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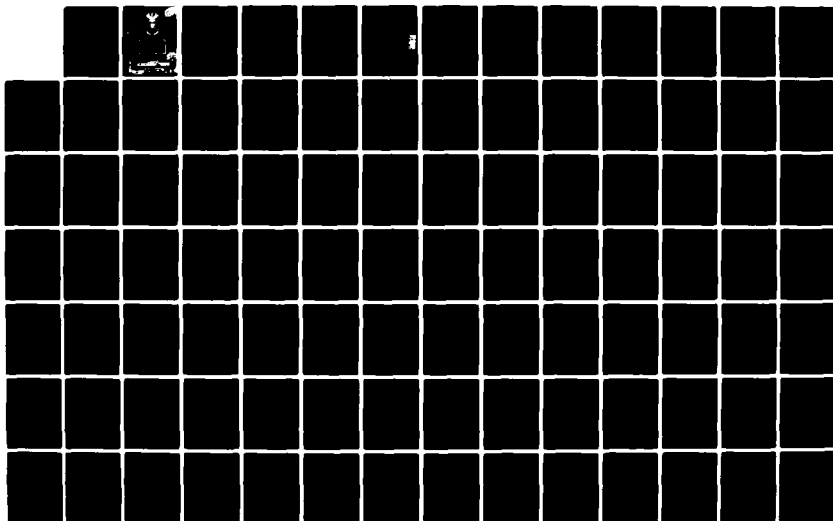
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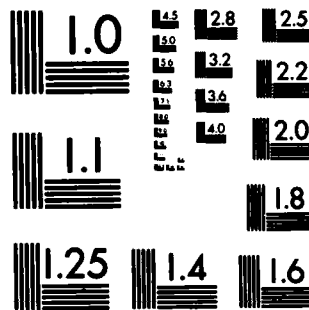
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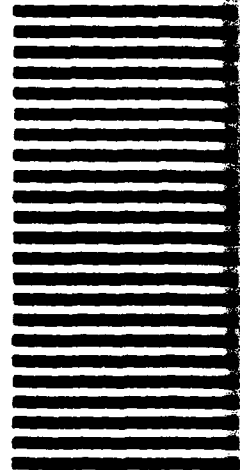


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This study investigates the predictive value of the organizational components job technology, control, and individual characteristics, as they influence the organizational outcomes performance and satisfaction. Drawing from the works of Hackman and Oldham (1980) and Ovalle (1981), this study proposes a model incorporating technology as the independent variable, control and individual characteristics as the moderating variables, and performance and satisfaction as the dependent variables. A survey questionnaire developed and tested by Ovalle (1981) was administered to 279 employees of an Air Force educational institution. Responses to the questions were analyzed using factor analysis, comparative analysis, and multiple linear regression. The individual characteristic investigated in this study, knowledge, played a significant role ( $p < .05$ ), as did technology ( $p < .05$ ) and control ( $p < .01$ ), in predicting organizational performance. However, only technology and control proved significant predictors of satisfaction. Further analysis also revealed the important moderating influences of knowledge on several of the individual organizational components under study. The findings suggest that workers' educational background and work experience play important roles, not only in determining the quantity and quality of their performance, but also in influencing technological and managerial processes which lead to performance. However, knowledge plays an insignificant role ( $p > .05$ ) in determining employees' levels of satisfaction.

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ORGANIZATIONAL TECHNOLOGY, CONTROL PROCESSES,  
AND INDIVIDUAL KNOWLEDGE AS PREDICTORS OF  
PERFORMANCE AND SATISFACTION: AN ANALYSIS  
OF ORGANIZATIONAL DETERMINANTS

A Thesis

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Engineering Management

By

William R. Floyd, BS  
Captain, USAF

September 1982

Approved for public release;  
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This thesis, written by

Captain William R. Floyd

has been accepted by the undersigned on behalf of the faculty  
of the School of Systems and Logistics in partial fulfillment  
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## CHAPTER I

### INTRODUCTION

During the past two decades, organizational behavior theorists have become increasingly interested in the potential influences of internal organizational factors on overall organization performance and satisfaction, as well as other behavioral outcome variables. Current research efforts are focusing on a number of organizational components (e.g., environment, technology, structure) and evaluating the interactions among these variables as they affect the organization. This research effort is intended to further delineate certain of these internal organizational elements, specifically job technology, control processes, and individual knowledge, their interrelationships with one another, and their influences on performance and satisfaction in a service-type organization.

There are three specific objectives for this research study. First, I will investigate the effects of job technology (defined in general terms as the nature of the work, or tasks, performed in an organization) and knowledge (defined in general terms as the familiarity, information, and understanding that an individual possesses, enabling him or her to perform certain tasks) on organizational control processes (defined in general terms as the means by which an

organization ensures that its activities produce the desired results) at the individual worker level in the organization. Second, I will investigate the effects of organizational control processes and knowledge on performance and satisfaction at the individual worker level. Third, I will investigate the existence and strength of the combined effects of technology, control, and knowledge on performance and satisfaction.

Major efforts have been conducted by organizational researchers examining the contextual nature of the organization (that is, those factors over which the organization was considered to have little control, such as its environment, size, and technology), and identifying their effects on the organization. Burns and Stalker (1961) determined that different types of organizational structures are effective, dependent on the nature of the external environment (e.g., stable versus dynamic) in which the organization operates. They defined a stable environment as one characterized by slow product technology and market change, and by conditions of substantial certainty, as opposed to the fast-paced, ever-changing, and uncertain nature of the dynamic environment.

Lawrence and Lorsch (1967) investigated environmental, structural, and strategic elements and their effects on the organization, which led to the development of their contingency theory of the organization. Their work represented one of the earliest attempts to evaluate and integrate both external and internal factors affecting organizational

well-being. This study provided an increased recognition of the numerous internal organizational states and processes, the environmental demands, and the complexity of the interrelationships among these various factors (Lawrence and Lorsch, 1967).

Continuous development and refinement of existing organizational theories induced substantial interest among researchers concerning the nature of the relationships between technology and structure and, to a lesser degree, among technology, structure, and performance. The importance of available product and production technologies as organizational determinants was generally recognized and accepted among researchers in this field. However, substantial disagreement still exists concerning how, and to what degree, this relationship affects organizational performance and satisfaction. Contradictory results and inconclusive findings which have provoked the controversy are due in part to inconsistencies in the units of analysis studied and differences in the operationalization of variables (e.g., technology and structure) across studies (Ford and Slocum, 1977). For example, the various dimensions of structure have been measured objectively by some researchers, while other researchers have relied on perceptions to describe and measure structure. These two approaches to conceptualizing structure have, in the past, been viewed as rivals, while Ford and Slocum (1977) suggested that they actually provide information about different aspects of structure. Ford and Slocum also proposed that the existing single-variable approach is inadequate in identifying the

technology-structure relationship, and that other variables, including individual elements of structure, may be modifying the technology-structure linkage.

In addition to the areas outlined by Ford and Slocum (1977), several other issues have surfaced concerning the relationships between technology, structure, and performance/satisfaction. Many researchers feel that the technology-organization relationships still have not been appropriately conceptualized.

Reeves and Woodward (1970) revolutionized organizational theory, proposing that the technology-organization relationships could be better conceptualized by analyzing the moderating effects of control processes on the technology-performance and technology-satisfaction linkages. Hall (1977) suggested that organizations must actively pursue and integrate, rather than "absorb," technology. Hall (1977) and Hunt and Near (1980) stressed the need to look at the organizational activities, processes, and interrelationships, rather than emphasizing a general, direct impact of technology on the organizational structure.

It is important to note here the divergence in schools of thought concerning the relationship between structure and control processes. Some researchers, such as March and Simon (1958), held that structure provides the framework and means by which control activities can operate; that structure is the substance of control. Others maintained that structure and control are not identical concepts with equivalent



meanings, but rather that structure and the processes involved in control are significantly different (Hall, 1977; Reeves and Woodward, 1970). Like Thompson (1967) and Ovalle (1981), I maintain that rather than structure and control processes being one and the same concept, it is the need for coordination and control that determines the effects of technology on structure. This latter view, that the technology-structure relationship is mediated by the nature of the control process, serves as a basic premise of this research effort.

Bobbitt and Ford (1980) and Ovalle (1981) further asserted that, in viewing organizational processes, the role of the decision maker has, in the past, been ignored. Current organizational models may better account for the effects of control processes on technology and the organization by concentrating on the processes by which decision makers ensure accomplishment of organizational objectives (performance) (Ovalle, 1981). Woodward (1965) was among the first to specifically investigate the nature of control processes, identifying two basic dimensions of control (i.e., personal-mechanical and unitary-fragmented). Ovalle (1981) offered a clarification of Woodward's dimensions, identifying five separate components of organizational control (i.e., job autonomy; acceptance of rules and standards; compatibility among rules and standards; personal-direct control; and rule-use). Ovalle's taxonomy for control processes at the subunit (work group) level is adopted for the current study.

Research on structure, and more recently, control

processes has been typified by analysis of the organization as a separate operating function or system. While investigation and data collection have been performed at the subunit level, the data have frequently been consolidated and analyzed at the system or organization level. More recent literature indicated the need for analysis of organizational technology, control, performance, and satisfaction at the subunit and individual level (e.g., Hunt and Near, 1980; Ovalle, 1981).

Like control processes, technology occurs, and can be analyzed, at any of the three organizational levels (i.e., individual or operator; subunit, work group, or work flow; and organization or system). However, technology has typically been studied under two divergent levels of analysis. Slocum and Sims (1980) described these two distinct approaches as the macro- and micro-perspectives. Those researchers investigating the "macro" characteristics of technology have analyzed the effects of organizational technology (and other contextual factors) on formal organizational structure. Those researchers investigating the "micro" characteristics of technology have focused their attention on job technology (work or task characteristics) and its effects on individual (and work group) performance and satisfaction. Slocum and Sims stressed the need to fuse the two perspectives, citing the various dimensions of managerial control as the means by which worker self-regulation (micro-perspective) could be integrated with technology (macro-perspective). In order to accomplish integration of the two separate perspectives,

Slocum and Sims suggested the systematic evaluation of the interrelationships among technology, managerial and self-regulated control processes, and job design. Ovalle (1981) combined both macro- and micro-perspectives in analyzing organizational technology, control processes, and performance at the subunit level. A framework identical to that used by Ovalle is used in this study to analyze organizational technology, control processes, performance, and satisfaction at the individual level.

As investigation of organizations and the interrelationships among the various external and internal components has progressed in recent years, researchers have recognized the need to take an increasingly introspective view of organization theory. In addition to the generally accepted organizational determinants such as technology, environment, and control processes, the individual worker's ability to perform his/her task has gained significant interest among researchers. Taylor (1911) first suggested the importance of considering the individual's skill and knowledge in employee selection and task assignment. Developing his scientific management principles, Taylor espoused improved employee performance through systematic selection, training, and development procedures. Taylor, however, saw systematic selection and task assignment, in conjunction with task design, as the chief determinants in maximization of employee performance. In recent work, on the other hand, theorists have begun to recognize the importance and the degree of influence of

individual attributes on the organization and its various components. Individual skill and knowledge cannot be examined in isolation from other organizational factors, but must be investigated in consonance with job technology, organizational control, and other organizational influences (Hackman and Oldham, 1980). Slocum and Sims (1980) addressed some of the important relationships which exist between worker skills and knowledge, various elements of technology (e.g., task interdependence, task uncertainty), and elements of organizational control processes (e.g., self-regulation or autonomy, and management control). I adopt this integrative view, which calls for a consolidated analysis of the interrelated effects of job technology, control processes, and operator skill, education, and experience (knowledge) on organizational performance and satisfaction.

In summary, the general intent of this research effort is to further delineate those internal organizational factors which affect performance and satisfaction. Specifically, this study will investigate three areas at the individual worker level: 1) the effects of knowledge on the technology-control process relationship; 2) the effects of knowledge on the control process-performance and control process-satisfaction relationships; and 3) the effects of control and knowledge, together and independently, on the technology-performance and technology-satisfaction relationships. Chapter II presents a review of literature relevant to the concepts and variables used in this study, and concludes with a formal statement of

the nine research hypotheses proposed in this work. Chapter III provides the research methodology used in evaluating the various hypotheses, while Chapter IV conveys the results of the analytical work. Chapter V summarizes the findings of the study with conclusions and offers recommendations for future research.

## CHAPTER II

### LITERATURE REVIEW AND RESEARCH HYPOTHESES

This chapter provides a review of literature relevant to the study of organization and job technology, control processes, and individual knowledge as they influence performance and satisfaction, and includes a formal statement of the research hypotheses. The chapter begins with the presentation and discussion of a general model of the organization depicting the relationships investigated in this study. Following the general model, the literature pertinent to this study is discussed in five separate sections. The first section deals with technology and the debate regarding the technology (versus size) and structure relationship. The second section reviews literature concerning the nature of organizational control processes, and the linkage between technology, control, and behavior (i.e., performance and satisfaction). The third section presents literature relative to individual worker characteristics and the linkage between technology, control, knowledge, and behavior. The final two sections deal with literature pertinent to the assessment of performance and satisfaction, respectively. Following this review of literature, the research hypotheses investigated in this study are presented.

### General Model of Organizations

As a prerequisite for understanding the nature of the variables and relationships to be discussed in the review of literature, I shall provide, in this section, a pictorial description to illustrate my view of the organization. The general model which I propose is shown in Figure 3.

The model I propose as representative of the typical organization is actually a composite of two separate models, each emphasizing different organizational components and relationships. Ovalle's (1981) model, illustrated in Figure 1, incorporated the contingency, rather than universalistic, perspective of organizational dynamics. Rather than search for those specific characteristics which would enable the manager to function successfully under any circumstances (the universalistic view), the contingency viewpoint maintains that the manager's performance is determined by a combination of his/her personality and the favorableness of the climate in which the decision-maker must act (Fiedler, Chemers and Mahar, 1976). This theory is founded on two key notions: 1) there is no single best way to organize, and 2) not all forms of organization are equally effective in a given situation (Galbraith, 1977). Although Ovalle argued for the primacy of technology as a determinant of components of strategy, he maintained that it is only one of several organizational factors influencing strategy. In other words, Ovalle viewed the contextual variables as independent variables and, ultimately, organizational outcomes (e.g., performance and

satisfaction) as the dependent variables. Proceeding analytically from the contextual factors through the components of strategy (e.g., structure and control processes) to the desired outcomes, the previous variable sets increased limitations on the range of possible variations in the succeeding variable. Additionally, like Bobbitt and Ford (1980), Child (1975), and Perrow (1967), Ovalle (1981) envisioned the operation of a feedback loop by which organizational outcomes influence the structure and the control process components of strategy, as well as generate efforts to influence the contextual variables.

Hackman and Oldham (1980) proposed a model which integrated much of Ovalle's (1981) contingency model, with various individual "Critical Psychological States" and individual characteristics, referred to as their Job Characteristics Model. This organizational model is shown in Figure 2. Where Ovalle's (1981) model addressed various major components of organizational characteristics, Hackman and Oldham (1980) used a more cursory view of organizational components, but introduced the characteristics and psychological states of individual workers as determinants of behavioral outcome.

My model, shown in Figure 3, builds on Ovalle's (1981) model as the foundation. The individual worker's moderating characteristics and critical psychological states identified by Hackman and Oldham (1980) are integrated with Ovalle's model, comprising my proposed organizational model.

Several points must be stated here to further clarify



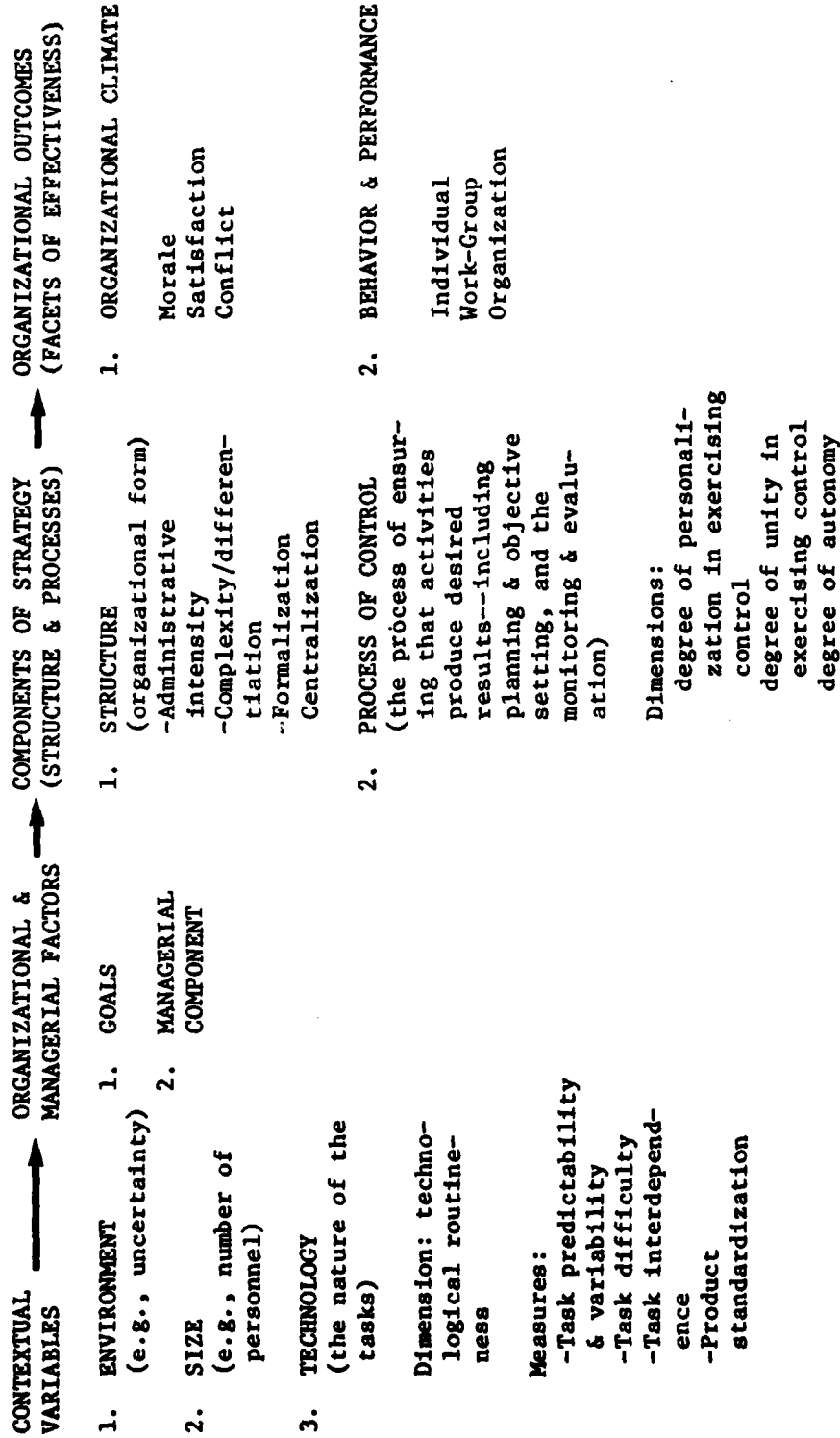


Fig 1. Ovalle's General Model of Organizational Relationships (1981)

