFFICIENTLY

28. How well do the nurses on your unit anticipate problems in order to prevent or minimize them?

1	2	3	4	5
VERY GOOD AT ANTICIPATING				VERY POOR AT ANTICIPATING

29. How well do nurses on your unit keep up with advances in techniques and equipment in your nursing specialty?

1	2	3	4	5
KEEP UP POORLY				KEEP UP VERY WELL

30. How quickly do nurses on your unit accept and adjust to these changes in techniques or equipment?

1	2	3	4	5
RAPIDLY ADJUST				SLOWLY ADJUST

31. What proportion of the nurses on your unit readily accept and adjust to these changes?

1	2	3	4	5
VERY FEW				MOST OF THEM

32. How much opportunity do nurses on your unit have to contribute to planned changes?

1	2	3	4	5
VERY LITTLE OPPORTUNITY				CONSIDERABLE OPPORTUNITY

33.How well do the nurses on your unit cope with emergencies?

1	2	3	4	5
VERY POORLY				VERY WELL

INSTRUCTION: For Questions 34 through 63 in this section, please circle the number that best describes your opinion.

1	2	3	4	5
STRONGLY DISAGREE				**STRONGLY AGREE**

	STRONGLY DISAGREE				STRONGLY AGREE
34. I willingly put in extra effort in order to help this hospital be successful.	1	2	3	4	5
35. I tell friends this hospital is a great place to work.	1	2	3	4	5
36. I feel very little loyalty to this hospital.	1	2	3	4	5
37. I would accept almost any type of nursing assignment in order to keep working for this hospital.	1	2	3	4	5
38. I find that my values and the hospital's values are very similar.	1	2	3	4	5
39.I am proud to tell others that I am part of this hospital.	1	2	3	4	5
40. I would be happy working for a different hospital as long as the type of work were similar.	1	2	3	4	5
41. This hospital really inspires me to do my best.	1	2	3	4	5
42. It would take very little change in my present circumstances to cause me to leave this hospital.	1	2	3	4	5

	STRONGLY DISAGREE				STRONGLY AGREE
43. I am very glad that I chose this hospital to work for, over others I was considering.	1	2	3	4	5
44. There's not too much to be gained by sticking with this hospital indefinitely.	1	2	3	4	5
45. I often disagree with this hospital's personnel policies..	1	2	3	4	5
46. I really care about the fate of this hospital.	1	2	3	4	5
47. For me, this is the best hospital to work for.	1	2	3	4	5
48. Deciding to work for this hospital was a definite mistake.	1	2	3	4	5

NOTE: QUESTIONS 49-63 REFER TO YOUR UNIT.

	STRONGLY DISAGREE				STRONGLY AGREE
49. I willingly put in extra effort to help this unit be successful	1	2	3	4	5
50. I tell my friends this unit is a great place to work.	1	2	3	4	5
51. I feel very little loyalty to this unit..	1	2	3	4	5
52. I would accept almost any shift or assignment in order to keep working for this unit.	1	2	3	4	5
53. I find that my values and the unit's values are very similar.	1	2	3	4	5

	STRONGLY DISAGREE				STRONGLY AGREE
54. I am proud to tell others that I am part of this unit.	1	2	3	4	5
55. I would be happy working for a different unit as long as the type of work were similar.	1	2	3	4	5
56. This unit really inspires me to do my best.	1	2	3	4	5
57. It would take very little change in my present circumstances to cause me to leave this unit.	1	2	3	4	5
58. I am very glad I chose this unit to work for, over others I was considering.	1	2	3	4	5
59. There's not too much to be gained by sticking with this unit indefinitely. .	1	2	3	4	5
60. I often disagree with the personnel policies of this unit.	1	2	3	4	5
61. I really care about the fate of this unit.	1	2	3	4	5
62. For me, this is the best unit to work for.	1	2	3	4	5
63. Deciding to work for this unit was a definite mistake.	1	2	3	4	5

Appendix 2

The Relevance of Unit Size in Structure-Technology Fit Studies

Traditionally, studies of organization structure and technology have investigated the factor of size as a key variable, but these studies were conducted at the whole organization level. At the work unit level, initially the small group researchers of the 1950's and 1960's provided some evidence for certain group size and structure links (Miller, 1952; Jennings, 1960; Hare, 1962). However, in the structure-technology literature of the 1970's and early 1980's, size is rarely mentioned. Van de Ven, Delbecq, and Koenig (1976) explored the influence of work unit size upon modes of coordination. They found that as task uncertainty increases, there are substantial decreases in the use of rules and large increases in the use of horizontal communication channels and group meetings. But theirs was not a contingency study, in that the structure-technology relationships were not related to work unit outcomes. The author of the present study is not aware of any contingency theory studies that have addressed work unit size.

Nevertheless, a brief overview of unit size may be instructive here. Unit size is traditionally operation-

alized as the number of persons working within a unit. Even this apparently straightforward definition is problematic in nursing, where many staff members are part-time and permanent staff (whether full or part-time) are frequently supplemented by temporary staff who do not appear in the "head count." A measure such as full-time equivalents would be more accurate than a head count, but FTE information was not available to this researcher.

Another reason staff size is not always an accurate measure of size is that staff to patient ratios vary significantly, with some ICU's having 3 nurses for every patient, while obstetrics may have 1 nurse for three patients. The intensity of nursing care varies with nursing specialty.

Another approach would look at output measures, such as number of patients treated (an area of data not available to this researcher) or number of beds. Even "bed" is a construct open to interpretation in hospitals. Bed is usually defined in terms of the Joint Commission on Accreditation of Hospitals (JCAH) requirement that in order to be counted, a bed must be ready for patient use, whether actually used or not. Beds in storerooms and unused corridors may be counted. Head nurses sometimes refer to "available" versus "actual" beds, with the former being an upper limit which is

rarely if ever employed, and the latter being the everyday reality of accessible, prepared, staffed beds.

Should unit size reflect the number of staff or patients or both? In this study, number of beds and number of staff (not FTE's) were measured. These are rough indicators of unit size. Correlations for these size variables and other study key variables are presented below.

CORRELATIONS FOR UNIT SIZE VARIABLES AND KEY VARIABLES

Correlation between BEDS and STAFF is .498**

	BEDS X=26 sd=20	STAFF X=18.03 sd=14.99
UNCERTN	-.134 [32]	.032 [38]
DECENT	-.342* [32]	-.389* [38]
DESTAND	-.234 [32]	.092 [38]
PRODUCT (SUP)	-.184 (.139) [32] [31]	-.280+ (.096) [38] [36]
ADAPT (SUP)	-.250 (.014) [32] [31]	-.221 (.182) [38] [36]
EFFECT (SUP)	-.191 (.031) [32] [31]	-.210 (.280+) [38] [36]
PRODUCT--all	-.108 [32]	-.235 [38]
ADAPT--all	-.159 [32]	-.137 [38]
EFFECT--all	-.103 [32]	-.105 [38]
COMUNIT	-.190 [32]	-.460** [38]
COMORG	.089 [32]	-.076 [38]

Sample sizes are in brackets. Certain units (ER and labor & delivery) were eliminated because they do not count beds. Two units had non-responding supervisors.

We note that as number of beds and staff increase, decentralization decreases, which means that staff in smaller units have higher levels of participation in decision-making. There is a tendency for nurses in larger staffed (but not larger in beds) units to perceive their units as less productive; while head nurses in larger staffed units tend to perceive their units as more effective.

The most significant correlation is between number of unit nursing staff and commitment to unit, with larger units having lower levels of unit commitment. This is consistent with small group research on deterioration of group cohesion as group size increases (Miller, 1952; Jennings, 1960).

From these minimal data, we might tentatively interpret evidence supporting the design of smaller nursing units to enhance nurses' participation in decision-making and unit commitment.

Appendix 3

RESPONSE RATES BY UNIT & HOSPITAL

For each column:
Unit # # distributed - # received - response rate

HOSPITAL 1	HOSPITAL 2	HOSPITAL 3
1 11 - 7 - 64%	16 48 - 4 - 8%	30 67 - 36 - 54%
2 8 - 1 - 13%	17 35 - 6 - 17%	31 29 - 7 - 24%
3 4 - 1 - 25%	18 53 - 20 - 38%	32 17 - 9 - 53%
4 11 - 3 - 27%	19 12 - 6 - 50%	33 18 - 4 - 22%
5 4 - 1 - 25%	20 48 - 8 - 17%	34 8 - 3 - 38%
6 3 - 3 - 66%	21 14 - 2 - 14%	35 25- 10 - 40%
7 11 - 5 - 45%	22 18 - 8 - 44%	36 17- 6 - 35%
8 6 - 2 - 33%	23 19 - 3 - 16%	37 10 - 5 - 50%
9 8 - 2 - 25%	24 29 - 9 - 28%	38 18 - 5 - 28%
10 8 - 2 - 25%	25 16 - 9 - 50%	39 33 - 4 - 12%
11 6 - 2 - 33	26 7 - 1 - 14%	
12 8 - 4 - 50%	27 12 - 6 - 50%	
13 8 - 4 - 50%	28 13 - 7 - 54%	
14 8 - 4 - 50%	29 10 - 4 - 10%	
11 9 - 6 - 66%		
113 - 46 - 41%	334 - 93 - 28%	242 - 89 - 37%