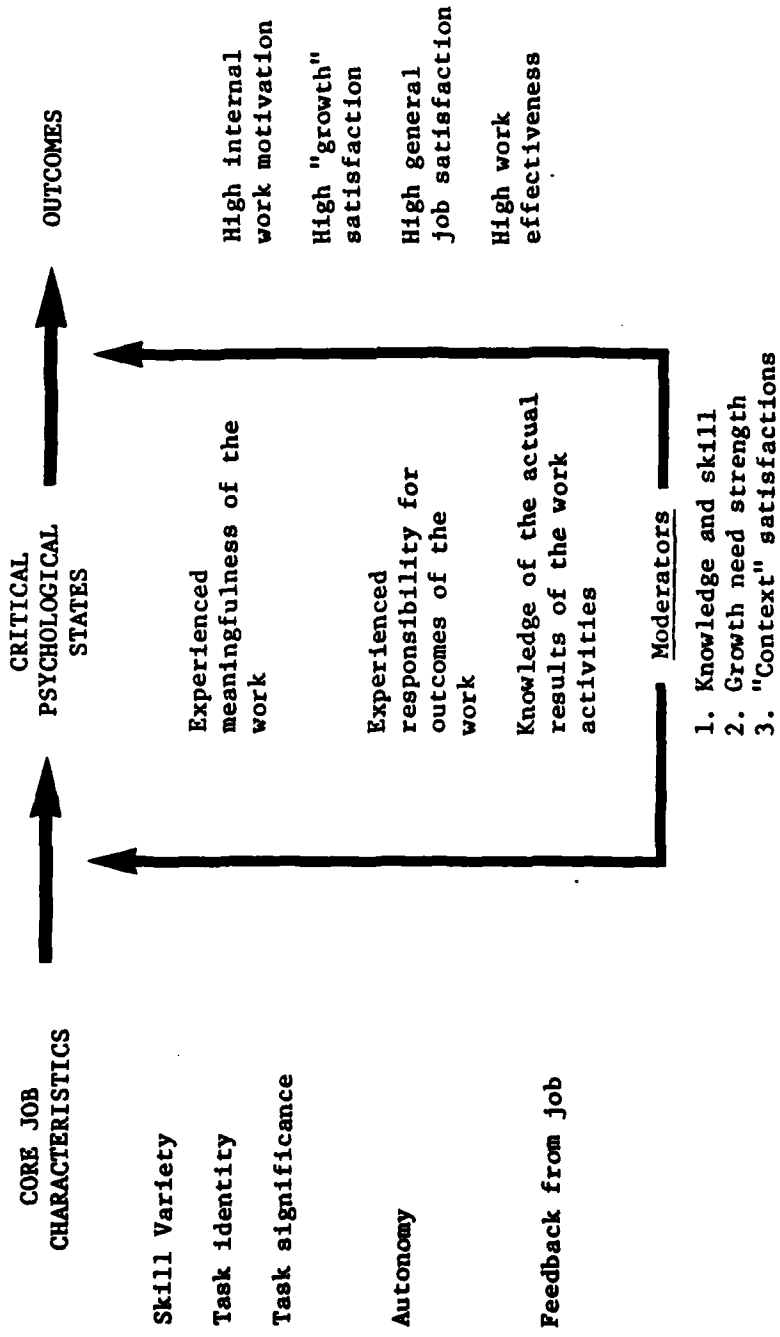


Fig 2. Hackman and Oldham's Job Characteristics Model (1980)

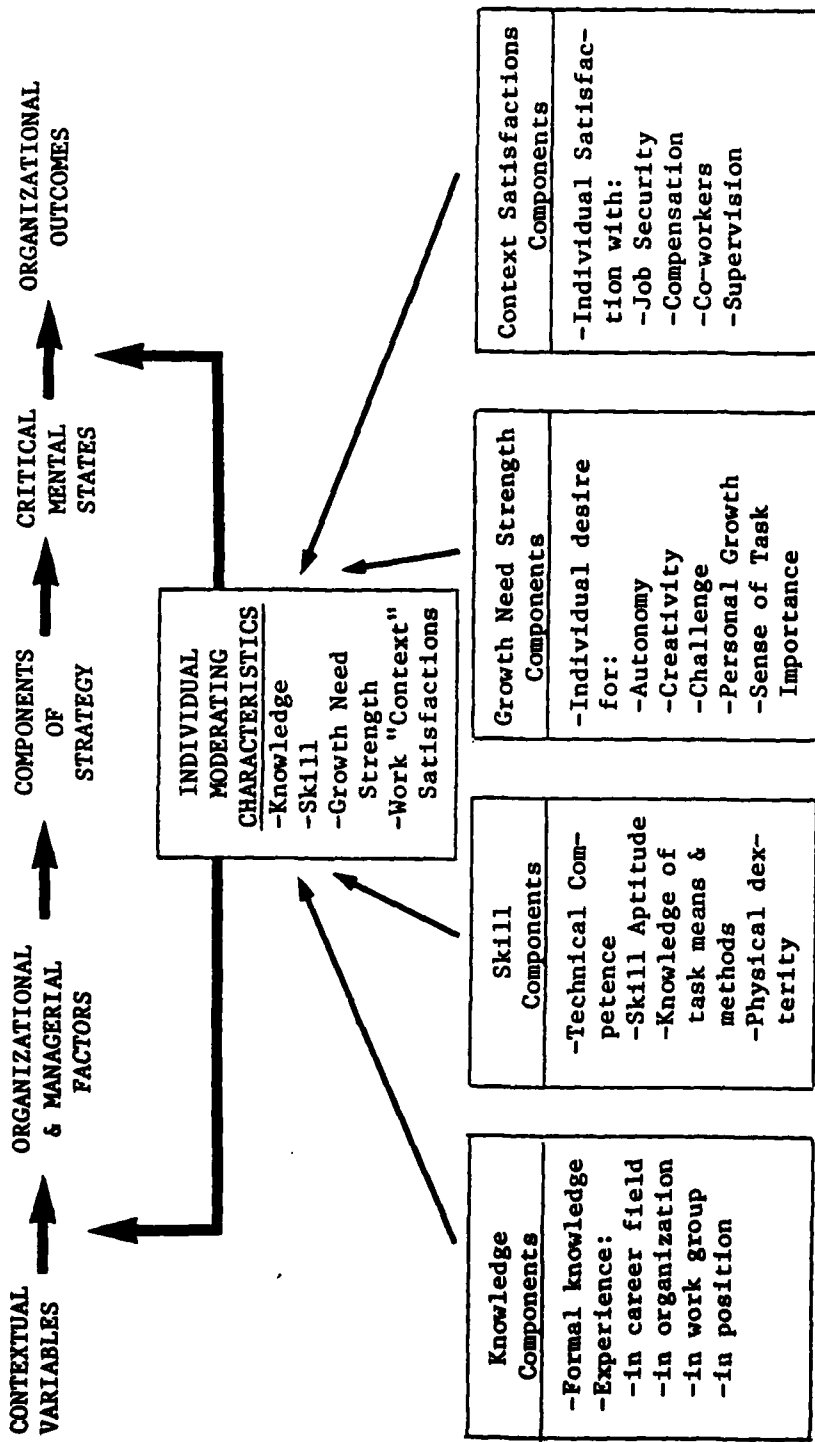


Fig 3. General Model of Organizational Outcomes and Influences

the model which I have presented and the research I will undertake. First, like Ovalle (1981) I define technology as those tasks which individuals perform upon some object in order to change that object. Rather than limiting analysis of technology only in terms of the production system (e.g., Woodward, 1965), the above definition allows analysis of activities at all levels in the organization. Second, Ovalle defined organizational control as the establishment of objectives and procedures as well as the monitoring and evaluation of behavior. I adopt this definition, which allows examination of control as a process (how the organization controls) rather than limiting analysis simply to what is controlled (i.e., output or behavior). Third, I have included Hackman and Oldham's (1980) critical psychological states for two reasons: 1) the existence of these states is a prerequisite for the outcomes which follow; and 2) they serve as a vehicle by which the individual characteristic moderators (e.g., knowledge, skill) can influence the job technology-control process-behavior relationship. As mentioned previously, the basic motivation for this study is investigation of the effects of technology, control, and individual worker knowledge on organizational performance and satisfaction. The model which I propose incorporates each of these elements. Fourth, as with Ovalle's (1981) model, my model begins with consideration of contextual variables and proceeds through successive variables which generate increasingly restrictive boundaries on the possible variations of the dependent variable, outcomes (behavior).

Finally, my model calls for the inclusion of various elements of satisfaction, both as individual moderating characteristics and as organizational outcomes. The outcomes specified in my model are not restricted in scope to the performance and satisfaction dimensions which are investigated in this study. It is possible that satisfaction influences other individual outcomes (e.g., internal work motivation, work atmosphere, community relations). The scope of this study, however, is restricted to investigating only knowledge as an individual moderating characteristic and satisfaction only as an outcome.

#### Technology and the Technology/ Size-Structure Debate

The study of technology as a determinant of organizational performance dates as far back as Frederick W. Taylor. Taylor (1911) espoused the development of technology (i.e., job design) in order to maximize human and, therefore, organizational productivity. In later years, beginning most notably with the Hawthorne studies, organization researchers concentrated their efforts more on the social infrastructure and its effects on individual and group behavior. This school of thought, known as the human relations movement, occurred in response to recognition of the importance of worker motivation. The human relations school was not, however, without its shortfalls in describing and explaining organizational determinants and their relationships. For example, technology and its effects on organizational outcomes were rarely

addressed (Kast and Rosenzweig, 1979; Scott and Mitchell, 1976).

The 1950's saw a resurgence of interest in technology, but melded with the then-current thinking on the socio-psychological aspects of work. Trist and Bamforth (1951) highlighted this relationship by calling attention to the disruptive effects which technological change has on the social structure. Walker and Guest (1952) recognized that technology is related to job satisfaction and social interaction, while Thompson and Bates (1957) found that the type of technology which an organization considers appropriate in reaching its goals delimits both structural and functional activities (processes).

The 1960's brought refinement of the initial technology-organization relationships identified in the 1950's. Burns and Stalker (1961) determined that technological innovation (technological change) is an important component of environmental uncertainty and, contrasted between organic and mechanistic organizational structures, appropriate respectively for high or low rates of technological and market change. Lawrence and Lorsch (1967) confirmed these findings.

Joan Woodward, in cooperation with a team of researchers (1965) was the first to draw attention (as well as substantial debate) to the relations between technology and structure. Her work produced the "technological imperative." This theory postulates that differences in structural composition are related to technological complexity, which is measured using a three-category scale ranging from unit, or small batch, through

mass, or large batch, to the continuous production process. Woodward found that organizations with the two extreme types of complexity (unit and process) tended to exhibit "organic" structure, while those with moderate complexity (large batch) tended to exhibit more "mechanistic" structures. She also found that, within each technology category, those organizations most nearly conforming to the median scores for structure in that specific category are financially more successful than those organizations above or below the median. Woodward concluded that success, measured by economic performance, depends on the fit of an organization's structure to the particular production technology(ies) used in that organization.

Woodward's general findings were further substantiated by Harvey (1968), Khandwalla (1974), and Zwerman (1970) and others. However, among these researchers gathering support for the technology-structure relationship, substantial differences existed in the operationalization and measurement of technology and structure. Harvey (1968), for example, saw Woodward's findings as a measure of the degree of task specificity or routineness, rather than complexity, where specificity decreases as the number of major product changes increases. Khandwalla (1974) confirmed these findings, noting that firms may use multiple technologies.

Following Woodward's initial work in stressing the technology-structure relationship, a divergent school of thought arose which questioned the importance of technology. The Aston Group studies provided the major thrust for the

size-structure relationship, arguing for the primacy of size as a structural determinant. Hickson, Pugh, and Pheysey (1969) were first to investigate the possible effects of additional variables on structure. Measurement of technology by Hickson, et al. was based on two key concepts. First, they concentrated on production continuity, measuring the "complexity" of operations technology using a modified version of Woodward's (1965) scale. Second, they developed a variable called "work flow integration," designed to measure such elements as the degree of automation, work flow rigidity, and the interdependence of various work flow segments. Their measures of technology and structure reflected the organization's executives' perceptions. Hickson, et al. (1969) concluded that while technology may be an important determinant of structure in small organizations (such as those studied by Woodward (1965)), size can generally be viewed as the primary factor affecting structure. The measurement scales for technology developed by Hickson et al. are not wholly dependent on the dominant production process of an organization. Rather, they allow at least cursory investigation of multiple technologies in a single organization. However, their measures for "work flow" are inadequate for distinguishing different technologies in many types of multiple-technology organizations (Hickson, et al., 1969; Lynch, 1972).

The results of the Aston Group studies lent substantial credence to the importance of size as a structural determinant. Their findings prompted further research into



the technology/size-structure dispute. Child and Mansfield (1972) found that size tends to be most strongly related to the overall aspects of structure, while technology tends to be more strongly associated with organizational configuration variables (e.g., centralization, functional specialization). They suggested the multidimensional nature of technology, and concluded that the two structural determinants involved in the controversy (i.e., technology and size) were not actually conflicting viewpoints, but rather that the controversy resulted from researchers investigating different facets of the organization. Child (1972b) added that at least some of the differences in the results of the technology/size-structure research could be attributed to variations in the definitions of the terms and the units of analysis.

Thus far, I have reviewed the divergent schools of thought concerning the technology/size-structure controversy. Woodward and her supporters advocated the primacy of technology in influencing structure, while those of the Aston Group and its supporters advocated the primacy of size in determining structure. Ovalle (1981) argued that both schools share some common elements as well as some common deficiencies. First, most of these researchers directed their major efforts toward operations or product technology. Little effort was made to dissect these two technologies into their components (e.g., characteristics of the material, work flow predictability, and variability) (Perrow, 1967). Second, while some researchers advocated the multidimensionality of technology

(e.g., Child and Mansfield, 1972; Hickson, et al., 1969), most confined their studies to a single, specific measure of technology. Third, most researchers emphasized the technology-structure linkage at the organizational level, and collected their data from senior management and executive personnel. Members of the Aston Group repeatedly demonstrated the complex and multidimensional natures of both technology and structure at the organization level (e.g., Hickson, et al., 1969; Pugh, Hickson, and Turner, 1968; Pugh, Hickson, Hinings, and Turner, 1969), yet subsequent studies continued to confine investigation of these two variables to different, specific dimensions or subdimensions as representative of the basic two variables (Reimann, 1980; Stanfield, 1976). Fourth, Ovalle (1981) recognized that these studies concentrated on the analysis of technology in industrial-type settings. The operational definitions used were inappropriate for analysis of non-industrial activities, such as service organizations (Lynch, 1972). Hunt (1976) suggested that greater emphasis be placed on the analysis of technology in terms of the tasks performed at the work flow and individual operator levels. Fifth, dissection of the structural component has revealed four major common elements: differentiation (or complexity), administrative intensity, formalization, and centralization (Ford and Slocum, 1977). Furthermore, numerous studies and theoretical works (e.g., Bobbitt and Ford, 1980; Child, 1972 and 1975) have stressed the crucial importance of managerial choice in control, a factor previously ignored in both theoretical and analytical efforts. Researchers

commonly defined structure such that analysis relied heavily on the structural form (organizational configurations). Ovalle (1981) proposed that more attention be given to the strategic processes which are, to some extent, related to structural form and which managers execute through choice utilizing, for example, the process of control.

The following portion of this review of literature addresses a third approach to analyzing technology in organizations. This alternate approach, adopted in the present study, addresses many of the problems noted above.

As mentioned previously, most research efforts restricted their analysis of technology and its effects to industrial-type operations at the systems level. The operational definitions, units of analysis, and study results were typically not generalizable to other types of organizations. Perrow (1967) offered a conceptual framework which is sufficiently broad to span several types of organizations and which permits investigation of multiple technologies in a single organization. Recognizing that the work processes of an organization provide the foundation on which social structure is built, Perrow saw the organization primarily as a system designed to accomplish work. Technology was viewed as the work performed by individuals acting directly upon an object (i.e., a living being, human or otherwise, a symbol, or an inanimate object) that is to be changed. Structure was defined as the interactions among individuals in the course of trying to transform the object. Perrow's (1967) concept of

technology is a cognitive one, referring not to the nature of the raw material or the conversion process, but to organizational and organizational member perceptions of the material and conversion process. Perrow, by defining technology and structure in terms of individual worker activities and interactions, permitted evaluation of technology at the individual and subunit levels, as well as at the systems level. Furthermore, by defining technology in terms of individual perceptions, Perrow gained the added advantages of enabling the researcher to investigate multi-technology organizations, as well as examine work in many different settings; research need not be confined only to industrial-type environments (e.g., Hage and Aiken, 1969; Lynch, 1972).

Perrow (1967) identified two dimensions in his cognitive conceptualization of technology: 1) the "number of exceptional cases" encountered in the work, or the perceived degree of familiarity of various stimuli; and 2) the degree to which the "search" behaviors (undertaken by individuals when exceptional cases occur) are capable of being analyzed. Perrow proposed a two-dimension, four-cell technology classification scheme utilizing the two dimensions described above, but found difficulty in operationalizing this scheme.

Hage and Aiken (1969) proceeded from Perrow's (1967) theoretical framework, but defined technology as the overall routineness of the work. They identified a significant relationship between task routineness and both formalization and participation in decision-making. The five-item measurement

scale for technology devised by Hage and Aiken was limited to indicating the perceived variability and not the perceived analyzability of technology (Ovalle, 1981). Lynch (1972), however, offered a seven-item measure of the technical variability in tasks which she used successfully in differentiating among the technologies of various library departments.

Hrebiniak (1974) investigated the multi-dimensional nature of technology using a six-item scale to measure: 1) task predictability (using Bell's (1965) criteria); 2) task interdependence (using one of Mohr's (1971) criteria); and 3) task manageability (using three of Mohr's (1971) criteria). Performing his analysis at the subunit (work group) level, Hrebiniak, like Bell (1965, 1967) and Mohr (1971) found that accounting for the effects of supervisory task discretion significantly enhances the relationship between technology and structure (Hunt and Near, 1980).

Ovalle (1981) evaluated technological routineness in a service - type organization using four separate indices: 1) task predictability and task variability; 2) task difficulty or complexity; 3) task interdependence; and 4) the nature of the production process. Utilizing factor analysis, Ovalle found six dimensions for measuring technological routineness at the work group level: 1) job routineness; 2) job variability; 3) job difficulty; 4) product-process routineness; 5) other dependence (i.e., dependence of others on an individual's work); and 6) dependence on others. Five of these six technology dimensions were significantly related to

some facet of control. Furthermore, Ovalle found the technology variable "product-process routineness" to be the best predictor across all dimensions of managerial control. This characteristic has been used routinely as a describer of "operations" technology (i.e., industrial-type organizations). These findings further substantiated the feasibility of designing multi-organization-type technology measurement scales capable of describing different technologies within a given organization.

Using Perrow's (1967) theoretical framework, Near (1982) measured technology using two main concepts: 1) technological uncertainty (e.g., the predictability of the production process, predictability of an individual's own tasks, and predictability of subordinates' tasks); and 2) task interdependence (e.g., the percentage of department tasks performed for the independent work flow, the sequential work flow, the reciprocal work flow, and the team work flow situations). Technological uncertainty and task interdependence are, according to Near, functions of the product and production process selected by the firm. She envisioned control as a subelement of structure, composed of those activities (i.e., direction, evaluation, and reward) which may influence other structural components (e.g., specialization, centralization, vertical and horizontal differentiation). While Near (1982) found moderate support for the constraining influence of technology on choice of control processes, only one of the structural measures (i.e., decentralization) was related to the measure

of control (i.e., standardization) which was, in turn, related to a measure of technology (i.e., task predictability), and this relationship was not significant. Conducted in fairly small firms ranging in size from 135 employees to 8400 employees, Near's (1982) findings contradicted Hickson, et al. (1969), who concluded that technology is a significant structural determinant in small organizations.

The theoretical and analytical works discussed above have provided a broad conceptual framework for analysis of organizational technology in numerous types of organizations (e.g., product, service). They indicate the multidimensional nature of technology, viewed in terms of individual perceptions of task characteristics. Comstock and Scott (1977) demonstrated that analysis at the subunit level, rather than the system level, offers substantial insight into the relationship between technology and structure. Ovalle (1981) has offered substantive support for this viewpoint. The need to evaluate the relationships between technology, structure, and behavior is also well-documented (e.g., Ovalle, 1981; Van de Ven and Delbecq, 1974). Finally, there is a substantial amount of evidence supporting Perrow's (1967) contention that the tasks (technology) performed by individuals and work groups can be successfully categorized through use of his "cognitive" framework (i.e., by measuring individuals' perceptions of their work). Strong arguments have been posited in defense of the cognitive process approach at the operator and work flow levels (Hunt, 1976; Hunt and Near, 1980). One

of the key points made in this argument is that the technology-organization linkage may be more appropriately described by the "cognitive burdens" imposed by tasks on organizational planning and control, rather than by a direct effect of technology on structure, although Near (1982) has recently refuted this notion. This view will be investigated more deeply in the next section, which reviews literature pertaining to organizational control and the technology-behavior (i.e., performance and satisfaction) connections.

Organizational Control Processes and the  
Linkage Between Technology  
and Performance

Organizational control may well be the most fundamental and essential of tasks which a manager performs, yet control and structure have not always been clearly distinguished in management literature (Ouchi, 1977). There is, nonetheless, a substantial amount of literature which addresses the underlying nature of control processes and their effects on the organization.

Pioneer management theorists recognized that control was a specific management function, but suggested that "directing" was the chief activity of management control. Church (1914) envisioned control as that function which coordinates all other management functions and which supervises work. Diemer (1915) considered control to be the means by which executives exercise their authority to guide organizational activities in accordance with organizational policies. Fayol



(1949) identified control as one of five key management functions, defining it as the review of activities and verification that they are being accomplished in compliance with approved plans and organizational guidance.

As management theory evolved, theorists adopted broader views of organizational control. The view of control itself was refined to include the work planning activity of the manager, and control was seen as a process or flow of individual activities. Davis (1940), for example, defined control as the instruction and guidance provided by the organization, as well as the direction and regulation of its activities, specifying routine planning as one of eight management control responsibilities. Holden, et al. (1941) viewed control as a process composed of three basic activities: setting the objectives, planning the implementation, and appraising the results.

Modern organizational theorists recognize that control is inherent in organizations; that to characterize an organization in terms of its control patterns is also to describe an essential and universal aspect of organization which every member encounters and to which he must adjust (Ovalle, 1981). Tannenbaum (1968), for example, considered control as any process through which a person, group of persons, or organization intentionally influences the expected behavior of another person, group, or organization.

Control was seemingly viewed by many as being synonymous with structure. Ford and Slocum (1977) in their review

of relevant literature found four components of structure most frequently used in research literature. These components are differentiation or complexity, standardization, formalization, and centralization. With the possible exclusion of formalization (normally used in referring to rule-usage), these components describe organizational configuration, without regard to managerial activities. The structure is generally presumed by these authors to perform the act of controlling. Ovalle (1981), on the other hand, maintained that structure often inhibits rather than enhances such managerial processes as communication, decision making, and even control. The current study maintains that, although technology is considered to influence structure, it is the processes of control and coordination accompanying technology that directly constrain the choice of organizational structure (Ovalle, 1981; Thompson, 1967; Woodward, 1970).

Tannenbaum (1968, 1974) was one of the first to attempt operationalization of control. He devised a method (known as his "control graph" method) for measuring the degree of hierarchy (structure) in the organization and assessing the exercise of power (control processes), primarily at the system level. Tannenbaum's framework did not address control activities at the sub-organizational levels, nor did it provide insight into relationships with other organizational variables such as technology, size, and behavior.

In addition to directing, evaluating activities has been considered by many researchers to be an important

component of control. Ouchi and Maguire (1975) and Ouchi (1977) defined control as a process which calls for the monitoring and evaluation of behavior and outputs. Control is distinguished from structure by associating structure with the configuration-descriptive variables (e.g., centralization, vertical and horizontal differentiation). Ouchi and Maguire (1975) envisioned control as consisting of two "modes," behavior control and output control, which are independent of each other. Behavior control is an evaluation process which requires that managers personally observe individual behavior. Output control is an evaluation process requiring managers to observe individual output. Ouchi and Maguire determined that the variance in behavioral control is best explained by the task characteristics at the individual level, while variance in output control is best explained by the environmental structure at the system level. Dornbusch and Scott (1975) also described control as a distinct process of the organization, involving performance evaluation; separate from, yet associated with, organizational structure.

Reeves and Woodward (1970), like Ouchi and Maguire (1975), considered performance evaluation to be an essential control process (activity) in their model of the organization, but they also included certain "prerequisite" activities. Reeves and Woodward described the act of controlling itself as the monitoring and evaluation of work. However, they defined the process of control in a much broader sense, to include planning and the setting of standards (their

"prerequisite" components). Reeves and Woodward's (1970) view of control, that the act of controlling per se is dependent on and constrained by the prior accomplishment of planning and standard-setting activities (themselves elements of the process of control), was in substantial consonance with theories of other writers discussing the topic (e.g., Kast and Rosenzweig, 1979; Thompson, 1967). This conceptualization of control is adopted in the present research effort.

Reeves and Woodward (1970), in developing their conceptual framework of the organizational control process, theorized two dimensions to explain control processes. The first, labelled "personal-mechanical" measures the degree to which goals and work flow are determined by individual (or personal) influence as opposed to mechanical (or impersonal) influence. They envisioned this dimension as varying from personal to mechanical, as size and technological complexity increase; the span of control becomes too broad to allow intricate, interpersonal exchange and control. Reeves and Woodward indicated that this dimension is actually composed of such variables as directness of control, emphasis on rules, and the extent of worker autonomy. In his study investigating a service-type organization (as opposed to Woodward's (1965, 1970) work with industrial-type organizations), Ovalle substantiated Reeves' and Woodward's (1970) "personal-mechanical" dimensions at the subunit level, finding three independent factors which described this dimension. Ovalle labelled these variables "personal-direct control," "rule-use," and "job

autonomy." Ovalle's taxonomy for this control dimension is adopted in the current study.

Reeves' and Woodward's (1970) second control dimension, labelled "unitary-fragmented," indicates the degree of congruency among rules, standards, and policies. This dimension is composed of variables such as the quantity of standards set for tasks, compatibility between the standards and between the rules guiding the work, and acceptance of these standards and rules. Ovalle (1981) found two independent factors to describe this dimension. He labelled these variables "acceptance" (of rules and standards) and "compatibility" (between rules and standards). Ovalle's taxonomy for the "unitary-fragmented" dimension is adopted for this research effort.

The preceding discussion highlighted the effects of control on behavior of organizational members and, eventually, organizational performance. The following context examines some of the theories linking control and performance. Simon (1976) described control as a factor, inherent in administration, which provides the means by which management insures both correct decision making and effective action. Simon recognized that control does remove some decisional autonomy from the individual, but that organizational control should serve to correct "bad decision-making" rather than correct "wrong decisions." Simon, in essence, distinguished between control as a restriction of freedom and control as a means for providing better "rationality" and "efficiency."

Other research efforts also suggested the existence of direct linkages between control and such variables as individual and group behavior and performance. Trist and Bamforth (1951) maintained that the technological interface in the organization could only be optimized if the work groups retained autonomy as well as flexibility in establishing the rate of work. Utilizing a coal mining organization for their setting, Trist and Bamforth found evidence suggesting the positive benefits of management providing for personal requirements and greater interpersonal exchange and support. Biddle and Hutton (1976) maintained that technological change affects the organizational climate since it poses a challenge (or perceived threat) to the "living space" which individuals and groups maintain about themselves in a work setting.

In addition to the preceding works, the interrelationships among control, human behavior, organizational climate, and performance have been postulated and investigated in such other theoretical frameworks as equity theory, reactance theory, social exchange theory, and operant conditioning theories (e.g., Blau, 1964; Brehm, 1972; Ouchi, 1978; Skinner, 1971; Susman, 1976).

Despite the examples cited above and numerous other analytical and theoretical works relating control to performance, the relationships between the nature of the work (technology) and worker behavior (including performance) have not yet been clearly defined. Woodward (1970) maintained that it is the nature of the control system (where control is considered

the managerial task of insuring activities produce desired results) which relates technology to performance and satisfaction. Woodward based this theory on the premise that technology (defined as the nature of tasks) can either facilitate or restrict individual behavior through its effects on control. Woodward (1970) further posited that technological routineness is a major determinant of the control process, which in turn, directly influences performance. Woodward's postulate concerning the direct and significant effect of technology on control was substantiated by Ovalle (1981) at the work group level.

Hunt (1976) identified two separate dimensions of technology in his theoretical description of the technology-performance linkage. He posited that perceptions of the nature of the task at the individual level are heavily dependent on the technological perspectives used in accomplishing the work. Furthermore, Hunt (1976) viewed the tasks at higher levels of the organization as being composites of the tasks at lower levels. The organization (system) itself performs multiple, interrelated tasks, called "extended tasks," purposively-oriented to produce specific outputs. Hunt, therefore, concluded that these organizational "extended tasks," viewed at the work flow level, are dependent on the technology necessary to ensure effective performance. Since the work flow is, in essence, the process of linking activities, i.e., coordinating and systematizing discrete tasks, into a "purposively-oriented system" (Gerwin, 1979; Hunt, 1976), ultimate subunit performance is a function of the system which

evaluates and modifies the work flow. The individual operator's performance is likewise a function of the system which evaluates and modifies his performance. This system (or process) which monitors, evaluates, and modifies work activities (i.e., develops and implements plans, rules, standards, and procedures, and regulates and revises) is the organizational control process. Based on this argument, Ovalle (1981) concluded that a large portion of the variability in performance can be explained by the fit between the technology required for the tasks performed and the control processes undertaken in task integration. Comstock and Scott (1977) suggested that analysis of the technology-control process-performance/satisfaction relationship can only be appropriately analyzed at the individual and subunit levels of analysis. Ovalle (1981) confirmed this viewpoint by demonstrating the significant relationship between technology and control and between control and performance at the subunit level. However, Ovalle found no significant improvement of the technology-control process-performance relationship over the control-performance relationship. Furthermore, he found that none of the factors he used to measure technological routineness significantly affects performance, suggesting the need to search for additional variables which may be confounding the relationship between technology and performance. The next portion of this literature review investigates literature pertaining to one possible category of confounding variables, individual characteristics.



Individual Characteristics and the Linkage  
with Technology, Control Processes,  
Performance, and Satisfaction

Throughout management history, the importance of the individual as an integral factor influencing performance in an organization has been an unquestionable truth. Through the turn of the twentieth century, however, management theorists had considered only one of the three essential human components in task design (technology), control, and ultimately outcomes. Frederick W. Taylor (1911) best exemplified this myopic view of the individual which upheld the primacy of the worker's physical and, to a lesser extent, mental capacity for work as a determinant of performance. Taylor stressed the importance of employee selection and task assignment based on individual skill and knowledge. However, his impersonal approach to hiring, training, and assigning personnel recognized only the individual's physical and mental ability to perform his/her task, without regard to the employee's willingness to do so.

Little progress was made toward investigating those factors in the individual which motivate him to work until the Hawthorne studies were conducted in the mid-1920's to the early 1930's and reported by Roethlisberger and Dickson (1939). The importance of the Hawthorne studies is best capsulized in the following comment presented in an article reviewing the 1975 symposium held by the Western Electric Company and the Harvard University Graduate School of Business Administration, celebrating the 50th anniversary of the Hawthorne Studies:

The enduring message of Hawthorne . . . has only recently achieved prominence. . . . it takes different kinds of people and different kinds of organizations to perform different kinds of tasks [Albanese, 1981: 506].

The Hawthorne Studies, in essence, unmasked the three-dimensional nature of the individual's influence on organizational structure (i.e., the individual's physical ability, mental ability, and internal willingness to perform a task).

The Hawthorne Studies carried further historical significance in that they led directly to the "Human Relations" movement, in vogue during the 1940's and 50's. This school of thought maintained that job satisfaction leads to increased productivity, and that relationships among employees in an organization are the key to job satisfaction. With the behavioral sciences (e.g., psychology and sociology) as their basic framework, human relations researchers recognized the importance of considering individual growth and achievement needs, that motivating individuals is important to work performance and satisfaction, and that the individual is a crucial element of the organization and should not be dissociated from it. However, researchers during this period failed to develop an explicit model considering differences among individuals.

Herzberg's (1959, 1966) two-factor theory of satisfaction and motivation offered a transitional model, incorporating both characteristics of the work and the work environment, as well as certain basic characteristics of the human being. He proposed that certain intrinsic factors of the work

performed (e.g., recognition, responsibility, personal growth in competence) are the principle determinants of employee satisfaction. Herzberg called these factors "motivators," believing them to be effective in motivating employees to superior effort and performance. "Hygiene" factors, on the other hand, are considered extrinsic to the work, and are seen as causing dissatisfaction in the employee. Examples of hygiene factors include company policies, supervisory control activities, and work conditions. Though Herzberg's model was still lacking consideration of individual differences, he did recognize the existence and importance of certain critical psychological states (e.g., personal growth and achievement needs). As such, Herzberg's greatest contribution was providing the catalyst to invoke further investigation into the nature of the task and the individual.

Several researchers performing studies subsequent to Herzberg's work failed to empirically substantiate the major tenets of his two-factor theory (e.g., Dunnette, Campbell, and Hakel, 1967; Hinton, 1968; King, 1970), suggesting the potential uncertainty of Herzberg's two-factor model. Ford (1969), for example, assumed that Herzberg's motivating factors would increase work motivation in all employees. However, more recent research suggests that some individuals are more positively motivated by "enriched" task characteristics than others (Hulin, 1971).

Socio-technical systems theory offered an attractive alternative to Herzberg's two-factor theory. This view of

the organization provided important insight into the interdependencies between the technological characteristics of the work and the broader social infrastructure of the organization in which the work is accomplished (Emery and Trist, 1969; Trist et al., 1963). One of the major contributions of socio-technical systems theory was the development of the "autonomous work group" concept, in which work group members share among themselves much of the planning, execution, and monitoring control processes of their work (Gulowsen, 1972; Herbst, 1962). However, despite its merits, the socio-technical systems model, like its predecessors, failed to explicitly define the interrelationships between the nature of the task (technology) and the social environment.

The preceding discussion has reviewed the evolutionary nature of organizational models as, by the mid to late 1960's, they more nearly encompassed full consideration of the three-factored individual influence on the organization. Herzberg and the socio-technical theorists recognized the existence of these three factors, or states, in the individual (i.e., the physical and mental ability, and the individual's willingness or motivation to perform his task), yet failed to describe the nature of the interrelationships among the task (to include both the task technology and the control processes involved in accomplishing the task), the individual, and the outcomes (performance and satisfaction). The context which follows will review the literature which offers an alternative model, capable of explicitly describing the interactions among

the task, the individual, and the outcomes.

One of the chief arguments levied against the previously discussed organizational models has been their failure to encompass the nature of individual differences as an integral influence on the organization (Gruneberg, 1979). Herzberg, et al. (1957) first discovered the potential influences of individual characteristics when they reported a significant relationship between job satisfaction and age. The existence of such a relationship was further substantiated by later research efforts (e.g., Glenn, et al., 1977; Hulin and Smith, 1965). Other research has shown that sex differences often mitigate the relationship between the task and the outcome (e.g., Bartol, 1974; Brief and Oliver, 1976; Manhardt, 1972). Similar findings have been identified and substantiated with cultural differences (e.g., Hulin and Blood, 1968; Turner and Lawrence, 1965), and personality differences (e.g., Korman, 1977; Porter and Steers, 1973).

One model which has gained substantial support in recent years envisions individual differences modifying the relationships between certain "core job characteristics" (composed of elements similar to Ovalle's (1981) technology and control process factors) and certain "critical psychological states" (which describe various of an individual's perceptions of his work) and between the "critical psychological states" and organizational outcomes (developed in Hackman and Lawler, 1971; Hackman and Oldham, 1980; Oldham, 1976). Hackman's and Oldham's (1980) model is depicted in Figure 2

of this research effort.

Hackman and Oldham (1980) argued that although many of the individual characteristics mentioned previously (e.g., age, cultural background) do appear to influence outcomes to some degree, the nature of the effect of individual differences is best represented by three distinct characteristics describing individual needs and abilities relating to work. These three moderators are: 1) knowledge and skill (i.e., the mental and physical ability to perform assigned tasks); 2) growth need strength; and 3) context satisfaction (the last two moderators together signifying the individual's willingness to perform assigned tasks). The present research effort specifically investigates the possible effects of knowledge (defined as the composite of formal education, and organizational and task experience) on organizational outcomes. While Hackman and Oldham (1980) maintained that individual characteristics moderate organizational outcomes through the "critical psychological states" and "internal work motivation," these two elements of the Hackman and Oldham model are not specifically investigated in this study. Rather, they are considered to occur as natural consequences of human interaction in the organization which, in turn, result in outcomes.

The influence which an individual's formal education exerts on his performance and satisfaction has been empirically supported in several cases (e.g., Herzberg, et al., 1957; Klein and Maher, 1966). Vollmer and Kinney (1955), for

instance, investigated the effect of level of education on job satisfaction in a study involving several thousand civilian employees in various institutions throughout America. Their results indicated that those individuals with college-level formal education tend to be more dissatisfied than those workers with high school-level education. This negative relationship was repeated in comparing high school-graduate employees to those who had only completed grammar school. Similar findings have been reported by others (e.g., Klein and Maher, 1966). Vollmer and Kinney explained this negative relationship by maintaining that those with higher level formal educations may generally expect higher paying jobs with better work conditions, etc. Therefore, when placed in lower level jobs, they tend to have higher expectations of their work than it offers, resulting in decreased satisfaction with the benefits they receive.

Proponents of a positive relationship between education and outcome maintain that workers are better able to understand their tasks and receive constructive evaluation and, therefore, perform better and are more satisfied (e.g., Herzberg et al., 1957). Hackman and Oldham (1980), however, accounted for the possibility that both positive and negative relationships can occur depending on the motivational nature of the task as perceived by each individual assigned to perform the task. This view of the effect of formal education on organizational outcomes is adopted for the present study.

In addition to formal education, knowledge can be

further described by measuring an individual's work experience. This measure would include such factors as an individual's total career time in his/her current line of work, and his/her total time spent in the present organization, in the present work group, and in the present position. Like formal education, researchers have demonstrated that the effect of tenure, or experience, on organizational outcomes can be both positive (e.g., Hulin and Smith, 1965) and negative (e.g., Gibson and Klein, 1970). The rationale for a positive relationship holds that with experience comes familiarity, not only with the work task, but with the work environment, with fellow workers, and with the work group supervisor, along with organizational policies, standards, and rules. This "familiarity" enables the worker to do two things. First, with increased experience and, in turn, familiarity, the worker can perform his/her task more effectively within prescribed boundaries. Second, experience in an organization frequently enables the worker to select the type of job in which he/she feels motivated to perform and satisfied with his/her work (Gruneberg, 1970).

Proponents of the negative relationship between experience and outcomes argue that often with experience comes the realization that the rewards of the job (e.g., pay, vacation, bonuses), both intrinsic and extrinsic, are not as great as hoped for or expected. The internal motivation to perform is decreased, as is the actual performance and satisfaction (Gibson and Klein, 1970). However, like Hunt and Saul (1975), I maintain that either situation can occur, even within the



same work group, since the interaction between experience and outcomes is clearly not a simple relationship, but is considerably influenced by factors such as task characteristics, control processes, and other individual differences.

The preceding discussions in this section of the review of literature have highlighted the development of current theory addressing the nature of the effects of individual differences in general, and specifically knowledge (formal education and experience) on the organization. Based on the preceding review, a few additional comments regarding the effect of knowledge in my model of the organization are in order. Hackman and Oldham (1980), in their model of the organization, have consolidated task technology (i.e., skill variety, task identity, and task significance) and organizational control processes (i.e., autonomy and feedback) into one category, called "core job characteristics," and call for moderation of these "characteristics" by individual differences. In similar fashion, the organizational model used in the present research effort calls for individual differences to moderate all three possible relationships (i.e., the technology-control process linkage; the control process-outcome linkage; and the technology-outcome linkage).

Individual knowledge may influence the technology-control process linkage in several ways. Individual mental ability to perform a task and experience in performing that task (which, in turn, may improve that skill), may, for example, reduce the need for certain control processes or

modify the types of control processes used. Also, as mentioned previously, task and organization experience may enable the employee to select the particular job he wishes to perform, which may, in turn, delimit the types of control processes used.

Individual knowledge may influence the control process-outcome linkage by enabling the individual to respond more effectively to control activities, thereby improving outcome. Perhaps, on the other hand, worker experience may inhibit performance and satisfaction if, for example, recent changes in control processes have acted to decrease one's internal work motivation.

Finally, individual knowledge can moderate the technology-outcome linkage in a fashion similar to the technology-control process linkage. Education and experience may provide a better understanding of the organization and task, allowing the individual to perform more effectively and with greater satisfaction within the organizational environment. On the other hand, education and experience in a particular task may reveal to the worker that his or her job may not meet his or her expectations for pay, advancement, responsibility, etc. As a result, the employee may experience decreased internal work motivation and, therefore, a degradation of performance as well as personal satisfaction.

In summary, based on the concepts developed by various authors and the preceding discussions, it is posited that individual knowledge, composed of formal education and work

experience for the purposes of this study, influences organizational outcomes through two separate moderating influences. The first is the relationship between the task technology and the control processes. The second and subsequent moderating relationship is between the control processes and the outcomes. The purpose of this study is to investigate the nature of the interrelationships among these various components.

Thus far, this review of literature has analyzed those variables (i.e., technology, control processes, and individual characteristics) which comprise the predictive portion of the organizational model proposed in this study. To accomplish this, the review has developed the conceptualization of the independent variable, job technology, and the moderating variables, control processes and individual knowledge, as they are interrelated and as they influence organizational outcomes. The two sections which follow present the conceptualization of the dependent variables performance and satisfaction. These are followed by a formal statement of the research hypotheses currently under study.

### Performance

The literature relevant to the evaluation of performance has typically called for analysis at the organizational level, requiring measurement based on physical output or monetary worth. Such measures are often inadequate for use in evaluating performance of certain service-type organizations (most notably, non-profit organizations) or when

attempting comparison of organizations or organizational subunits with dissimilar goals, activities, and/or performance measures.