Overall individual response rate: 33% (688 distributed; 228 returned)

Unit response rate: Range 8 - 66%, Mean of 35%

Appendix 3
(Continued)

NURSING UNITS BY SPECIALIZATION AND HOSPITAL

	Hosp.1	Hosp.2	Hosp.3
L & D/Nursery	2	1	2
Obstet./Gynecol.	1	1	1
Pediatrics	1		1
Medical-Surgical	3	2	2
Orthopedics	1	1	1
Neurology	1	1	
Oncology	1	1	
Telemetry	1	1	
Dialysis			1
Psychiatry		1	
Rehabilitation		1	
Intensive Care*	3	3	1
PACU**	1		
Emergency Room		1	1
	15	14	10

* Includes coronary, medical, surgical, neonatal ICU's
** Post Anesthesia Care Unit (surgical recovery unit)

Appendix 4

CORRELATION OF SHIFT AND STATUS WITH KEY VARIABLES

Correlation Coefficient
Probability
Number of Observations (respondents)

	SHIFT	STATUS[1]
UNCERTN	.078	-.031
	.473	.724
	87[2]	130[3]
DECENCOM	.096	-.005
	.382	.958
	85	127
DESTDCOM	.061	-.212
	.578	.016*[4]
	87	130
EFFECT	-.103	.11
	.344	.212
	87	129
COMORG	-.018	.168
	.866	.056
	87	130
COMUNIT	-.054	.123
	.624	.165
	86	129

---

[1] Status was coded per diem = 0; salary = 1.

[2] Only Hospital 3 respondents vary on shift.

[3] Only Hospitals 1 & 3 have a per diem status.

[4] * $p<.05$

Appendix 4
(Continued)

RESPONSE RATES FOR SALARY VERSUS PER DIEM NURSES

(All numbers indicate percentages by category, within unit.)

UNIT	SALARY RESPONSE RATE	PER DIEM RESPONSE RATE
1.[1]	N/A[2]	N/A
2.	N/A	N/A
3.	N/A	N/A
4.	N/A	N/A
5.	50	50
6.	N/A	N/A
7.	50	0
8.	N/A	N/A
9.	N/A	N/A
10.	N/A	N/A
11.	20	50
12.	80	0
13.	80	33
14.	66	50
15.	N/A	N/A
30.	70	24
31.	26	0
32.	46	50
33.	27	0
34.	N/A	N/A
35.	44	17
36.	38	33
37.	50	0
38.	33	22
39.	7	11

[1] Only units from Hospitals 1 & 3 vary on status.

[2] N/A = information not available, or not applicable (i.e., no per diem nurses assigned to that unit).

Appendix 5

DEMOGRAPHIC FREQUENCIES & PERCENTAGES BY HOSPITAL--I

		HOSP.1 n=46	HOSP.2 n=93	HOSP.3 n=89	TOTAL n=228
SEX					
	Female	46 (100)	89 (95.7)	85 (96.6)	220 [97]
	Male	0	4 (4.3)	3 (3.4)	7 [3]
AGE (years)					
	Mean	40	35.8	39.6	37.9
	Min.-Max.	24-62	21-63	23-63	21-63
	S.D.	9.8	10.6	10	10.3
RACE					
	White	41 (89.1)	90 (96.8)	61 (68.5)	192 [84]
	Asian	3 (6.5)	3 (3.2)	21 (23.6)	27 [12]
	Hispanic	1 (2.2)	0	5 (5.6)	6 [3]
	Black	1 (2.2)	0	2 (2.3)	3 [1]
NATIVE LANGUAGE					
	English	41 (89.1)	92 (98.9)	74 (83.2)	207 [91]
	Other	5 (10.9)	1 (1.1)	15 (16.9)	21 [9]

Numbers in parentheses are percentages within each organization.
Numbers in brackets are percentages within the total sample of respondents.

Appendix 5
(Continued)

DEMOGRAPHIC FREQUENCIES & PERCENTAGES BY HOSPITAL--II

	HOSP.1 n=46	HOSP.2 n=93	HOSP.3 n=89	TOTAL n=228
EDUCATION				
*A.A./Dip.	27 (60)	75 (80.7)	49 (55.1)	151 [66.2]
B.A./B.S.	15 (33.3)	14 (15.1)	40 (44.9)	69 [30]
M.A./M.S.	2 (4.4)	2 (2.1)	0	4 [2]
None	1 (2.2)	2 (2.2)	0	3 [1]
LICENSE				
L.V.N.	2 (4.4)	3 (3.2)	1 (1.1)	6 [2]
R.N.	43 (93.5)	90 (96.8)	87 (98.9)	220 [97]
TENURE ON UNIT (in years)				
Mean	6.64	4.64	7.38	6.11
Min.-Max.	.33-20	.05-20	1-29	.05-29
S.D.	4.96	4.5	6.66	5.66
TENURE IN ORGANIZATION (in years)				
Mean	9.03	6.87	9.08	8.7
Min.-Max.	.66-26.3	.17-30	.08-29	.08-30
S.D.	5.92	5.65	7.35	6.48
TENURE IN PROFESSION (in years)				
Mean	15.2	10.7	14.9	13.22
Min.-Max.	4-39	0-40	0-40	0-40
S.D.	9.9	9.9	9.7	10.04

(#)= Percentages within each organization.

Appendix 5
(Continued)

DEMOGRAPHIC FREQUENCIES & PERCENTAGES BY HOSPITAL--III

	HOSP.1 n=46	HOSP.2 n=93	HOSP.3 n=89	TOTAL n=228
EMPLOYMENT STATUS				
Salary	36 (78.3)	93 (100)	67 (79.8)	196 [86]
Per Diem	10 (21.7)	N.A.	17 (20.2)	27 [12]
HOURS WORKED PER WEEK				
=> 40	12 (26.1)	63 (67.7)	49 (55.1)	124 [54]
20-39	34 (73.9)	26 (28)	34 (38.2)	94 [41]
=< 19	0	4 (4.3)	6 (6.7)	10 [4]
SHIFT ASSIGNMENT				
Day	46 (100)*	N.A.	41 (47.1)	87 [39]
Evening	N.A.	N.A.	32 (36.8)	32 [14]
Night	N.A.	N.A.	14 (16.1)	14 [6]
Rotating	N.A.	93 (100)	N.A.	93 [41]

(#)= Percentages within each organization.
[#]= Percentages within the total sample of respondents.
* In Hospital 1, only day shift nurses were available to participate.

Appendix 5
(Continued)