General lack of agreement on the nature and domain of performance (or effectiveness), as well as the manner in which an organization operates, have resulted in dysfunctional attempts to codify performance. The result has been a multitude of conceptualizations of performance lacking consistency, coherence, and generalizability.

Ovalle (1981) maintained that any rational conceptualization of performance must meet three specific criteria. First, any approach to evaluating performance must be sufficiently delimited to preclude overstepping the rational boundaries of performance. Second, the approach must not be constricted to the extent that generalizability to and comparison with dissimilar units is not possible. Finally, a rational approach to conceptualizing performance must be consistent with the open-systems perspective. The open-systems perspective views active interchange between the organization and the environment as a crucial component of the functional organization. Organizational and subunit processes must be directed such that achievement of productivity goals is effectively balanced with such organizational dimensions as adaptability (and innovation), flexibility, and forecasting for and accommodation of environmental problems and changes.

Although several theorists recommend tailoring measurement of effectiveness to the organization under study,

generalizability of measurement across dissimilar organizations similarly facilitates research on generalizability of organizational models, a goal generally recognized and pursued by theorists and analysts alike. Several studies which at first appeared to have substantially different conceptualizations of effectiveness utilized several of the same factors for its description. Ovalle (1981), for example, cited the common use of such criteria as adaptiveness, innovation, flexibility, and successful use of resources and productive capacity in several studies involving different organization types, sizes, and models (e.g., Campbell, 1973; Duncan, 1973; Mott, 1972; and Webb, 1974). Mott's (1972) representation of effectiveness has proven particularly well-suited to Ovalle's (1981) conceptual criteria.

Mott defined effectiveness (performance) as ". . . the ability of an organization to mobilize its centers of power for action--production and adaptation [1972: 17]." Mott identified three basic components which, together, explain the nature of performance. The first performance component, productivity, measures quantity, quality, and effectiveness of organizational operations or processes. The remaining two components, adaptability and flexibility, describe the organization's ability to anticipate and react promptly to problems and changes. This notion of the nature of performance has been adopted for the current study.

## Satisfaction

This portion of the literature review addresses two important concerns. First, unlike performance, satisfaction of the individual is not, in itself, a quantifiable benefit accruing to the organization, and its relevance to the study of the organization is frequently seen as questionable. The succeeding paragraphs will discuss the rationale for including satisfaction in the current study. Second, the conceptualization of satisfaction is generally very well organized and accepted in organizational theory, particularly so in relation to other organizational concepts. Following the rationale for the inclusion of satisfaction in this study will be a brief discussion of the satisfaction taxonomy used in the current analytical effort.

Employee satisfaction, as far as the organizational system is concerned, is not in itself a desirable end: a satisfied (or dissatisfied) worker is not necessarily a more effective (or less effective) worker than one who is dissatisfied (or satisfied) (e.g., Gruneberg, 1979; Lawler, 1975; Locke and Schweiger, 1979). Despite the theoretical rationality and practical appeal of the satisfaction-performance relationship, there is little empirical proof to substantiate such a claim. The causal relationship, if any, between satisfaction and performance remains a current source of substantial controversy in organizational theory (e.g., see Herzberg, 1966; Locke and Schweiger, 1979; Vroom, 1964). It is not the intent of this research effort to offer further

insight to the nature of the performance and satisfaction relationship, although the data base used offers an opportunity to do so.

As mentioned previously, substantial evidence exists indicating that satisfaction has important influences on such organizational concerns as absenteeism and turnover (e.g., Hulin, 1966; Kovach, 1977; Porter and Steers, 1973). These factors, according to Locke and Schweiger (1979), can and do affect long-term effectiveness of an organization. However, as with the relationship that exists between performance and satisfaction, this study is not concerned with the possible influences of satisfaction on other variables. Rather, this study concerns itself specifically with delineation of those factors which may determine satisfaction in order to provide a better understanding of the constituents and nature of satisfaction. It is hoped that this will, in turn, allow others to better conceptualize the complex nature of employee satisfaction and its influences on other organizational components.

Worker satisfaction was first recognized as an important organizational factor during Elton Mayo's research at the Hawthorne plant of the Western Electric Company (as reported in Roethlisberger and Dickson, 1939). Hoppock (1935) conducted one of the first major research studies using survey methods and attitude scales to examine the nature of satisfaction. Applewhite (1965), in his review of theoretical and empirical works, identified five elements generally common to all studies:

1) attitudes toward one's work group; 2) attitudes toward general working conditions; 3) attitudes toward one's company; 4) attitudes toward monetary benefits; and 5) attitudes toward supervision.

Amid the diversity of measures which currently exist, one measure, the Cornell Job Description Index (JDI) is generally regarded as the most carefully developed instrument available for measuring job satisfaction. The JDI operationalizes Applewhite's (1965) five categories of satisfaction with some modification. However, the JDI is a somewhat flexible instrument, open to interpretation of terms (i.e., people with different backgrounds and levels of education could conceivably describe identical views and feelings using different terms). Furthermore, it is a nonparametric instrument, describing only the existence or absence of various dimensions of each of the five satisfaction categories, and not the individual intensity of these feelings.

Andrews and Withey (1976) overcame the problems of the JDI by simply listing their five categories (the job, the co-workers, the tasks involved in the job, the work environment, and facilities and supervision at the worker's disposal) and asking the respondent to describe the direction and intensity of his feelings using a seven-point, Likert-type scale. This conceptualization of satisfaction, as well as the instrument which Andrews and Withey used to measure satisfaction is adopted in this study.



## Research Hypotheses

The design of this research effort follows that of Ovalle (1981). Specifically, using the data base collected by Ovalle, this study evaluates several relationships at the individual level as a follow-on to Ovalle's (1981) investigation at the work group level. Where Ovalle's conceptualization of the organization called for the moderation of the technology-performance relationship by the control processes used within the organization, the model which is proposed in the current study integrates certain characteristics of the individual, specifically Hackman's and Oldham's (1980) "knowledge and skill," "growth need strength," and "context satisfaction." This research effort investigates one dimension of these individual characteristic variables, "knowledge," and adds to Ovalle's analysis of the dependent variable, "performance," Andrews' and Withey's (1976) conceptualization of satisfaction.

In order to accomplish these general tasks, three objectives for this study were presented in the preceding chapter. The first called for investigation of the effects of knowledge on the technology-control process relationship identified by Ovalle (1981). The following hypothesis is presented to satisfy this objective:

H<sub>1</sub>: The indirect effects of job technology, mediated by individual knowledge, will explain more of the variance in organizational control processes than will the direct effects of job technology.

The two "linkages" examined in the first hypothesis are depicted in Figure 4.

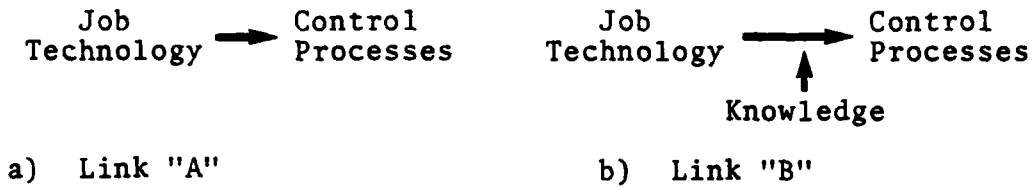


Fig 4. a) Link "A": the direct effects of technology on control; b) Link "B": the indirect effects of technology on control, as mediated by knowledge.

The second objective of this research effort established the need to investigate the effects of knowledge on the control process-performance and control process-satisfaction relationships, resulting in the following two hypotheses:

H<sub>2</sub>: The indirect effects of control processes, mediated by individual knowledge, will explain more of the variance in individual performance than will the direct effects of control processes.

H<sub>3</sub>: The indirect effects of control processes, mediated by individual knowledge, will explain more of the variance in individual satisfaction than will the direct effects of control processes.

The two basic linkages examined in the second and third hypotheses are depicted in Figure 5.







Fig 7. Link "G", shown above is the combination of Links "A" and "C", and represents the indirect effects of technology on outcomes (performance and satisfaction), as mediated by control processes.

H<sub>8</sub>: The indirect effects of technology, mediated by both control processes and individual knowledge, will explain more of the variance in individual performance than will the indirect effects of technology, mediated by control processes alone; the indirect effects of technology, mediated by individual knowledge alone; or the direct effects of technology alone.

H<sub>9</sub>: The indirect effects of technology, mediated by both control processes and individual knowledge, will explain more of the variance in individual satisfaction than will the indirect effects of technology, mediated by control processes alone; the indirect effects of technology, mediated by individual knowledge alone; or the direct effects of technology alone.

The new linkage addressed in the eighth and ninth hypotheses is shown in Figure 8.

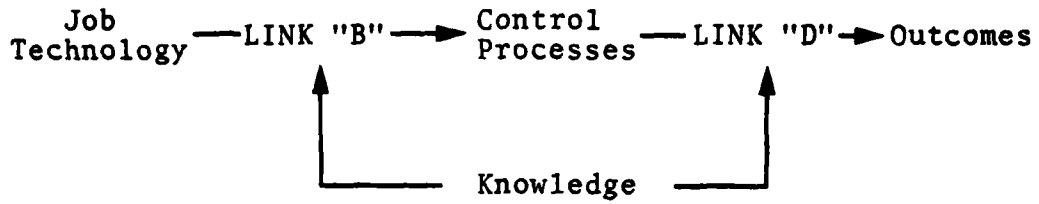


Fig. 8. Link "H", shown above, is the combination of Links "B" and "D", and represents the indirect effects of technology on outcomes (performance and satisfaction), as mediated by both control processes and individual knowledge.

## CHAPTER III

### RESEARCH METHODOLOGY

#### General Design

The purpose of this research effort is to build on Ovalle's (1981) work in further delineating organizational determinants of performance and satisfaction. While Ovalle's analysis was performed at the work group level, he collected data at the individual level, performed factor analysis at the individual level, and then aggregated the information for regression analysis at the work group level. Using both Ovalle's data base and the results of his factor analysis, certain interrelationships among task technology, control processes, and individual knowledge are investigated herein using multiple regression at the individual level. A second "series" of analyses is then performed to examine the relationship between each of these variables and the organizational outcomes, performance and satisfaction, again using multiple regression at the individual level.

#### Sample

Ovalle's (1981) sample consisted of 279 full-time staff employees (excluding supervisors) of a large educational institution in the United States Air Force. This organization provides undergraduate- and graduate-level education,

continuing professional education, specialized training, research, and consulting for the Air Force. Educational disciplines include scientific, technological, managerial, medical, and other fields. The organization has been in existence for over 60 years. Ovalle selected this service-type (i.e., educational) organization primarily to test his model (derived from taxonomies generally reserved for production-oriented organizations) in a non-industrial organization. Additionally, Ovalle determined, a priori, that the tasks performed by the various respondents differed significantly. Composition of the tasks performed by respondents included teaching, faculty research and consulting, administration, and general resource management (e.g., computer services, financial administration, and library support).

#### Research Instrument

Ovalle (1981) developed a 100-item questionnaire which he administered to all full-time staff employees of the educational institution. The questionnaire was designed to measure individual perceptions of task technology, control processes, performance, satisfaction, and demographic information (including knowledge). All items, with the exception of the demographic questions, were measured using a seven-point, Likert-type scale. A copy of Ovalle's survey is provided in Appendix A.



## Measures

### Operationalization of Technology

Defining technology as the routineness of tasks performed in an organization, Ovalle (1981) used four separate indices to measure task technology. Utilizing Perrow's (1967) framework, Ovalle measured task predictability and variability by assessing the number of exceptional cases encountered in an individual's work and the degree of accessibility to information concerning the accomplishments of such cases (see Questions 1 through 15, Appendix A).

Ovalle's second index evaluates task difficulty based on Perrow's (1967) conceptualization and Mohr's (1971) and Van de Ven's and Delbecq's (1974) scales. In quantifying task difficulty, each respondent is asked to evaluate his/her perceptions of the extent to which there are established and known procedures specifying the sequence of steps to be followed in performing his/her task. Questions 16 through 28 measure task difficulty (Appendix A).

Ovalle's (1981) third index measures task interdependence using the concepts and scales developed by Lynch (1972, 1974), Mohr (1971), and Overton, et al. (1977). As defined by Ovalle, interdependence refers to the interrelatedness among tasks in the work flow as viewed at the individual and sub-unit levels. Respondents are asked to indicate their perceptions of the degree to which their tasks are dependent on those of others and, conversely, the dependence of other

individuals' tasks on the respondent's tasks. Questions 29 through 34 comprise this scale (Appendix A).

The fourth technology index which Ovalle incorporated in his survey uses Woodward's (1965) conceptualization of the nature of the production process. Questions 35 through 38 measure the degree of product or service standardization and the degree of complexity in the production process using scales developed by Lynch (1972) and Woodward (1965).

#### Operationalization of the Nature of Control

Ovalle (1981) defined organizational control as the means by which an organization ensures that its activities produce the desired results. Ovalle adopted the theoretical conceptual framework of Reeves and Woodward (1970) who envisioned two basic dimensions to the nature of control processes, labelled "personal-mechanical," and "unitary-fragmented." However, Ovalle maintained that the variables used by Reeves and Woodward actually describe three, rather than two, dimensions.

Two indices are used to measure Ovalle's first dimension, "degree of personalization in exercising control," (similar to Reeves' and Woodward's "personal-mechanical" dimension). The first index, composed of three items (Questions 46 to 48) measures the extent to which the guidance, direction, and evaluation respondents receive is provided directly by their immediate supervisor, rather than through organizational policies and guidelines issued by

higher-level management. The second index, which also consists of three items (Questions 49-51), measures the degree to which the respondent's task performance is governed by formal, written rules, standards, and procedures. These measures were extracted from the works of Hrebiniak (1974) and Lynch (1972).

Ovalle's second hypothesized dimension, labelled "degree of unity in exercising control," is similar to Reeves' and Woodward's "unitary-fragmented" dimension. The first of three indices used to evaluate this aspect of control measures the extent to which formal standards of work performance prescribe the quantity and quality of output to be achieved by employees in their work. This index contains three items (Questions 52 to 54).

Ovalle's second index measuring his "degree of unity in exercising control" dimension is a scale used to assess the degree of compatibility between formal standards of work performance and between rules and procedures which guide the work itself. Formal standards of work performance are considered those criteria which prescribe the quantity and quality of output to be attained. Rules and procedures refer to the policies, directives and guidelines which prescribe the manner in which work is to be performed and the desired behavior of organizational members in their jobs. Seven items are used to measure this index (Questions 55 to 61).

The last index used to measure the "degree of unity in exercising control" is a scale used to measure the degree to

which respondents accept, are committed to, and feel challenged by, the standards, procedures, and rules guiding their work. This scale is composed of seven items (Questions 62 to 68).

Ovalle's hypothesized third dimension is labelled "autonomy/discretion." He described this as a measure of the degree of autonomy experienced by the respondent in determining how to perform his/her task (procedures, sequence, and pace). Most of Ovalle's eight items (Questions 69 to 76) were drawn from the works of Hrebiniak (1974) and Lynch (1972).

Ovalle's final index pertaining to the assessment of organizational control processes measures the two "modes of control" (behavior and output) proposed by Ouchi and Maguire (1975). These four items (Questions 77 to 80) were included by Ovalle to determine what relation, if any, these "modes" of control have with other variables of control. Ovalle expected these "modes" to indicate "what" is controlled rather than "how" an organization controls, which was the focus of Ovalle's study. These items were, therefore, excluded from the scope of Ovalle's 1981 study and were included in his survey as an area for future research.

#### Operationalization of Performance

Ovalle (1981) considered performance as ". . . a unit's ability to mobilize its centers of power for action [productivity and adaptability] [1981: 50]." Drawing from the taxonomies developed by Hendrix and Halverson (1979) and by Mott (1972), Ovalle used a seven-item index (Questions 39 to 45)

to measure various performance criteria, including: the quantity and quality of output; the efficiency in resource utilization; and the flexibility, adaptability, and capability of the respondent to anticipate and deal with problems and changes.

#### Operationalization of Job Satisfaction

As envisioned in the current research effort, satisfaction is viewed as both a moderating and a dependent variable, although only the latter is investigated in this study. Ovalle measured satisfaction based on the "Job Index" developed by Andrews and Withey (1975). Five items are used in this index (Questions 81 to 85), measuring the degree of satisfaction with various aspects of the job (e.g., co-workers, the work itself, and the general work environment supervision). This scale has been determined to have an alpha coefficient (for reliability) of .81.

#### Operationalization of Knowledge

In his survey, Ovalle (1981) included a section with 15 items (Questions 86 to 100) designed to gather background information about the respondents (e.g., work experience, sex, grade level). Five of these items (i.e., Questions 87, 89 to 91, and 96) are used to assess the respondent's knowledge, defined here as the composite of an individual's formal education and his/her experience with various aspects of his/her work (e.g., time in career field, time in organization, time

in position). These items are measured using various linear and non-linear scales composed of from seven to ten points.

### Validity and Reliability of Instrument Measures

Construct validation for technology, control, and performance was accomplished using independent factor analysis for the grouping of variables according to similarities in the item (dimension) being measured (Ovalle, 1981).

Ovalle performed factor analysis using the SPSS "FACTOR" program (Nie, et al., 1975). The specific factoring method used was principal factoring with iteration employed to improve estimates of communality. Orthogonal ROTATION, based on VARIMAX criterion, was used. Ovalle established two basic objectives for factoring prior to analysis. First, the final factor solution was required to consist of only those factors containing a significant number of high loadings to allow clear identification of each factor. Second, Ovalle required the final factor solution to account for as many of the original items as possible, while attempting to specify clear and independent factors. In essence, the overall objective was to account for as much of the "common variance" among items as possible and yet maintain independence among the resulting "subconstructs" (factors or dimensions). Ovalle established three specific criteria to meet the above-stated goals. First, a minimum factor loading of .40 was established for a given variable to "load" or associate with a particular factor. Second, at least two to three variables with high

loadings on a single given factor were essential to define a factor. Third, eigenvalues, which indicate the amount of variance in all the variables which a given factor can explain, had to be greater than or equal to one (1.0) in order to determine the number of factors to be used in the final solution. The factors identified by Ovalle and the individual variables associated with each are reported in Table I, following the discussion of Ovalle's reliability test.

Reliability estimates were obtained to measure the internal consistency of the dimensions or scales (resulting from factor analysis) of technology, control, and performance. Reliability was evaluated using coefficient, or Cronbach's alpha (Cronbach, 1951), which analyzes measurement error resulting from a lack of internal consistency in responses to a particular item of an index. It sets an upper limit to the measure of reliability such that low coefficients alpha indicate that the items measured by a particular index have little in common or there are not enough items in the index. The SPSS subprogram RELIABILITY was used to evaluate the various scales obtained in the factor analysis. The results are depicted in Table I.

Table I summarizes the results of Ovalle's factor and reliability analyses. Numbered rows in the left-hand column indicate the new dimensions, or indices, which Ovalle found, followed on the succeeding line by the items (i.e., questions/variables) which comprise the indices in the left-hand column, and by the respective coefficient alpha in the right-hand column.

TABLE I  
Results of Ovalle's Factor Analysis and  
Reliability Tests  
(1981)

Technology Indices	Coefficient Alpha
1. Job Routineness Items 1, 3, 5, 11, 12 and 18	$\alpha = .86$
2. Job Variability Items 2, 9, 10 and 13	$\alpha = .81$
3. Job Difficulty Items 17, 19, 20, 23 and 28	$\alpha = .78$
4. Product/Production Process Routineness Items 35, 36, 37 and 38	$\alpha = .79$
5. Other-Dependence Items 31 and 32	$\alpha = .79$
6. Dependence on Others Items 29 and 30	$\alpha = .72$
Control Indices	Coefficient Alpha
1. Job Autonomy Items 69, 70, 71, 73, 74, 75 and 76	$\alpha = .89$
2. Acceptance Items 62, 63, 64, 65, 66, 67 and 68	$\alpha = .87$
3. Compatibility Items 55, 56, 57, 58, 59 and 60	$\alpha = .79$
4. Personal-Direct Control Items 46, 47 and 79	$\alpha = .81$
5. Rule-Use Items 49 and 51	$\alpha = .65$
Performance Index	Coefficient Alpha
1. General Performance Items 39, 40, 41, 42, 43, 44 and 45	$\alpha = .85$



## Data Analysis

Multiple regression was used in this study to test all nine hypotheses. Nie, et al. (1975) stated that multiple regression is both a descriptive tool by which the linear dependence of one variable on others can be summarized and decomposed, and an inferential tool by which relationships in the population are evaluated through examination of a representative sample. This study, which investigated the nature of the interrelationships among technology, control processes and knowledge as they influence performance and satisfaction, called for the descriptive aspects of multiple regression.

According to Nie, et al. (1975), as a descriptive tool, the most important uses of multiple regression are: 1) to identify the best linear prediction equation and evaluate its predictive accuracy; 2) to control for other confounding factors in order to evaluate the contribution of a specific variable or group of variables; and 3) to find structural relations and provide explanations for complex multivariate relationships. Analysis of the nine hypotheses forwarded in this research effort focused on the first application.

The SPSS REGRESSION program, as described in Nie, et al. (1975) was used as the computer-based support for regression analysis. Using the factor scores for each of the dimensions found by Ovalle (1981) for technology, control processes, performance, and satisfaction, stepwise regression (see Nie, et al., 1975) was specified for all independent and moderating variables. The stepwise method calls for analysis of all

independent and moderating variables, entering variables into the regression equation on the basis of their respective contributions to the explained variance of the dependent variable. Regression was ceased at the point where the significance of the explanatory contribution of entering variables fell below the .05 level. Statistical tests of significance of the predictive capability of the model as a whole and the respective individual variables were then performed using the "F" test at the .05, .01, and .001 levels.

Each of the nine hypotheses called for a comparison of models as was depicted in Chapter II. In the event that both models in the comparison had the same number of predictive variables, the smaller of the two original models (i.e., the model exclusive of the new moderating variable under study) was selected. Where the two models being compared had different numbers of predictive variables, the following equation was used to determine which provided the best prediction of the dependent variable:

$$F = \frac{(R_C^2 - R_R^2)/(k - g)}{(1 - R_C^2)/[n - (k + 1)]}$$

where:

$R_C^2$  = Adjusted  $R^2$  for the model with the larger number of variables

$R_R^2$  = Adjusted  $R^2$  for the model with the smaller number of variables

n = number of cases

k = number of variable coefficients in the larger model

$g$  = number of variable coefficients in the smaller model

$k-g = v_1$  = degrees of freedom in the numerator

$n-(k+1) = v_2$  = degrees of freedom in the denominator

Reject the smaller model if  $F > F_{\alpha, v_1, v_2}$ . (See McClave and Benson, 1979; Nie, et al., 1975). This "F" test, like the preceding two "F" tests, was conducted at the .05, .01, and .001 significance levels.

In testing hypothesis one, a separate regression was performed with all of the technology dimensions (or factors) and/or knowledge variables regressed on each of the control process dimensions taken individually. In other words, each of the control process factors was taken as a separate dependent variable in the regression analysis for hypothesis one, with the various job technology factors (the independent variables) and the various knowledge variables (the moderating variables) entered into the equation using the stepwise method.

Analysis for each of the remaining eight hypotheses was performed in a fashion similar to that for hypothesis one, with the exception that in each hypothesis only one factor, either performance or satisfaction, served as the dependent variable with technology (the independent variable) and/or control processes/knowledge (the moderating variables) entered into the predictive equation (as appropriate for the particular hypothesis under study) using the stepwise method. The results of the regression analysis performed on the nine hypotheses are presented in the following chapter.

## CHAPTER IV

### RESULTS AND ANALYSIS

This chapter summarizes the results of the multiple regression analyses and comparisons performed within the methodology guidelines established in the preceding chapter. The hypotheses presented in Chapter II were placed in their particular sequence to allow a "stepping-stone" analysis of the model. In other words, each hypothesis built on the previous hypothesis, and served as a foundation on which to expand the succeeding hypothesis. The structure of this section of the study is, therefore, based on the individual hypothesis tested. Figure 9 illustrates the proposed general model of the organization, shown here with the various components (i.e., technology, control processes, knowledge, and outcomes) broken down into the various subcomponents, or "dimensions," which comprise each component. In each of the hypotheses analyzed, these various dimensions provided the basis for analysis. However, only those dimensions (i.e., variables) which entered the equation at significance levels of less than .05 are reported. Additionally, all  $R^2$  values reported are the "adjusted  $R^2$ " values computed in the SPSS analysis.

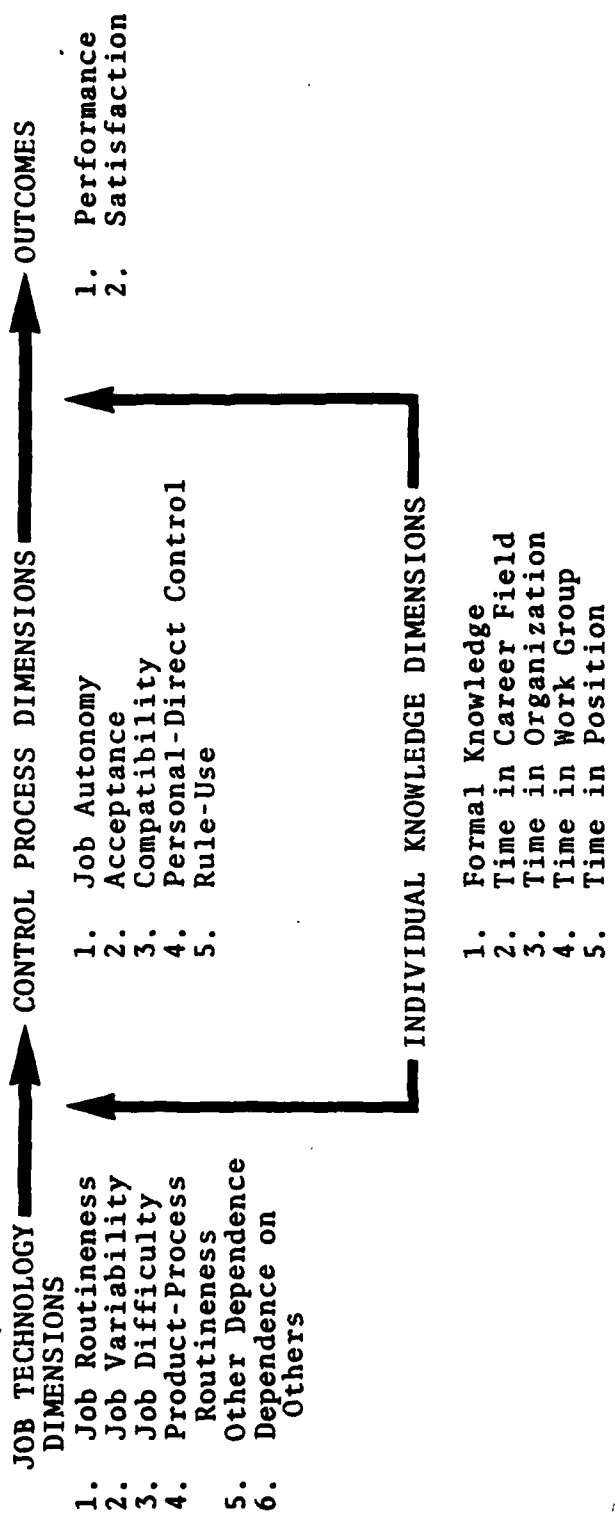


Fig 9. The Full Organizational Model With the Various Dimensions Tested

The Nature of the Relationships Between Job  
Technology, Individual Knowledge, and  
Control Processes: Hypothesis One

The five subsections which follow address the analysis performed and results identified in support of the first objective set forth in this study: to investigate the effects of job technology and individual knowledge on organizational control processes at the individual worker level in the organization. In testing hypothesis one, two models were used. The first was composed of only job technology as the independent variable and each of the five control processes (taken independently) as the dependent variable (Link A). Technology was herein seen as the best of all available predictors of control processes. The second model incorporated individual knowledge as the moderating variable (Link B), thereby maintaining that the inclusion of knowledge significantly enhances the predictive ability of the preceding model as used to determine (or constrain) the choice of control processes. Analysis was performed individually on each of the five dimensions of control processes (the dependent variables in hypothesis one) as previously discussed, and separate multiple regressions were performed on each dependent variable for the two separate models presented above. The succeeding paragraphs present and discuss the results of this analysis.

Job Technology, Individual Knowledge,  
and Job Autonomy

The results of the regression analyses performed between technology and job autonomy (Link A) and between technology

and job autonomy with individual knowledge as a moderating variable (Link B) are reported in Table II and are illustrated in Figures 10 and 11.

Analysis of the results found in Link A revealed that both job variability and job difficulty were found to have significant effects ( $p < .01$ ) on job autonomy. Additionally, job variability and a new technology variable, dependence on others, had significant influence on job autonomy at the  $p < .001$  level. Three other technology variables (job routineness, product-process routineness, and other dependence) had no significant effect on job autonomy.

Inspection of the results for Link B showed that one of the five knowledge variables (time in present position) significantly enhanced the predictive ability of the model incorporating the previously cited job technology variables in assessing job autonomy ( $p < .001$ ). The remaining four knowledge variables (time in career field, time in organization, time in work group, and level of education) played no significant roles as determinants of autonomy.

Comparison of the two models, or links, indicated that Link B, with its inclusion of knowledge as a moderating variable provided a significant ( $p < .001$ ) amount of additional information to the prediction of job autonomy. Based on the significance of the Beta coefficients in Link B, the data provided strong indications that job autonomy decreases with greater dependence on others and greater job difficulty, and increases with greater job variability and experience (time in

TABLE II

Job Technology and Individual Knowledge As  
Predictors of the Job Autonomy Dimension  
of Control Processes: Links "A" and "B"

Step #	Independent Variable†	Standardized Regression Coefficient††	R <sup>2</sup>	ΔR <sup>2</sup> †††
<u>Link "A": T - Control Processes</u>				
1.	Job Variability (T)	0.37	0.10***	0.098
2.	Dependence on Others (T)	-0.20	0.13***	0.033
3.	Job Difficulty (T)	-0.19	0.16**	0.028
Overall Adjusted R <sup>2</sup> :			0.16***	
<u>Link "B": T - K - Control Processes</u>				
1.	Time in Present Position (K)	0.25	0.11***	0.107
2.	Job Variability (T)	0.31	0.17***	0.060
3.	Dependence on Others (T)	-0.17	0.19**	0.019
4.	Job Difficulty (T)	-0.17	0.21**	0.023
Overall Adjusted R <sup>2</sup> :			0.21***	
* p < .05                      Comparison, Link B with Link A:				
** p < .01                      F = 17.09 > F .001,4,00 = 4.62				
*** p < .001                      Select Link B.				
† The "T" or "K" label for each independent variable indicates that the variable is a technology (T) or a knowledge (K) dimension.				
†† Positive values indicate a positive relationship between the dependent and independent variables.				
††† The "ΔR <sup>2</sup> " label is used here to denote the change in R <sup>2</sup>				



position). These findings may be explained using the following rationale: first, with increasing dependence on others, the individual's work performance is governed increasingly, either directly or indirectly, by other personnel with whom one associates (both superiors and peers). Second, increasing task difficulty suggests a wider range of means for dealing with problems and, thus, a wider range of possible outcomes. Given that only one, or relatively few, of the possible outcomes may be desirable, those who can benefit or be adversely effected by the results, aside from the employee in question, are more likely to infringe upon the worker's autonomy.

The positive influence of increasing job variability on job autonomy suggests that with more and varied individual tasks, the employee experiences greater autonomy in selection of which tasks are to be performed and when, and that perhaps fewer of those employees in the worker's immediate environment feel qualified to influence the individual.

Finally, the longer one has filled the current position, the greater the autonomy the employee will experience. This may be best explained by two phenomena. First, obviously, with more experience on the job, less supervision is required to guide the worker toward the desired goals. Perhaps more subtly, however, with increased experience in the position, the employee may in fact become an authority on the conduct of the tasks involved, further decreasing outside influence on the performance of one's work.

In summary, then, the combined effects of job variability, dependence on others, job difficulty, and experience in one's position, appear to significantly improve the predictive ability of the technology model as a descriptor of the job autonomy dimension of control processes. Based on this portion of the analysis, hypothesis one is supported.

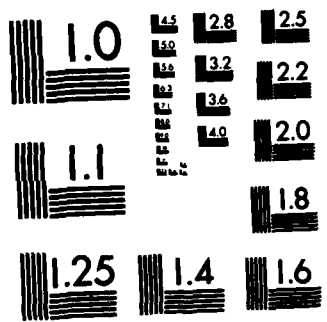
Job Technology, Individual Knowledge,  
and Acceptance of Rules and Standards

The results of the regression analysis focusing on technology and acceptance of rules, standards, and procedures (Link A) and between technology and acceptance of rules, standards, and procedures with individual knowledge as a moderating variable (Link B) are reported in Table III and are illustrated in Figures 10 and 11.

The results found in Links A and B concerning the influence of technology on control processes are in substantial agreement. In each link, the same three technology variables (job difficulty, job variability, and product-process routineness), were found to significantly affect acceptance of rules, standards, and procedures ( $p < .001$ ). The three remaining job technology variables (job routineness, other dependence, and dependence on others) demonstrated no significant effects on acceptance.

Regression analysis in Link B further revealed that one knowledge dimension (time in present work group) had a significant effect ( $p < .01$ ) on acceptance. The remaining four knowledge variables showed no significant effects on





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE III

Job Technology and Individual Knowledge  
As Predictors of the Acceptance Dimension  
of Control Processes: Links "A" and "B"

Step #	Independent Variable†	Standardized Regression Coefficient††	R <sup>2</sup>	ΔR <sup>2</sup> †††
<u>Link "A": T - Control Processes</u>				
1.	Job Difficulty (T)	-0.30	0.06***	0.057
2.	Job Variability (T)	0.34	0.13***	0.072
3.	Product-Process Routineness (T)	0.22	0.17***	0.039
Overall Adjusted R <sup>2</sup> :			0.17***	
<u>Link "B": T - K - Control Processes</u>				
1.	Job Difficulty (T)	-0.28	0.05***	0.054
2.	Job Variability (T)	0.32	0.13***	0.075
3.	Product-Process Routineness (T)	0.25	0.17***	0.039
4.	Time in Present Work Group (K)	0.17	0.19**	0.024
Overall Adjusted R <sup>2</sup> :			0.19***	
<p>* p &lt; .05                      Comparison, Link B with Link A:  ** p &lt; .01                      F = 6.67 &gt; F<sub>.001,4,00</sub> 4.62  *** p &lt; .001</p> <p>† The "T" or "K" label for each independent variable indicates that the variable is a technology (T) or knowledge (K) dimension.  †† Positive values indicate a positive relationship between the dependent and independent variables.  ††† The "ΔR<sup>2</sup>" label is used here to denote the change in R<sup>2</sup></p>				

acceptance.

Comparison of the two models indicated that the inclusion of knowledge in Link B significantly enhanced ( $p < .001$ ) the prediction of acceptance of rules, standards, and procedures. Based on the significance of the Beta coefficients in Link B, the data provided strong indications that acceptance decreases with higher levels of job difficulty, and increases with higher levels of job variability, product-process routineness, and time in present work group. These phenomena may be explained using the following rationale: first, as job difficulty increases, set rules, standards, and procedures delimiting employee behavior may be inadequate to guide the worker's performance. Second, increasing job variability places increasing demands on the individual who must diversify his or her talents or skills to cope with the range of tasks involved in the job. Rules, standards, and procedures may be realistic and acceptable to the worker in the more simplified tasks by specifying how and within what limits a task must be performed, leaving the employee the time needed to cope personally with, and solve by oneself, the more difficult problems which arise. Third, product-process routineness may increase acceptance because of certain formally stated requirements for consistency of performance (perhaps stipulated as a basis for continued employment). Also, stability in the product-production process may maintain a low level of turmoil among those resistant to change. Finally, one's increasing experience in a particular

work group may positively influence the employee's acceptance of rules, standards, and procedures because of the realization over time that the rules, standards, and procedures therein established adequately define the employee behavior necessary to complete specific tasks. Peer influence may further generate acceptance, as would one's participation in the development of rules and standards relevant to the performance of one's own job.

In summary, the combined effects of job difficulty, job variability, product-process routineness, and experience in one's work group, appear to be significantly strong determinants of the acceptance dimension of control processes. Based on this portion of the analysis, hypothesis one is supported.

Job Technology, Individual Knowledge,  
and Compatibility Among Rules,  
Standards, and Procedures

The results of the regression analysis focusing on technology and compatibility among rules, standards, and procedures (Link A) and on technology and compatibility among rules, standards, and procedures with individual knowledge as a moderating variable (Link B) are reported in Table IV and are illustrated in Figures 10 and 11.

The results found in both Link A and Link B concerning the influence of technology on control processes are in substantial agreement. In each model, product-process routineness showed a significant effect ( $p < .001$ ) on compatibility

TABLE IV

Job Technology and Individual Knowledge As Predictors of the Compatibility Dimension of Control Processes: Links "A" and "B"

Step #	Independent Variable†	Standardized Regression Coefficient††	R <sup>2</sup>	ΔR <sup>2</sup> †††
<u>Link "A": T - Control Processes</u>				
1.	Product-Process Routineness (T)	0.24	0.05***	0.053
Overall Adjusted R <sup>2</sup> :			0.05***	
<u>Link "B": T - K - Control Processes</u>				
1.	Product-Process Routineness (T)	0.27	0.06***	0.055
2.	Time in Present Position (K)	0.41	0.08***	0.022
3.	Time in Present Work Group (K)	-0.28	0.09**	0.015
Overall Adjusted R <sup>2</sup> :			0.09***	
* p < .05 Comparison, Link B with Link A:				
** p < .01 F = 5.97 > F .001,3,00 = 5.42				
*** p < .001 Select Link B.				
† The "T" or "K" label for each independent variable indicates that the variable is a technology (T) or a knowledge (K) dimension.				
†† Positive values indicate a positive relationship between the dependent and independent variables				
††† The "ΔR <sup>2</sup> " label is used here to denote the change in R <sup>2</sup>				

as perceived by the individual employee. The five remaining job technology dimensions demonstrated no significant effects on compatibility among rules, standards, and procedures.

Regression analysis in Link B indicated the significant influence of two knowledge dimensions (time in present position (p < .001) and time in present work group (p < .001)).



The other three individual knowledge variables (time in career field, time in present organization, and level of education) showed no significant effects on compatibility among rules and standards.

Comparison of the two models revealed that the inclusion of knowledge in Link B significantly improved ( $p < .001$ ) the predictive characteristics of Link A in assessing compatibility among rules, standards, and procedures. Based on the significance of the Beta coefficients in Link B, the data offered strong indications that compatibility among rules, standards, and procedures as perceived by the employee increases with higher degrees of product-process routineness and greater experience in one's present position, while perceived compatibility appears at first to decrease with increasing time in one's present work group. This is a direct contradiction to the logical assumption that the knowledge variables time in present position and time in present work group should be highly and positively correlated. This fact was borne out in analysis using the PEARSON CORR subprogram of SPSS (Pearson's Correlation Coefficient (R) = 0.881). Nunnally (1967) offered an explanation for similar situations where two highly correlated variables assume opposite signs in any given equation. The first of the two highly correlated variables to enter the model or prediction equation explains more of the variance in the dependent variable than does the other, correlated variable. The second, highly correlated variable then enters the equation with a reversed

sign. The second variable, called a "suppressor variable" in such cases, is included to extract the common variance between the two correlated variables, thereby increasing the predictive strength of the first variable on the dependent variable. This point was substantiated in the current situation by noting the significant increase in the Beta coefficient of the first variable when the suppressor variable entered the equation (from 0.16 at the .01 significance level to .41 at the .001 significance level).

The positive relationships of product-process routineness and time in present position with compatibility may be accounted for along the following lines: the more routine the nature of the product and the process resulting in the final product, the more quantifiable and descriptive each becomes. The more routine the product and its processes, the less need there is for decision-making on the part of the supervisor and the worker. Routineness, therefore, lends itself more readily to description and quantification than does variability in the product or its assemblage (or performance in a service-type situation). The result is potentially greater compatibility among rules and procedures that need not account for numerous possible variations in the product and work flow. Furthermore, with increasing experience in one's position, the worker may better understand the interlocking relationships between the rules, standards, and procedures established for one's job. The worker, with increased experience, may even become increasingly involved in developing

the rules and policies pertinent to his or her own work.

Summarizing the findings, the concerted effects of product-process routineness and experience in one's position, with experience in the work included to improve the predictive ability of experience in one's position, appear to significantly influence the compatibility among rules, standards and procedures. Based on this portion of the analysis, hypothesis one is supported.

Job Technology, Individual Knowledge,  
and Personal-Direct Control

The results of the regression analysis focusing on technology and personal-direct control (Link A) and on technology and personal-direct control with individual knowledge as a moderating variable (Link B) are reported in Table V and are illustrated in Figures 10 and 11.