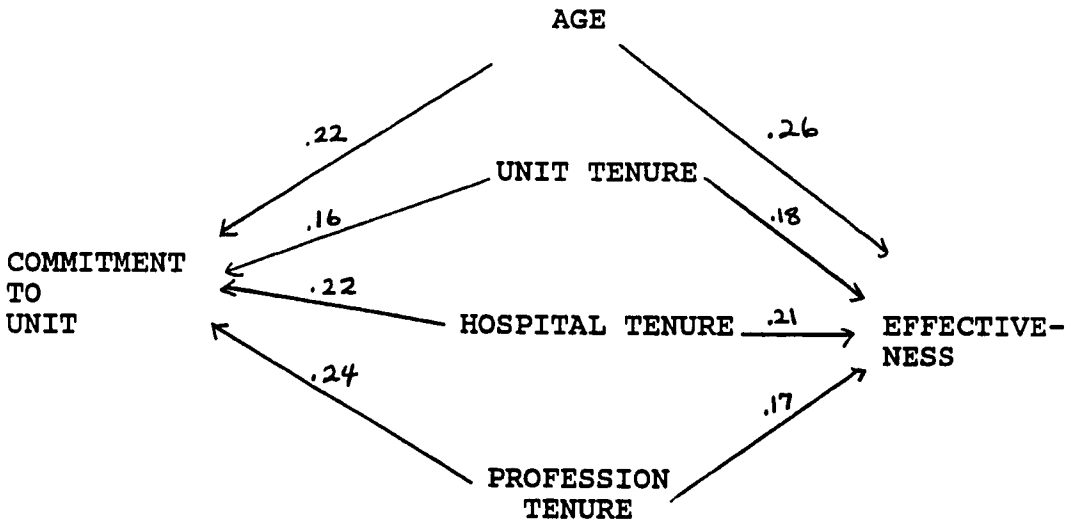
CORRELATION OF DEMOGRAPHIC VARIABLES
WITH KEY STUDY VARIABLES

	UNCERTN	DECENCOM	DESTDCOM	EFFECT	COMUNIT
SEX	-.086	.123+	.037	.011	-.021
AGE	-.164**	-.166*	-.296***	.26***	.215***
LANGUAGE	-.005	.038	.09	.025	.051
EDUCATION	-.048	.057	.061	-.035	-.094
LICENSE	-.042	.073	.159	-.017	-.067
TENUNIT	-.125+	.087	-.181**	.175**	.16*
TENHOSP	-.076	.012	-.264***	.207**	.220***
TENPROF	-.129+	-.043	-.255***	.174*	.241***

+p<.10, *p<.05, **p<.01, ***p<.001

Appendix 5
(Continued)

THE CORRELATION OF DEMOGRAPHIC VARIABLES
WITH STUDY OUTCOMES



Appendix 5
(Continued)

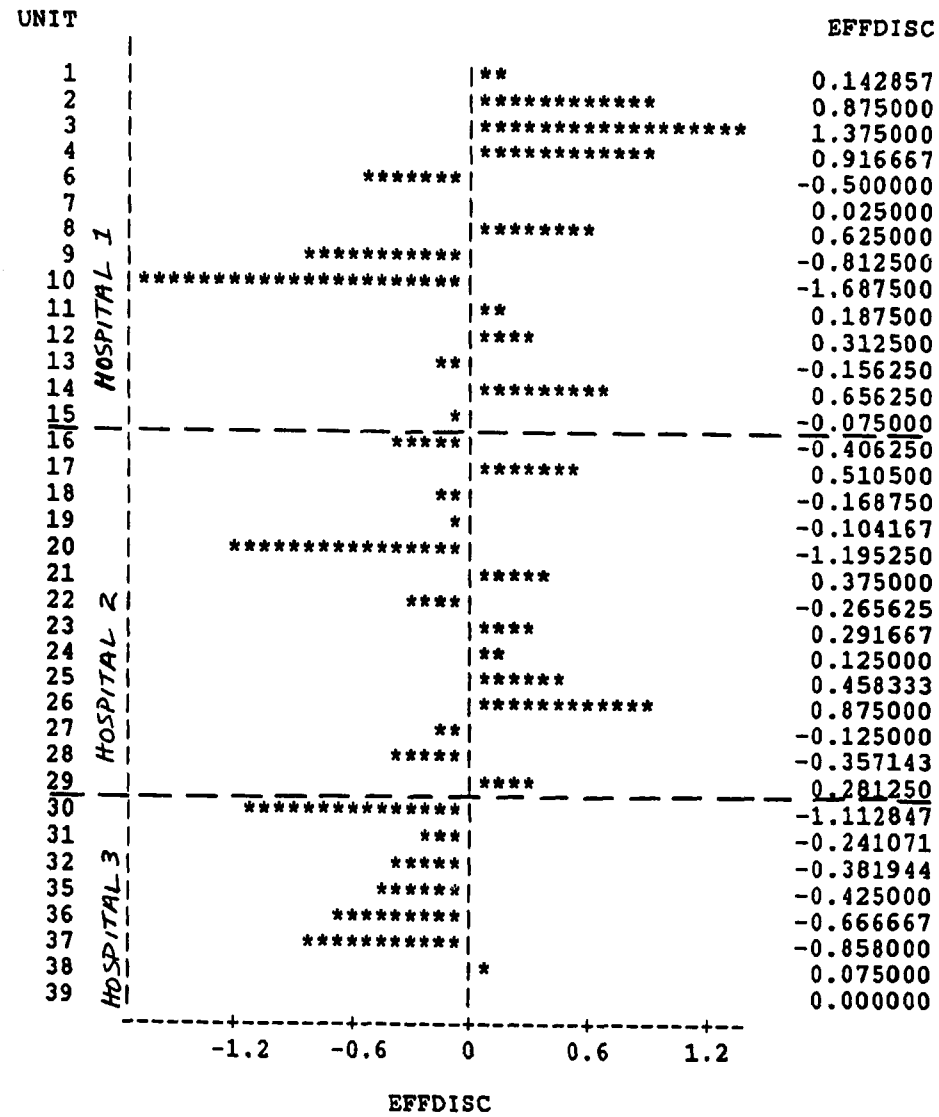
AGE & TENURE INTERHOSPITAL DIFFERENCES

Results of multiple t tests, two-tailed.