A review of the findings in Link A illustrated that one of the technology variables (dependence on others) played a significant role ( $p < .01$ ) in the determination of the nature of personal-direct control. Two additional technology variables (product-process routineness and job variability) also proved significant ( $p < .05$ ) as determinants of personal-direct control.

With the addition of individual knowledge as a moderating variable in Link B, one of the five knowledge dimensions (level of education) accounted for the largest portion of the variance in the model (at the  $p < .001$  significance level). Additionally, knowledge influenced the predictive ability of

TABLE V

Job Technology and Individual Knowledge As  
 Predictors of the Personal-Direct Control  
 Dimension of Control Processes:  
 Links "A" and "B"

Step #	Independent Variable†	Standardized Regression Coefficient††	R <sup>2</sup>	ΔR <sup>2</sup> †††
<u>Link "A": T - Control Processes</u>				
1.	Dependence on Others (T)	0.16	0.02**	0.022
2.	Product-Process Routineness (T)	0.16	0.03*	0.011
3.	Job Variability (T)	0.12	0.04*	0.010
Overall Adjusted R <sup>2</sup> :			0.04**	
<u>Link "B": T - K - Control Processes</u>				
1.	Level of Education (K)	-0.32	0.08***	0.081
2.	Dependence on Others (T)	0.15	0.09*	0.010
3.	Job Routineness (T)	-0.22	0.10**	0.012
4.	Product-Process Routineness (T)	0.17	0.12**	0.021
Overall Adjusted R <sup>2</sup> :			0.12***	
* p < .05	Comparison, Link B with Link A:			
** p < .01	F = 24.55 > F <sub>.001,4,00</sub> = 4.62			
*** p < .001	Select Link B.			
†	The "T" or "K" label for each independent variable indicates that the variable is a technology (T) or a knowledge (K) dimension.			
††	Positive values indicate a positive relationship between the dependent and independent variables.			
†††	The "ΔR <sup>2</sup> " label is used here to denote the change in R <sup>2</sup>			

the model incorporating technology alone, apparently explaining some of the variance in personal-direct control explained by the job variability dimension (which was a significant factor in Link A), and allowing a new technology variable (job routineness) to enter the model.

Comparison of the two models (Link A and Link B) indicated that the inclusion of individual knowledge in Link B significantly improved ( $p < .001$ ) the predictive ability of the model in Link A as a determinant of personal-direct control. Using the Beta coefficients in Link B as a basis for comparison, the data provided strong indications that personal-direct control decreases with increasing levels of educational background and job routineness, while personal-direct control increases with higher levels of dependence on others and product-process routineness. A feasible explanation of these results might use the following rationale: employees who possess higher levels of education have a better understanding of the tasks which they perform, as well as the importance of their tasks. They may also be more able to cope with variability and difficulty in a task where problems arise which require increasingly complex, but rational, solutions (this may explain in part why job variability was no longer a significant predictor of personal-direct control in Link B, compared to Link A). This results in a reduced need for supervisory interaction.

With increasing dependence on others comes the need for interaction among personnel. This interaction requires

increasingly complex and intricate coordination and control to integrate and direct individual tasks toward common objectives. However, the more routine an individual's task may be, the more rules and standards there are likely to be, freeing one's supervisor for more important management functions. (NOTE: This point is substantiated in the investigation of job technology and knowledge as they influence the rule-use dimension of control processes.) Finally, increasing levels of product-process routineness appear to dictate an increased level of direct-personal control. This may be attributed to the perception on the part of employees that supervisors view quality control of the product and the integration of its parts as significantly more important than control of the individual performing his or her own particular portion of the overall product (or service).

Summarizing the results, the combined effects of educational background, dependence of one's own task on those of others, job routineness, and product-process routineness appear to be significantly related to the direct-personal control dimension of control processes. Based on this segment of the analysis, hypothesis one is supported.

#### Job Technology, Individual Knowledge, and Rule-Use

The results of the regression analysis performed to delineate the relationship between technology and rule-use (Link A) and between technology and rule-use with individual knowledge acting as a moderating variable (Link B) are

reported in Table VI and are illustrated in Figures 10 and 11.

A comparison between Link A and Link B demonstrated nearly identical results with regard to technology's predictive ability in assessing rule-use. The same three technology variables (job routineness, dependence on others, and product-process routineness) were found significant ( $p < .001$  for job routineness and dependence on others,  $p < .01$  for product-process routineness) predictors in all cases. No other technology variables showed significant effects on rule-use.

In addition, Link B in the current research effort showed that the addition of individual knowledge to the model increased the model's utility as a determinant of rule-use. In this instance the employee's level of formal education proved a significant ( $p < .001$ ) predictor of rule-use.

Using the significance of the Beta coefficients in Link B as a basis for comparison, the data offered strong indications that rule-use increases with greater job routineness, dependence on others, and product-process routineness, and decreases with higher levels of education. The following rationale is offered as one possible explanation of this phenomena. The more routine the job or task, the more susceptible it is to quantification and description through written guidelines or procedures. With such rules (assumed to adequately define employee behavior, task procedures, and expected outcome), the need for intervention by supervision may well decline. The relationship between product-process routineness and rule-use may be similarly explained. Increasing dependence

TABLE VI

Job Technology and Individual Knowledge As Predictors of the Rule-Use Dimension of Control Processes: Links "A" and "B"

Step #	Independent Variable†	Standardized Regression Coefficient††	R <sup>2</sup>	ΔR <sup>2</sup> †††
<u>Link "A": T - Control Processes</u>				
1.	Job Routineness (T)	0.41	0.29***	0.291
2.	Dependence on Others (T)	0.27	0.35***	0.064
3.	Product-Process Routineness (T)	0.15	0.37**	0.016
Overall Adjusted R <sup>2</sup> :			0.37***	
<u>Link "B": T - K - Control Processes</u>				
1.	Job Routineness (T)	0.34	0.29***	0.287
2.	Dependence on Others (T)	0.26	0.35***	0.066
3.	Level of Education (K)	-0.17	0.37***	0.022
4.	Product-Process Routineness (T)	0.15	0.39**	0.016
Overall Adjusted R <sup>2</sup> :			0.39***	
* p < .05		Comparison, Link B with Link A:		
** p < .01		F = 8.85 > F <sub>.001,4,00</sub> = 4.62		
*** p < .001		Select Link B.		
† The "T" or "K" label for each independent variable indicates that the variable is a technology (T) or a knowledge (K) dimension.				
†† Positive values indicate a positive relationship between the dependent and independent variables				
††† The "ΔR <sup>2</sup> " label is used here to denote the change in R <sup>2</sup>				



on others may increase rule-use because of the multiplicity of conceivable outcomes and management's realization of the requirement to delimit as much as possible these various results in order to maintain consistency, quantity, and quality, and achieve organizational objectives. It must be noted here, however, that an increase in rule-use does not necessarily imply a decrease in personal-direct control, nor does increased rule-use necessarily occur exclusive of increased personal-direct control; both may occur simultaneously under certain conditions.

Employees possessing higher levels of education appear to experience less rule-use in the performance of their tasks. This may be accounted for by the possibility that management feels that those with higher levels of education should be better able to maintain certain consistency, quality, and quantity levels without management intricately and formally specifying how to do so. Additionally, management may feel that those with higher levels of education are better able to deal with variability and difficulty on their own than could be achieved by specifically spelling out steps and procedures for dealing with each conceivable contingency or event.

In summary, the combined effects of job routineness, dependence on others, educational background, and product-process routineness appear to be significantly related to the rule-use dimension of control processes. Based on this portion of the analysis, hypothesis one is accepted.

JOB TECHNOLOGY DIMENSIONS → CONTROL PROCESS DIMENSIONS

Job Variability

Dependence on Others

Job Difficulty

Job Autonomy

Job Difficulty

Job Variability

Product-Process  
Routineness

Acceptance

Product-Process  
Routineness

Compatibility

Dependence on Others

Product-Process  
Routineness

Job Variability

Personal-Direct  
Control

Job Routineness

Dependence on Others

Product-Process  
Routineness

Rule-Use

Fig 10. Link "A": The Models Identified Using Multiple Regression of Technology on Each of the Control Process Dimensions

JOB TECHNOLOGY  
DIMENSIONS



CONTROL PROCESS  
DIMENSIONS

INDIVIDUAL  
KNOWLEDGE  
DIMENSIONS

-----  
Job Variability

Dependence on  
Others

Time in Present  
Position

Job Autonomy

Job Difficulty

-----  
Job Difficulty

Job Variability

Time in Present  
Work Group

Acceptance

Product-Process  
Routineness

-----  
Product-Process  
Routineness

Time in Present  
Position

Time in Present  
Work Group

Compatibility

-----  
Dependence on  
Others

Job Routineness

Level of Education

Personal-Direct  
Control

Product-Process  
Routineness

-----  
Job Routineness

Dependence on  
Others

Level of Education

Rule-Use

Product-Process  
Routineness

-----  
Fig 11. Link "B": The Models Identified Using  
Multiple Regression of Technology and Knowledge  
on Each of the Control Process Dimensions

### Discussion of the Analysis of Hypothesis One

The first hypothesis focused on the additional variance in control processes which could be explained by the inclusion of individual knowledge as a moderating variable of job technology (Link "B"). Figures 10 and 11 depict the results of this analysis. As indicated in Figure 11, in every instance, at least one of the knowledge dimensions aided significantly in the prediction of the particular control process under study. Hypothesis one is, therefore, accepted.

Consolidating the individual results of the analysis, several points bear noting. First, overall technology continues to be a substantially strong predictor of organizational control processes. In fact, in four of the five Link B models analyzed, at least one of the technology dimensions proved significant at the .001 level. Product-process routineness appears to have been the strongest job technology predictor of control, appearing in four of the five models (consistently at the .01 level or better). Dependence on others also provided a significant explanation of the control process component, appearing in three of the five models ( $p < .05$  or better). Each of the three other technology variables (job routineness, job variability, and job difficulty) appeared in two of the five models. Only one of the technology variables (other dependence) offered no significant explanation of variance in any of the control process dimensions. While this suggests that other dependence may not be a predictor of

control processes at the individual level, the exclusion of this dimension from future studies would be premature. Ovalle (1981) suggested that task interdependence is actually composed of two dimensions, dependence on others (shown to be a significant predictor of control processes at the individual level in this study) and other dependence. Additional research is needed to further assess these two dimensions.

Three of the five knowledge dimensions (time in work group, time in position, and level of education) proved to be significant predictors of control processes. Each of these three knowledge dimensions appeared in two of the five predictive equations for control processes, mostly at the .001 significance level. The remaining two knowledge dimensions (time in career field and time in present organization) offered no significant explanation of any of the control process dimensions. This may well be due to redundancy in the information contained in these variables with information contained in the variables time in present position and time in present work group. However, additional research should be conducted with these dimensions included to validate the general insignificance of their contributions to the explanation of control processes.

#### The Nature of the Relationships Between Control Processes, Knowledge and Outcomes

The two subsections which follow address the analysis performed and results identified in support of the second objective of this study: to investigate the effects of

organizational control processes and individual knowledge on performance and satisfaction at the individual worker level in the organization. Hypotheses two and three were presented in order to meet this objective. In testing each hypothesis, two models were used. The first was composed of only control processes as the independent variable and the outcome (either performance or satisfaction) as the dependent variable (Link C). Control was seen herein as the best of all available predictors of performance and satisfaction. The second model incorporated individual knowledge as a moderating variable (Link D), thereby maintaining that the inclusion of knowledge significantly improves the predictive ability of the preceding model as used to determine (or constrain) the resulting outcomes.

Organizational Control Processes,  
Individual Knowledge, and Per-  
formance: Hypothesis Two

The results of the regression analysis focusing on the relationship between control processes and performance (Link C), and between control processes and performance with individual knowledge as a moderating variable (Link D) are reported in Table VII and are depicted in Figures 12 and 13.

Comparison of the two models (Link D with Link C) demonstrated that the addition of knowledge, while replacing the job autonomy and personal-direct control dimensions of control processes, offered no additional explanation of the variance in performance. Analyzing Link D, three control

TABLE VII

Control Processes and Individual Knowledge As  
Predictors of Performance: Links "C" and "D"

Step #	Independent Variable†	Standardized Regression Coefficient††	R <sup>2</sup>	ΔR <sup>2</sup> †††
<u>Link "C": C - Performance</u>				
1.	Acceptance (C)	0.22	0.13***	0.131
2.	Compatibility (C)	0.15	0.15*	0.026
3.	Job Autonomy (C)	0.19	0.17**	0.000
4.	Personal-Direct Control (C)	0.13	0.18*	0.012
Overall Adjusted R <sup>2</sup> :			0.18***	
<u>Link "D": C - K - Performance</u>				
1.	Acceptance (C)	0.26	0.13***	0.128
2.	Time in Present Work Group (K)	0.19	0.15***	0.023
3.	Compatibility (C)	0.16	0.17**	0.015
4.	Level of Education (K)	-0.12	0.18*	0.013
Overall Adjusted R <sup>2</sup> :			0.18***	
<p>* p &lt; .05                      Comparison of Link D with Link C:  ** p &lt; .01                      Identical R<sup>2</sup> with same number of  *** p &lt; .001                      variables. Retain Link C.</p> <p>† The "C" or "K" label for each independent variable indicates that the variable is a control process (C) or a knowledge (K) dimension.</p> <p>†† Positive values indicate a positive relationship between the dependent and independent variables.</p> <p>††† The "R<sup>2</sup>" label is used here to denote the change in R<sup>2</sup></p>				

CONTROL PROCESS DIMENSIONS → PERFORMANCE

---

Acceptance  
 Compatibility  
 Job Autonomy  
 Personal-Direct Control

Performance

---

Fig 12. Link "C": The Model Identified Using Multiple Regression of Control Processes on Performance

CONTROL PROCESS DIMENSIONS → PERFORMANCE

↑  
 INDIVIDUAL KNOWLEDGE DIMENSIONS

---

Acceptance      Time in Present Work Group  
 Compatibility      Level of Education

Performance

---

Fig 13. Link "D": The Model Identified Using Multiple Regression of Control Processes and Knowledge on Performance

process dimensions (acceptance, compatibility, and job autonomy) showed significant effects on performance. Link C in the current research also indicated that personal-direct control is a significant predictor ( $p < .05$ ) of performance at the individual level. The remaining control process variable (rule-use) had no significant effect on performance.



Using the Beta coefficients in Link C as a basis for comparison, the data offered strong indications that performance increases with higher levels of control in general, and acceptance, compatibility, autonomy, and personal-direct control in particular. In rationalizing these findings, the following lines of reasoning may offer one feasible explanation of the results: acceptance of rules, standards, and procedures suggests that the worker views rules, standards, and procedures as both relevant and an aid to the accomplishment of one's work. These formalized directions are seen as guides to the successful completion of work and, perhaps, even as a sound measure of one's quantity and quality of completed tasks. This, in turn, may help the individual better understand the nature of his or her role in the organization. Similarly, increased compatibility among rules, standards, and procedures may reduce confusion about one's task, thereby allowing the employee to concentrate on performing the work rather than trying to determine how it should be accomplished.

Given the above, that a worker understands the assigned task and how it is to be accomplished, autonomy in performing that task plays an important role in improving performance. The worker may feel that with fewer interruptions from peers and superiors and given sound rules, standards, and procedures, he or she is better able to perform assigned work in terms of quantity and quality.

Finally, performance has been indicated to improve with

increasing levels of personal-direct control. While this may at first appear contradictory with improved performance resulting from autonomy, one possible explanation might be that in those exceptional cases which do arise, employees prefer personal interaction with those in authority as compared to seeking solutions in established rules, standards, and policies, or assuming responsibility for solutions on their own.

Based on the results of this analysis, hypothesis two is rejected: individual knowledge does not add significantly to control processes as predictors of performance.

Organizational Control Processes,  
Individual Knowledge, and Satisfac-  
tion: Hypothesis Three

The results of the regression analysis performed to delineate the relationship between control processes and satisfaction (Link C) and between control processes and satisfaction with individual knowledge as a moderating variable (Link D) are reported in Table VIII and are depicted in Figures 14 and 15.

Comparison of the two models (Link D with Link C) revealed that the inclusion of knowledge as a moderator of organizational control processes in Link D significantly ( $p < .05$ ) improved the predictive ability of Link C. The same dimensions (acceptance, job autonomy, and compatibility) showed significant effects on satisfaction in both models. The remaining control process variables (personal-direct control and rule-use) showed no significant effect on

TABLE VIII

Control Processes and Individual Knowledge As  
Predictors of Satisfaction: Links "C" and "D"

Step #	Independent Variable†	Standardized Regression Coefficient††	R <sup>2</sup>	ΔR <sup>2</sup> †††
<u>Link "C": C - Satisfaction</u>				
1.	Job Autonomy (C)	0.19	0.07**	0.068
2.	Acceptance (C)	0.15	0.10*	0.029
3.	Compatibility (C)	0.13	0.11*	0.011
Overall Adjusted R <sup>2</sup> :			0.11***	
<u>Link "D": C - K - Satisfaction</u>				
1.	Acceptance (C)	0.18	0.07**	0.066
2.	Job Autonomy (C)	0.16	0.09*	0.027
3.	Level of Education (K)	0.15	0.11*	0.017
4.	Compatibility (C)	0.12	0.12*	0.010
Overall Adjusted R <sup>2</sup> :			0.12***	
<p>* p &lt; .05                      Comparison, Link D with Link C:  ** p &lt; .01                      F = 3.07 &gt; F<sub>.05,4,00</sub> = 2.37  *** p &lt; .001                     Select Link D.</p> <p>† The "C" or "K" label for each independent variable indicates that the variable is a control process (C) or a knowledge (K) dimension</p> <p>†† Positive values indicate a positive relationship between the dependent and independent variables.</p> <p>††† The "ΔR<sup>2</sup>" label is used here to denote the change in R<sup>2</sup></p>				

CONTROL PROCESS DIMENSIONS → SATISFACTION

Job Autonomy

Acceptance

Compatibility

Satisfaction

Fig 14. Link "C": The Model Identified Using Multiple Regression of Control Processes on Satisfaction

CONTROL PROCESS DIMENSIONS → SATISFACTION



INDIVIDUAL KNOWLEDGE DIMENSIONS

Acceptance

Job Autonomy

Compatibility

Level of Education

Satisfaction

Fig 15. Link "D": The Model Identified Using Multiple Regression of Control Processes and Knowledge on Satisfaction

satisfaction. Only one of the five knowledge dimensions (educational background) showed a significant effect on satisfaction.

Based on the significance of the Beta coefficients in Link D as a means for comparison, the data offered strong

support for the contention that satisfaction increases with rising levels of acceptance of rules, standards, and procedures; job autonomy; formal education; and compatibility among rules and standards. One possible explanation is herein forwarded. As discussed in the previous section, acceptance of and compatibility among rules, standards, and procedures helps to delineate an individual's task, defining one's role in the organization while describing how the task involved should be performed. This, in turn, delimits the confusion often inherent in the typical job description. As a result, the individual, knowing what he or she is supposed to do and how it is to be done, feels more comfortable (satisfied) with both the actual performance of the work, as well as the results. Furthermore, often with autonomy comes the sense (whether right or wrong) that one is considered competent and is trusted in the performance of one's work, again resulting in a satisfied worker.

Finally, those workers possessing higher levels of education may tend to be generally more satisfied with the conditions of their work because they better understand their integral role in the organization as well as the intricacies of their tasks, and are more receptive to constructive evaluation of their work. The net result is that they are more satisfied with the nature of their work situation.

Based on the findings cited and discussed above, hypothesis three is accepted.

The Nature of the Relationships Between  
Job Technology, Control Processes,  
Individual Knowledge and Performance

The following three subsections address the analysis performed and results identified in support of the first portion of the final objective for this research effort: to investigate the existence and strength of the combined effects of technology, control, and knowledge on performance. Hypotheses four, six, and eight were presented in order to meet this objective. Four models were used in assessing the overall influence of job technology, knowledge, and control processes on performance. The first model was comprised of only job technology and performance (Link E). Here, technology was considered the best of all available predictors of performance. Successive models were built on this foundation. The second model incorporated knowledge as the sole moderating variable (Link F) of the technology-performance relationship. In similar fashion, the third model (Link G) called for the inclusion of the moderating variable control processes as the lone mediating influence on the technology-performance relationship. Finally, the fourth model consolidated the previous three, with technology as the independent variable, performance as the dependent variable, and both individual knowledge and control processes as the moderating variables. The following three subsections present the results of the analysis performed using these four models.

Job Technology, Individual Knowledge,  
and Performance: Hypothesis Four

The results of the regression analysis focusing on the relationship between job technology and performance (Link E) and between job technology and performance with individual knowledge as a moderating variable (Link F) are reported in Table IX and are depicted in Figures 16 and 17.

Comparison of the two models (Link F with Link E) revealed that the addition of knowledge as a moderator of job technology in Link F significantly ( $p < .05$ ) enhanced the predictive ability of Link E. Two technology dimensions (job variability ( $p < .01$ ) and job difficulty ( $p < .05$ )) proved important determinants of individual performance in the current study. Two knowledge variables (time in present work group ( $p < .001$ ) and formal education level ( $p < .05$ )) were also shown significant in the prediction of performance. None of the remaining technology or knowledge variables played a significant role as a determinant of performance.

Using the Beta coefficients in Link F as a basis for comparison, the data provided strong indications that performance increases with experience in the work group and job variability, and decreases with increasing educational background and job difficulty. Based on these findings, hypothesis four is accepted.

TABLE IX

Job Technology and Individual Knowledge As  
Predictors of Performance: Links "E" and "F"

Step #	Independent Variable†	Standardized Regression Coefficient††	R <sup>2</sup>	ΔR <sup>2</sup> †††
<u>Link "E": T - Performance</u>				
1.	Job Variability (T)	0.25	0.03***	0.031
2.	Job Difficulty (T)	-0.20	0.06**	0.031
Overall Adjusted R <sup>2</sup> :			0.06***	
<u>Link "F": T - K - Performance</u>				
1.	Time in Present Work Group (K)	0.21	0.05***	0.050
2.	Level of Education (K)	-0.13	0.07*	0.024
3.	Job Variability (T)	0.20	0.09**	0.019
4.	Job Difficulty (T)	-0.14	0.11*	0.014
Overall Adjusted R <sup>2</sup> :			0.11***	
<p>* p &lt; .05                      Comparison, Link F with Link E:  ** p &lt; .01                      F = 7.58 &gt; F<sub>.001,4,00</sub> = 4.62  *** p &lt; .001                      Select Link F.</p> <p>† The "T" or "K" label for each independent variable indicates that the variable is a technology (T) or a knowledge (K) dimension.</p> <p>†† Positive values indicate a positive relationship between the dependent and independent variables.</p> <p>††† The "ΔR<sup>2</sup>" label is used here to denote the change in R<sup>2</sup></p>				





TABLE X

Job Technology and Control Processes As  
Predictors of Performance: Link "G"

Step #	Independent Variable†	Standardized Regression Coefficient††	R <sup>2</sup>	ΔR <sup>2</sup> †††
<u>Link "G": T - C - Performance</u>				
1.	Acceptance (C)	0.27	0.13***	0.128
2.	Compatibility (C)	0.20	0.15***	0.023
3.	Job Variability (T)	0.16	0.17**	0.020
Overall Adjusted R <sup>2</sup> :			0.17***	
* p < .05                      Comparison, Link G with Link F: ** p < .01                      Link G has larger R <sup>2</sup> using fewer *** p < .001                      variables. Select Link G. † The "T" or "C" label for each independent variable indicates that the variable is a technology (T) or a control process (C) dimension. †† Positive values indicate a positive relationship between the dependent and independent variables. ††† The "ΔR <sup>2</sup> " label is used here to denote the change in R <sup>2</sup>				

and procedures) offered significant ( $p < .001$ ) explanation of performance. One technology dimension (job variability) was retained from Link F at the .01 significance level.

Comparison of Link G with the best model identified thus far, Link F, indicated that the variables identified in Link G provide a significantly ( $p < .001$ ) better explanation of the variance in performance than do those in Link F. The resultant Beta coefficients indicated that performance increases commensurate with higher levels of individual acceptance of and perceived compatibility among rules, standards, and procedures, and with higher levels of job variability.

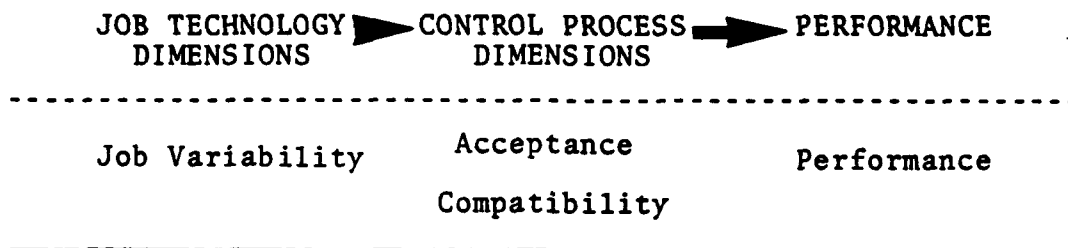


Fig 18. Link "G": The Model Identified Using Multiple Regression of Technology and Control Processes on Performance

The remaining technology and control process variables played no significant role in accounting for variance in performance in the current study. On the basis of these findings, hypothesis six is accepted.

Job Technology, Control Processes,  
Individual Knowledge, and Performance:  
Hypothesis Eight

The results of the regression analysis addressing the relationship between job technology, control processes, individual knowledge, and performance (Link H) are reported in Table XI and are depicted in Figure 19.

The results indicated that the inclusion of knowledge as a moderating variable to the technology-control process-performance relationship identified in Link G provided significant ( $p < .01$ ) improvement in the prediction of performance. One technology dimension (job variability ( $p < .05$ )) was retained from the original equation presented in Link E. The remaining technology variables offered no significant additional explanation of variance in performance. Two individual

TABLE XI

Job Technology, Individual Knowledge, and Control Processes As Predictors of Performance: Link "H"

Step #	Independent Variable†	Standardized Regression Coefficient††	R <sup>2</sup>	ΔR <sup>2</sup> †††
<u>Link "H": T - C,K - Performance</u>				
1.	Acceptance (C)	0.23	0.13***	0.126
2.	Time in Present Work Group (K)	0.18	0.15**	0.028
3.	Compatibility (C)	0.18	0.17**	0.020
4.	Level of Education (K)	-0.13	0.18*	0.012
5.	Job Variability (T)	0.13	0.20*	0.013
Overall Adjusted R <sup>2</sup> :			0.20***	
* p < .05 Comparison, Link H with Link G:				
** p < .01 F = 5.04 > F <sub>.001,5,00</sub> = 4.10				
*** p < .001 Select Link H.				
† The "T," "C" or "K" label for each independent variable indicates that the variable is a technology (T), a control process (C), or a knowledge (K) dimension.				
†† Positive values indicate a positive relationship between the dependent and independent variables.				
††† The "ΔR <sup>2</sup> " label is used here to denote the change in R <sup>2</sup>				

knowledge variables (time in present work group (p < .01) and level of formal education (p < .05)) were retained from Link F. None of the other three knowledge variables provided significant prediction of performance. The two control process variables identified in Link G (acceptance of rules, standards, and procedures (p < .001) and perceived compatibility of rules, standards, and procedures (p < .01)) remain

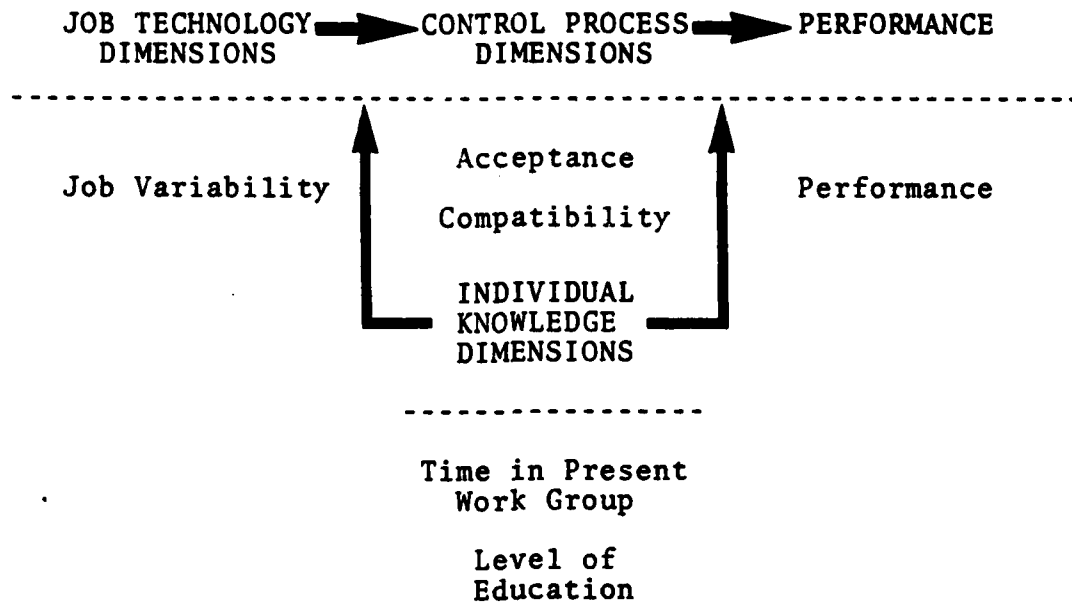


Fig 19. Link "H": The Model Identified Using Multiple Regression of Technology, Control Processes, and Knowledge on Performance

in the expanded model of Link H. No other control process dimensions showed significant influence on the dependent variable performance.

Comparison of the Beta coefficients revealed strong indications that performance increases with greater acceptance of and compatibility among rules, standards, and procedures, with greater job variability, and with tenure in the present work group. Furthermore, higher levels of education attained by an individual have a negative influence on one's performance. Based on the results of this analysis, hypothesis eight is supported, and Link H is accepted.

Discussion of the Results:  
Technology, Control Processes,  
and Knowledge as Predictors of  
Performance

Discussion of the methodology for this study in Chapter III indicated that, in this segment of the analysis, successive models were built on previous models. Link H, reflecting performance as the dependent variable, technology as the independent variable, and control processes and knowledge as the moderating variables, represents the culmination of this "model-building" process, as well as the best predictive model of performance in this study. Link H incorporates certain elements of each of the three preceding models, resulting in each of the independent and moderating components under study providing significant information useful in assessing performance.

The results of the analysis of Link H, which focused on the influence of technology, knowledge, and control processes on performance, gave strong indications that performance increases with increasing levels of acceptance; time in work group; compatibility among rules, standards, and procedures; and job variability, and decreases with higher levels of education. The following discussion offers one possible explanation for these results.

Acceptance of rules, standards, and procedures proved to be the most significant of the variables under study as a positive influence on performance. Workers may feel that those formalized descriptors of their tasks which define

their jobs and delimit the procedures and results of their work aid substantially in guiding their efforts. With a better understanding of what is expected, the worker may feel better qualified to produce the desired results, both in quantity and quality. Compatibility of these rules, standards, and procedures may eliminate much of the confusion inherent in a particular task, thereby further enabling the individual to improve performance.

With experience in the work group comes a better understanding of the internal workings and interpersonal relationships necessary to maintain a productive workflow. The individual may, with time, better appreciate the importance of one's position as it relates to others in the work group, resulting in increased efficiency in performance.

Increased job variability, indicating diversity in the nature of the task and the skills necessary to accomplish the work was shown to positively influence work performance. This may be attributed to the opportunity for the individual to exercise a range of skills rather than concentrating on only one or a few of one's capabilities. This may, in turn, offer two advantages: first, the worker is offered a certain degree of flexibility concerning how the assigned task(s) should be accomplished. Second, it may relieve the boredom and, in turn, declining productivity often associated with task routineness and/or repetitiveness.

As determined in the current study, performance appears to decline among those workers with increasingly higher levels

of education. One possible reason for this decline may be that the more highly educated employees experience fewer challenges in their work than they may have originally anticipated. Many of the task and interpersonal skills they may have acquired through their formal education might remain dormant in their current work, reducing their dedication to the task. Declining motivation may occur in such a situation with a resultant negative impact on task performance.

It should be noted that each of the major components posited in the original model of the organization forwarded in this study has, in part, played a significant role in the model identified in Link H. Future research may reveal additional components or new dimensions of components herein studied, which will further delineate individual performance.

#### The Nature of the Relationships Between Job Technology, Control Processes, Individual Knowledge and Satisfaction

The three subsections which follow address the analysis performed and results identified in support of the last portion of the final objective for this research effort: to investigate the existence and strength of the combined effects of job technology, control processes, and individual knowledge on satisfaction. Hypotheses five, seven, and nine were presented in support of this objective. As in the previous section, four models were used in evaluating the overall influence of job technology, individual knowledge, and organizational control processes on satisfaction. The successive



structuring of the models (Links E, F, G, and H) in this section is identical to that outlined in the preceding section. The following three subsections present the results of the analysis conducted using these four models.

Job Technology, Individual  
Knowledge, and Satisfaction:  
Hypothesis Five

The results of the regression analysis focusing on the relationship between job technology and satisfaction (Link E) and between job technology and satisfaction with individual knowledge as the moderating variable (Link F) are reported in Table XII and are depicted in Figures 20 and 21.

Comparison of the two models (Link F with Link E) revealed that the addition of knowledge as a moderator of technology in Link F had no significant effect on the predictive ability of Link E. In fact, the inclusion of knowledge appears to have a slightly confounding effect on the technology-satisfaction linkage. In both models, only two technology variables (job variability ( $p < .001$ ) and dependence on others ( $p < .01$ )) offered a significant amount of explanation of variance in satisfaction. Analysis of the Beta coefficients showed that satisfaction increases with greater perceived job variability and decreases with higher levels of dependence on the efforts of others. Based on the above findings, hypothesis five is rejected: knowledge does not provide a significant improvement in the determination of satisfaction over the information provided by technology alone.



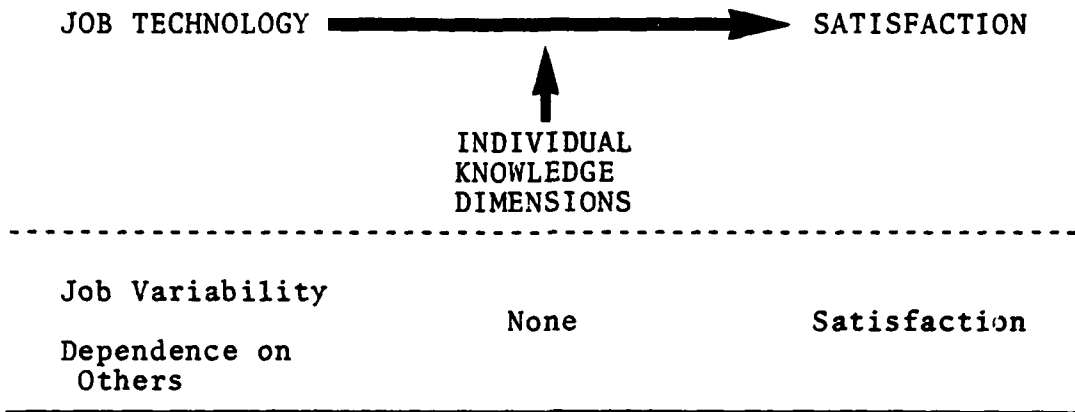


Fig 21. Link "F": The Model Identified Using Multiple Regression of Technology and Knowledge on Satisfaction

Job Technology, Control Processes, and Satisfaction: Hypothesis Seven

The results of the regression analysis conducted between job technology and satisfaction with control processes as the moderating variables (Link G) are reported in Table XIII and are depicted in Figure 22.

The results showed that two control variables (acceptance of rules, standards, and procedures ( $p < .001$ ) and dependence on others ( $p < .05$ )) provided significant additional explanation of variance in satisfaction in conjunction with one of the technology variables identified in Link E (dependence on others ( $p < .05$ )) and a new technology dimension (acceptance of rules, standards, and procedures ( $p < .001$ )). Job variability, a significant determinant of performance in Link E offered no significant contribution in Link F, nor did the remaining three technology variables.

Comparison of Link G with the best model identified

TABLE XIII

Job Technology and Control Processes As  
Predictors of Satisfaction: Link "G"

Step #	Independent Variable†	Standardized Regression Coefficients††	R <sup>2</sup>	ΔR <sup>2</sup> †††
<u>Link "G": T - C - Satisfaction</u>				
1.	Job Autonomy (C)	0.16	0.07**	0.068
2.	Acceptance (C)	0.25	0.10***	0.029
3.	Job Difficulty (T)	0.19	0.13**	0.034
4.	Dependence on Others (T)	-0.13	0.14*	0.012
Overall Adjusted R <sup>2</sup> :			0.14***	
* p < .05		Comparison, Link G with Link E:		
** p < .01		F = 11.15 > F <sub>.001,4,00</sub> = 4.62		
*** p < .001		Select Link G.		
† The "T" or "C" label for each independent variable indicates that the variable is a technology (T) or a control process (C) dimension.				
†† Positive values indicate a positive relationship between the dependent and independent variables.				
††† The "ΔR <sup>2</sup> " label is used here to denote the change in R <sup>2</sup>				

thus far, Link E, indicated that the variables identified in Link G provided a significantly ( $p < .001$ ) better explanation of the variance in performance than did the technology variables alone (Link E). The resultant Beta coefficients indicated that satisfaction increases with higher levels of job autonomy and difficulty, and with greater acceptance of rules and standards, and decreases with greater dependence on others. On the basis of these findings, hypothesis seven is accepted.

JOB TECHNOLOGY DIMENSIONS   ▶▶  CONTROL PROCESS DIMENSIONS   ▶▶  SATISFACTION

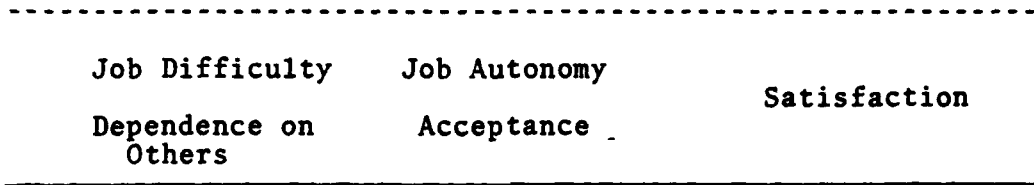


Fig 22. Link "G": The Model Identified Using Multiple Regression of Technology and Control Processes on Satisfaction

Job Technology, Control Processes, Individual Knowledge, and Satisfaction: Hypothesis Nine

The results of the regression analysis addressing the relationship between job technology, control processes, individual knowledge, and satisfaction (Link H) are reported in Table XIV and are depicted in Figure 23.

The results indicated that the model in Link H, with the inclusion of knowledge, was substantially identical to the model adopted in Link G: the addition of knowledge offered no significant improvement to the predictive model composed only of the dependent variable satisfaction, the independent variable job technology, and the moderating variable, control processes (Link G). The insignificant contribution of knowledge as a moderating influence of technology in the prediction of satisfaction resulted in rejection of hypothesis nine, and general acceptance of the job technology-control processes-satisfaction equation posited in hypothesis seven.



Discussion of Results:  
Technology, Control Processes,  
and Knowledge as Predictors  
of Satisfaction

Each of the models tested in this section of Chapter IV with regard to the prediction (or limitation) of satisfaction was composed of elements from preceding models and served as a basis for development of successive models. The analysis revealed that, in the current study, the individual knowledge component offered insufficient information to the determination of satisfaction to warrant its inclusion in the final model. Link G was, therefore, selected as the best predictive model, incorporating satisfaction as the dependent variable, technology as the independent variable, and control processes as the moderating variable.

The results of the analysis of Link G provided strong indications that satisfaction increases with higher levels of job autonomy; acceptance of rules, standards, and policies; and job difficulty, while increasing dependence on others tends to decrease satisfaction in the individual worker. The following discussion offers one feasible explanation for these findings.

Although opposite in their influences on satisfaction, the control dimension "job autonomy" and the technology dimension "dependence on others" can be explained using identical rationale. The worker, given a particular task or group of tasks, finds satisfaction and self-worth in the realization that not only can he or she perform the assigned work exclusive

of any outside assistance (either from fellow workers or supervisors), but that others (again, fellow workers and supervision) entrust him or her to do so. Furthermore, given a difficult task which challenges one's skills, yet for which one has certain guidelines which are perceived as relevant and useful, that worker's satisfaction with the existing work situation increases even more.

As noted previously, only two of the three major components (i.e., technology and control processes) proposed in the original model under study in the current effort proved significant in the determination of satisfaction. The failure of knowledge to provide significant predictive information in the current study should in no way preclude its incorporation in future works utilizing various sample types and measurement instruments. Future research may also reveal additional dimensions or major components which better serve the prediction of satisfaction than do those incorporated in the current model.