Hospital Pair	AGE	TENHOSP	TENUNIT	TENPROF
2 vs. 3	N.S. 2<3	p<.10 2<3	p<.05 2<3	p<.05
1 vs. 3	N.S.	N.S.	N.S.	N.S.
1 vs. 2	N.S.	N.S.	N.S.	N.S.

Appendix 6

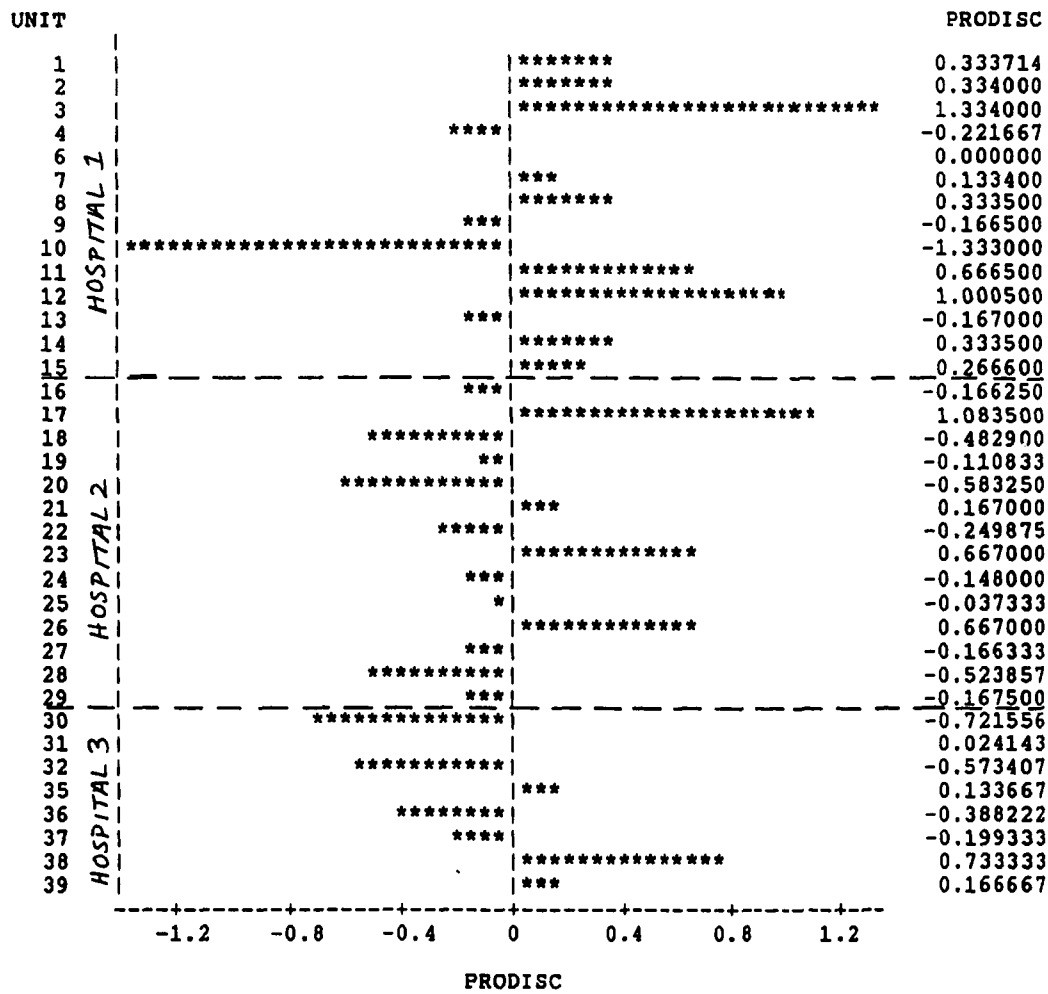
DISCREPANCY BETWEEN STAFF AND SUPERVISORS' EFFECTIVENESS RATINGS: OVERALL EFFECTIVENESS



Note: Supervisor rating subtracted from staff mean rating = EFFDISC. Short bars interpreted as higher agreement; long bars as higher discrepancy. Long bars to right connote higher supervisor ratings; to left, higher staff ratings

Appendix 6
(Continued)

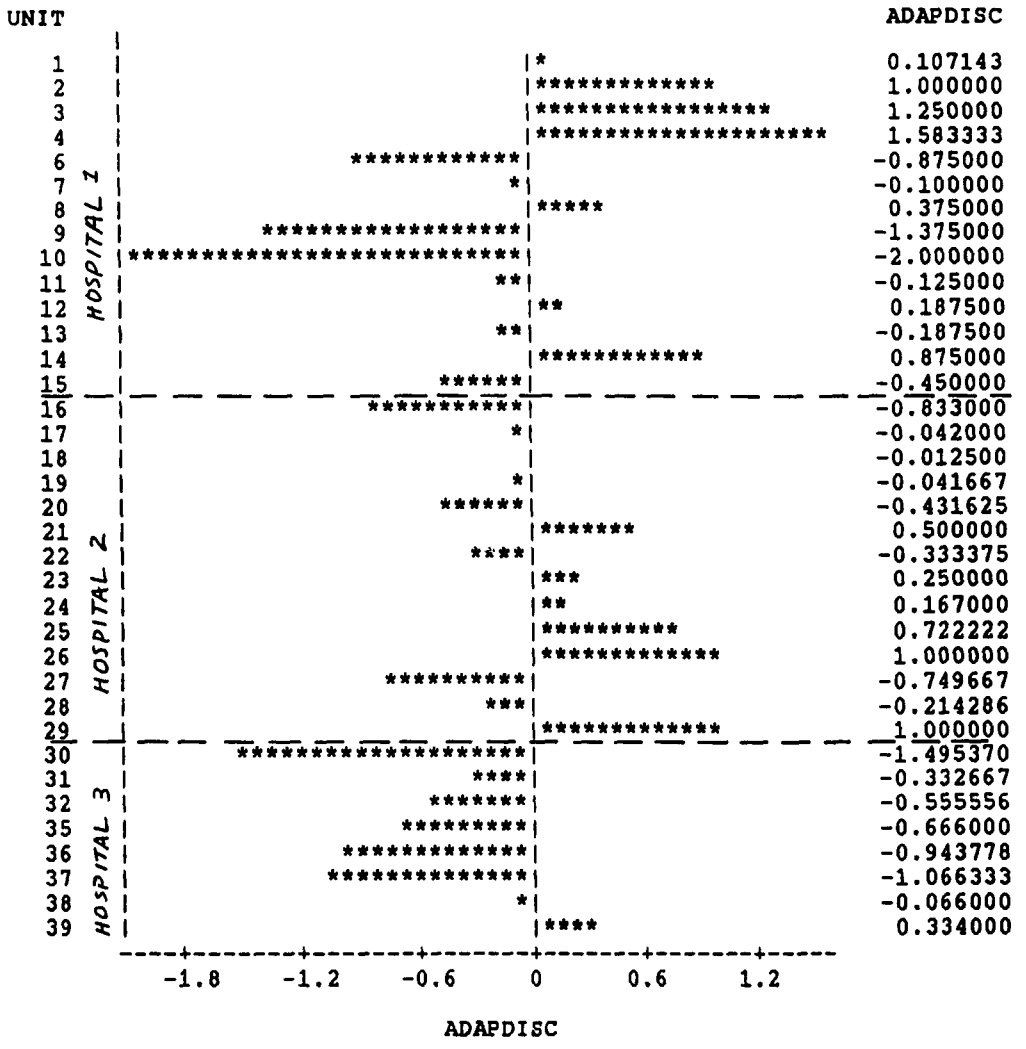
DISCREPANCY BETWEEN STAFF AND SUPERVISORS' EFFECTIVENESS RATINGS: PRODUCTIVITY



Note: Supervisor rating subtracted from staff mean rating = PRODISC. Short bars interpreted as higher agreement; long bars as higher discrepancy. Long bars to right connote higher supervisor ratings; to left, higher staff ratings

Appendix 6
(Continued)

DISCREPANCY BETWEEN STAFF AND SUPERVISORS' EFFECTIVENESS RATINGS: ADAPTABILITY



Note: Supervisor rating subtracted from staff mean rating = ADAPDISC. Short bars interpreted as higher agreement; long bars as higher discrepancy. Long bars to right connote higher supervisor ratings; to left, higher staff ratings

Appendix 7

PATTERN ANALYSIS: PRELIMINARY PROCEDURES

The first step in pattern analysis is to establish a priori ideal pattern profiles of levels of key variables such as technology and structure dimensions. Contingency theory posits these profiles for this study's dimensions:

	Under Conditions of Technological Uncertainty That Is:		
	LOW	MED.	HIGH
Unit Structure Should Be:			
DESTANDARDIZATION	LOW	MED.	HIGH
DECENTRALIZATION	LOW	MED.	HIGH

The next step is to select a subsample of high-outcome units. The top-scoring units for all outcomes (13 units in most cases; 12 units in one case) are identified. Each of these high-outcome subsamples is then divided into three levels of technological uncertainty: high, medium, and low. The mean structure variable score of units within each level of uncertainty is considered an empirically derived ideal type.

Analysis of variance is then utilized to determine if the profiles within each subsample are statistically significantly different, and in the predicted ordinal

relationships specified by the model above.

Differences between these ideal patterns and actual patterns of remaining units are then calculated using a Euclidean distance metric:

$$DIST = \sqrt{(Xis - Xjs)^2}$$

where Xis is the score of the ideal unit on the sth structure dimension

where Xjs is the score of the focal unit on the same dimension

The resulting distance calculations are between a focal unit and its respective ideal type, according to the focal unit's level of technological uncertainty. The distance measure is then correlated with outcome measures. Misfit is demonstrated if the distance score is negatively correlated with performance measures.

Subsamples and empirically derived ideal types were created and ANOVA's performed for this study's data. Results are presented in tables below. Only one ANOVA was significant at $p<.10$. For high-productivity units (staff ratings), decentralization scores are significantly different and in the predicted ordinal order, but only for the medium and high uncertainty levels. High adaptability and high commitment subsamples show ordinally ordered values in the predicted directions for

all three levels of uncertainty, but the differences are small and not statistically significant.

The distance measure was not calculated because data in this study did not meet the criterion of supporting the ideal structure-technology typology. In Drazin and Van de Ven's study (1985), regression analysis failed to produce evidence for contingency theory, but pattern analysis did yield significant results. In this data, pattern analysis is not an appropriate alternative or complement to regression analysis to test contingency theory hypotheses.

Appendix 7
(Continued)

PROFILES OF MEAN UNIT STRUCTURE SCORES
FOR HIGH OUTCOME UNITS,
BY LOW, MEDIUM, AND HIGH UNCERTAINTY:
STAFF RATINGS

High Effectiveness Units (Staff ratings)

Structural Characteristic	Technological Uncertainty Low	Medium	High	ANOVA F	p
Decentralization	3.981	4.075	4.02	.01	.99
Destandardization	2.401	2.221	2.384	.20	.82

High Productivity Units (Staff ratings)

Structural Characteristic	Technological Uncertainty Low	Medium	High	ANOVA F	p
Decentralization	3.863	3.812	4.602	3.71	.06
Destandardization	2.112	2.309	2.580	2.38	.14

High Adaptability Units (Staff ratings)

Structural Characteristic	Technological Uncertainty Low	Medium	High	ANOVA F	p
Decentralization	3.844	3.916	4.789	2.45	.14
Destandardization	2.219	2.324	2.673	1.08	.38

High Commitment Units (Staff ratings)

Structural Characteristic	Technological Uncertainty Low	Medium	High	ANOVA F	p
Decentralization	3.694	4.11	4.425	.91	.44
Destandardization	2.229	2.34	2.478	.28	.76

Appendix 7
(Continued)

PROFILES OF MEAN UNIT STRUCTURE SCORES
FOR HIGH OUTCOME UNITS,
BY LOW, MEDIUM, AND HIGH UNCERTAINTY:
SUPERVISOR RATINGS

High Effectiveness Units (Head RN ratings)

Structural Characteristic	Technological Uncertainty Low	Medium	High	ANOVA F	p
Decentralization	3.850	3.796	3.781	.01	.99
Destandardization	2.307	2.509	2.487	.28	.76

High Productivity Units (Head RN ratings)

Structural Characteristic	Technological Uncertainty Low	Medium	High	ANOVA F	p
Decentralization	3.594	3.575	4.146	1.58	.25
Destandardization	2.508	2.326	2.602	.07	.93

High Adaptability Units (Head RN ratings)

Structural Characteristic	Technological Uncertainty Low	Medium	High	ANOVA F	p
Decentralization	3.686	3.932	3.838	.12	.89
Destandardization	2.143	2.449	2.342	.92	.43