## CHAPTER V

### CONCLUSIONS AND RECOMMENDATIONS

The focus of this research effort has been to further delineate certain of the internal organizational factors which influence the relationship between job technology and individual performance and satisfaction. The influence of the available product and production technology on organizational outcomes (e.g., performance) has been generally recognized and accepted by researchers in this field. However, the literature addressing this issue illustrates that some controversy still exists among theorists investigating the various potentially intervening factors defining the relationship between technology and performance. Recent literature suggests that this debate is centered not so much on what general organizational factors influence outcomes, but on how structure and control (often synonymously defined and conceptualized) influence the technology-outcome relationship. Moreover, research in this vein has been typified by analysis at the system (organization) or subsystem (work group) levels.

The current research effort has sought to investigate the technology-organizational outcome relationship from a different perspective. Data was collected and analyzed at the individual worker level, allowing broad application

across organization and technology types. In addition, investigation at the individual level allowed the inclusion of a new dimension, i.e., various characteristics of the individual, which has heretofore received only cursory attention.

Three specific objectives served as the basis for this study. The first objective established the requirement to investigate the effects of individual knowledge on the technology-control processes relationship identified by Ovalle (1981). The second objective stipulated the need to investigate the effects of knowledge on the relationship between control processes and outcomes (performance and satisfaction), addressed, in part, by Ovalle (1981). The final objective sought to delineate the nature of the relationships between organizational outcomes (the dependent variables), job technology (the independent variable), and control processes and individual knowledge (the moderating variables).

The results of the analysis relative to the first objective (hypothesis one) indicated that, in general, the inclusion of knowledge as a moderator of the technology-control process relationship provides a significant improvement in the prediction of control processes. In fact, at least one dimension of knowledge explained a significant amount of the variance in each of the five control process dimensions. In particular, three of the five knowledge variables (time in present work group, time in present position, and level of education) provided significant amounts of information in explaining two of the five control dimensions. These findings

substantiate the model proposed in Hackman and Oldham (1980) which incorporates knowledge as one of the moderating individual characteristics. The two knowledge dimensions which failed to provide any significant explanation of control were "time in present career field" and "time in present organization." The exclusion of these two knowledge (i.e., experience) dimensions highlights two important points. First, the absence of the "time in present career field" dimension suggests that one's experience in a particular career field does not necessarily enhance one's ability to cope with the technologies prevalent in the current position and work group, nor does it influence the type and extent of control the individual experiences. In other words, given the same career field, the job technology may vary significantly between various organizations (and even between work groups) as witnessed by the absence of the "time in present organization" dimension, even though the various organizations or subunits are themselves subunits of a larger organization (e.g., the U.S. Air Force). Second, the failure of the "time in present organization" variable to provide significant information to the prediction of control was due in part to its high correlation to the "time in work group" and "time in position" variables. This, in turn, suggests that the impact of job technology and the type of control exercised are governed more by the individual's experience in the current situation than by one's organizational or career background. In other words, technology and control appear to be peculiar

to the specific work group in which the worker is employed. In this light, future research may prove fruitful in two areas. First, since the level of formal knowledge, the time in the present work group, and the time in the present position all proved to be significant moderators of the technology-control relationship, future research should investigate the nature of the individual's indoctrination into the existing situation. In particular, analysis of one's training peculiar to the technologies present in one's particular work group would provide important information in determining the most appropriate type of control processes. Second, additional research is necessary to verify the exclusion from further consideration of the two knowledge variables found to be insignificant in the current study.

The results of the evaluation of the second objective, addressing the control process-performance relationship (hypothesis two), indicated that the addition of individual knowledge as a moderating variable provides no significant improvement to the predictive ability of control alone. Although two knowledge variables replaced two of the control variables in the full equation, the overall significance of the model remained unchanged. This finding is contradictory to the Job Characteristics Model posited by Hackman and Oldham (1980). However, this finding does not preclude the possibility that Hackman's and Oldham's other two individual characteristics ("growth need strength" and "context satisfactions") may play important roles in predicting performance.

Future research with these two dimensions may provide further insight into the description of performance by control processes.

The findings relative to the second objective, focusing on the control process-satisfaction relationship (hypothesis three), indicated that one of the knowledge dimensions, level of formal education, explained a significant amount of the variance in satisfaction. Although this offers support for the model proposed in the current study, additional research in this area, similar to that described in the preceding paragraph, should be performed before excluding the remaining four knowledge variables from the control process-satisfaction predictive equation.

The results of the analysis regarding the third objective, addressing the relationship between performance (the dependent variable), job technology (the independent variable), and control processes and individual knowledge (the moderating variables), provided support for a model incorporating certain dimensions of each of these variables. While only one technology dimension, job variability, was retained in the final equation, two control process variables and two knowledge variables also provided substantial explanation of the variance in performance. The two control process variables, labelled acceptance of and compatibility among rules and standards, significantly influenced the job technology-performance relationship. These findings also showed that the variables labelled personal-direct control, rule-use,

and job autonomy, played insignificant roles as predictors of performance in the current model. This suggests that the perceived quantity and types of control (i.e., personal-direct control, rule-use, and job autonomy) play a less important role than the perceived quality of control (i.e., acceptability and compatibility of the rules and standards) in affecting individual performance. Future research should further investigate this possibility and include additional measures to better evaluate the quantity and quality aspects of control processes.

The two knowledge variables, tenure in the present work group and level of education, lent support to the contention that knowledge as a moderating variable adds significantly to the determination of performance. The influence of tenure on performance suggests that with greater experience, the individual worker has a better understanding of his tasks and is, therefore, better able to cope with job variability and, by the same token, is more receptive to the control processes used to guide one's behavior. Hulin and Smith (1965) also found significant support for the notion that tenure in one's work group and position improves performance by increasing the individual's familiarity with the task, with the coworkers and supervision, and with the control processes used by management to insure accomplishment of organizational goals. Future research should be directed at investigating the tenure dimension to either support or refute the substantiated findings of the current study. The

second knowledge variable, level of education, had a negative effect on performance. This suggests that workers with higher levels of formal education may feel that certain of the control processes are unnecessary or irrelevant in their situation, and often impede the performance of their tasks. This particular finding may carry significant importance in organizations which have traditionally used stringent rules and standards to guide the performance of employees. Future research should continue to investigate these two knowledge variables and evaluate some of the other individual characteristics posited in the organizational model developed for this research effort (e.g., "context satisfactions").

In comparing the various models studied to fulfill the second portion of the final objective, two of the three organizational components under investigation were shown to provide the best predictive equation used in assessing satisfaction. Two of the technology variables, in conjunction with two of the control process variables, offered the best explanatory model tested. The inclusion of the five knowledge dimensions provided no additional information concerning the variance in satisfaction. The two technology variables, job difficulty and dependence on others, indicated that workers are increasingly satisfied with more difficult work, while greater dependence on others results in less satisfaction. Furthermore, the two control variables involved, job autonomy and acceptance of rules and standards, improved worker satisfaction. In other words, the worker finds greater satisfaction in

tasks which are more difficult, require more individual effort, are free of intervention by fellow workers and by supervision, and are guided by rules and standards which the individual perceives as acceptable. These same findings were found under all conditions of educational background and tenure. Further research is needed to assess the influence of knowledge on satisfaction before this factor can be justifiably excluded from future predictive models. Additionally, future research should investigate the influences on satisfaction imposed by those individual characteristics proposed but not investigated in the present study (i.e., skill, growth need strength, and context satisfactions).

In summary, this study has sought to build on existing research and theory in organizational behavior by further delineating certain of the major organizational components which play important roles in the determination of organizational outcomes. The key moderating variables investigated in this study, control processes and individual knowledge, have herein been shown to exert significant influence on organizational outcomes in a single service-type organization. The survey instrument used in this study has been tested only once, providing the data base used in the current study. Though a large portion of this instrument incorporates several previously validated indexes, several new indexes were developed and incorporated by Ovalle (1981). This instrument must, therefore, be validated across organization-types and refined to include additional organizational components and dimensions



not investigated here. Any broad applications of the findings across organization-types would, therefore, be premature. Further research will undoubtedly help to refine the instrument and the organizational model on which the current study is based. Toward this end, future research calls for continued investigation not only of those internal factors influencing organizational outcomes, but also of those environmental factors, external to the organization, which may influence the achievement of organizational objectives.

APPENDIX A

QUESTIONNAIRE ASSESSING THE NATURE OF ORGANIZATIONAL  
TECHNOLOGY, CONTROL PROCESSES, INDIVIDUAL KNOWLEDGE,  
PERFORMANCE, AND SATISFACTION

PRIVACY STATEMENT

In accordance with paragraph 30, AFR 12-35, the following information is provided as required by the Privacy Act of 1974:

a. Authority:

- (1) 5 U.S.C. 301, Departmental Regulations; and
- (2) 10 U.S.C. 8012, Secretary of the Air Force, Powers, Duties, Delegation by Compensation; and
- (3) EO 9397, 22 Nov 43, Numbering System for Federal Accounts Relating to Individual Persons; and
- (4) DOD Instruction 1100.13, 17 Apr 68, Surveys of Department of Defense Personnel; and
- (5) AFR 30-23, 22 Sep 76, Air Force Personnel Survey Program.

b. Principal purposes. The survey is being conducted to collect information to be used in research aimed at illuminating and providing inputs to the solution of problems of interest to the Air Force and DOD.

c. Routine uses. The survey data will be converted to information for use in research of management related problems. Results of the research, based on the data provided, will be included in a written doctoral dissertation and may also be included in published articles, reports, or texts. Distribution of the results of the research, based on the survey data, whether in written form or presented orally, will be unlimited.

d. Participation in this survey is entirely voluntary.

e. No adverse action of any kind may be taken against any individual who elects not to participate in any or all of this survey.

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## GENERAL INFORMATION

The purpose of this questionnaire is to obtain information about you, your job, your work group and your organization. Specifically, this information is being collected in support of research assessing the relationships between the nature of job technology, job control processes and performance in organizations.

Please be assured that all information will be held in the strictest confidence. Your individual responses will NOT be provided to your organization or to any other agency. Only the individual performing this research will have access to your completed questionnaire. In addition, when the results of this study are published, readers will NOT be able to identify specific individuals or work groups.

When you have completed the questionnaire, please seal it and the two machine-scored response sheets in the enclosed, addressed envelope and return it through inter-office mail distribution within five working days.

Thank you for your cooperation. If you have any questions please contact the researcher at the following address:

Major Nestor K. Ovalle, 2d  
AFIT/LSB  
Wright-Patterson AFB OH 45433  
Office Phone: 255-4529

## KEY WORDS

The following should be considered as key words throughout the questionnaire:

1. Supervisor: The person to whom you report directly.
2. Work Group: All persons who report to the same supervisor as you do.
3. Organization: The overall organizational unit, (e.g., Base Hospital, Organizational Maintenance Squadron, etc). The overall organizational unit will be composed of various (perhaps many) work groups which might be referred to as sections, branches or departments.

## INSTRUCTIONS

1. This questionnaire is composed of 5 sections, with a total of 100 items (individual "questions") numbered "1" through "100". All 100 items must be answered by filling in the appropriate spaces on the machine-scored response sheets provided. If for any item you do not find a response that fits your case exactly, use the one that is the closest to the way you feel.

2. Please use a "soft-lead" (number 2) pencil, and observe the following:

- a. Make heavy black marks that fill in the space (of the response you select).
- b. Erase cleanly any responses you wish to change.

- c. Make no stray markings of any kind on the response sheet.
- d. Do not staple, fold or tear the response sheet.
- e. Do not make any markings on the questionnaire booklet.

3. You have been provided with two response sheets. Do NOT fill in your name on either sheet so that your responses will be anonymous. Please note that each sheet has an ID number (in the spaces labelled "Identification Number") ending with the number "1" or "2". Please use the response sheet with the ID number ending with the number "1" to respond to the first 80 items (or questions) and then answer questions 81 through 100 on the response sheet with the ID number which ends with the number "2", using the first 20 answer blocks.

4. Each response block has 10 spaces (numbered 1 through 10) or a 1-10 scale. The questionnaire items normally require a response from 1-7 only, therefore, you will rarely need to fill in a space numbered 8, 9, or 10. Questionnaire items are responded to by marking the appropriate space on the response sheet as in the following example:

Using the scale (seven descriptive statements which may reflect your opinion) below, evaluate "sample item 1."

SCALE:

- |                                |                      |
|--------------------------------|----------------------|
| 1 = Strongly disagree          | 5 = Slightly agree   |
| 2 = Moderately disagree        | 6 = Moderately agree |
| 3 = Slightly disagree          | 7 = Strongly agree   |
| 4 = Neither agree nor disagree |                      |

Sample item 1:

The guidance you receive in your job from your supervisor is frequently unclear.

[If you "moderately agree" with sample item #1, you would "blacken in" the corresponding number of that statement (moderately agree = 6) on the response sheet for item numbered "sample item 1".]

Sample response:      1 2 3 4 5 6 7 8 9 10

## THE NATURE OF THE JOB TECHNOLOGY

### Instructions

Below are 38 items (numbered 1 through 38) which relate to the nature of the tasks and work performed by you. Read each item carefully and then decide to what extent you agree with each item. Indicate the extent of your agreement by choosing the statement below which best represents your opinion and "blacken in" the corresponding number of that statement on the separate response sheet for items numbered 1 through 38.

- |                                |                      |
|--------------------------------|----------------------|
| 1 = Strongly disagree          | 5 = Slightly agree   |
| 2 = Moderately disagree        | 6 = Moderately agree |
| 3 = Slightly disagree          | 7 = Strongly agree   |
| 4 = Neither agree nor disagree |                      |

1. I do about the same job in the same way most of the time.
2. There is a great deal of variety in the work I do.
3. Regardless of the variety of work I do, the methods I use to do it are about the same.
4. Think of the different work inputs which generate work for you (e.g., requests or requirements made by a supervisor, another office worker, another work group, another organization). In my job I am able to anticipate and predict the frequency of these work inputs most of the time.
5. In my job I encounter the same kinds of problems most of the time.
6. Many jobs require the use of searching procedures (to search for information essential to accomplishing the work). The searching procedures I use in my job are very similar from one day to the next.
7. The decisions I make in my job are very dissimilar from one day to the next.
8. It is very difficult to learn enough about my job to handle all of the different problems that come up.
9. I encounter a great deal of variety in the types or kinds of tasks in my job.
10. I encounter a great deal of variety in the types of methods I use to perform my work.
11. In my job I basically perform repetitive activities from one day to the next.

- |                                |                      |
|--------------------------------|----------------------|
| 1 = Strongly disagree          | 5 = Slightly agree   |
| 2 = Moderately disagree        | 6 = Moderately agree |
| 3 = Slightly disagree          | 7 = Strongly agree   |
| 4 = Neither agree nor disagree |                      |

12. Regardless of the variety of work I do, my job is mainly concerned with routine matters.
13. In my job there is a great deal of variety in the events that cause or generate my work.
14. In my job there is a great deal of uncertainty about the appropriateness of a given procedure (method) to use in accomplishing a given task.
15. In my job it is very difficult to predict the work/tasks I'll be performing from one day to the next.
16. There is a clear and understandable sequence of steps that I follow in doing most of my work.
17. In the course of my job I frequently encounter difficult problems which I don't know how to solve immediately.
18. The majority of the problems I encounter in my job are similar from one day to the next.
19. The problems I encounter in my job are of such a nature that they require a great deal more time devoted to "thinking" (e.g., trying to define them specifically, deciding what further information is needed to identify causes and/or potential alternative solutions, etc.) than to actually acting on some solution(s).
20. The problems I encounter in my job are of such complexity that they require a great deal of consultation with others (in or outside of your work group) and/or they require a great deal of reference to written guidelines/procedures before I can act on some solution(s).
21. If, in my job, I encounter some problem that I don't know how to handle, there are others I can readily consult with who will know how to resolve it.
22. If, in my job, I encounter some problem that I don't know how to handle, there is documentation (written guidelines, procedures, etc.) I can readily consult to show me how to resolve it.
23. In some jobs things are fairly predictable. In others, you are often not sure what the outcome will be. In my job I am sure what the results of my efforts will be most of the time.

1 = Strongly disagree  
2 = Moderately disagree  
3 = Slightly disagree  
4 = Neither agree nor disagree

5 = Slightly agree  
6 = Moderately agree  
7 = Strongly agree

24. Aside from formal training (i.e., the basic prerequisite training required of all job applicants for my job), the problems I encounter in my job are of such complexity that a very long (greater than six months) on-the-job training program would be necessary to adequately prepare someone for this job.
25. The problems I encounter in my job are of such complexity that no formal training provided for this job could possibly provide me with the capability of handling most of the problems.
26. In some aspects of a job we are often able to seek solutions to problems at a reasonable pace (rather than having to respond immediately with little or no time for analysis). In my job, most of the time I am forced to respond to problems without much analysis.
27. In my job most of the work I perform can be planned ahead of time (i.e., most of my work does not appear spontaneously).
28. In general, I would describe my work as being extremely difficult and complex.
29. Some jobs are dependent upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, my job depends a great deal on someone else (or others) in my work group doing their job first.
30. Some jobs are dependent upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, my job depends a great deal on someone else (or others) in another work group(s) doing their job first.
31. Some jobs are dependent upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, the job of someone else (or others) in my work group depends a great deal on me doing my job first.
32. Some jobs are dependent upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, the job of someone else (or others) in another work group(s) depends a great deal on me doing my job first.
33. During an average week, the nature of my work is such that I interact a great deal with other members in my work group about specific aspects of my work.



- |                                |                      |
|--------------------------------|----------------------|
| 1 = Strongly disagree          | 5 = Slightly agree   |
| 2 = Moderately disagree        | 6 = Moderately agree |
| 3 = Slightly disagree          | 7 = Strongly agree   |
| 4 = Neither agree nor disagree |                      |

34. During an average week, the nature of my work is such that I interact a great deal with other members in another work group(s) about specific aspects of my work.
35. The product(s) or service(s) provided by an organization may be categorized as being custom-designed (e.g., highly individualized to meet customer specifications) or they may be fairly standard (e.g., very similar for all customers). The product(s) or service(s) my work group provides is relatively standard.
36. The product(s) or service(s) provided by an organization may be described as remaining relatively similar over time or they may change with some frequency (e.g., every year or so). The product(s) or service(s) my work group provides remains relatively the same over time.
37. As part of the process of providing a product or service, every work group within an organization is required to complete certain tasks. In my work group, the procedures and steps followed for completing our primary tasks are fairly standard and remain relatively similar over time.
38. The process (procedures used or steps taken) of providing a product or service may be fairly predictable (i.e., if you do this, that will happen) or not very predictable (i.e., you often are not sure whether something will work or not). In my work group, the process(es) followed for completing our primary tasks is very predictable.

## PERCEIVED PERFORMANCE

### Instructions

Below are seven items (numbered 39 through 45) which relate to the performance of your work group as you view it. It is important that your answers reflect a thoughtful, honest response, reflecting the actual performance in your work group as you see it. Read each item carefully and then decide to what extent you agree with the item. Indicate the extent of your agreement by choosing the statement below which best represents your opinion and "blacken in" the corresponding number of that statement on the separate response sheet for items numbered 39 through 45.

- |                                |                      |
|--------------------------------|----------------------|
| 1 = Strongly disagree          | 5 = Slightly agree   |
| 2 = Moderately disagree        | 6 = Moderately agree |
| 3 = Slightly disagree          | 7 = Strongly agree   |
| 4 = Neither agree nor disagree |                      |

With respect to the seven items that follow, the term "output" needs some clarification. Every work group member produces something in their work. "Output" refers to what each member produces. It may be a "product" or "service". But sometimes it is very difficult to identify the product or service for individual work groups or their members. Below are listed some examples of the many products or services being produced by different work groups in an organization:

- develop management information system requirements
- perform engineering assessment studies
- prepare staff papers
- develop and administer contracts
- cost analysis
- job classification
- monitor new programs
- evaluate support requirements

These are just a few examples of the things being produced in this sample organization.

Please think carefully of the things you and your work group members produce as you respond to the items below.

39. The quantity of output of your work group members is very high.
40. The quality of output of your work group members is very high.
41. Your work group members always get maximum output from the available resources (e.g., personnel, money, material).
42. Your work group members do an excellent job in anticipating problems that may come up in the future and preventing them from occurring or by minimizing their effects.

1 = Strongly disagree  
2 = Moderately disagree  
3 = Slightly disagree  
4 = Neither agree nor disagree

5 = Slightly agree  
6 = Moderately agree  
7 = Strongly agree

43. When high priority work arises (e.g., short suspenses, crash programs and schedule changes) your work group members do an excellent job in handling these situations.
44. When changes are made in the routines of your work group (e.g., the structure, the tasks performed), your work group members do an excellent job in accepting and adjusting to these.
45. Your work group's performance in comparison to similar work groups is very high.

## THE NATURE OF THE JOB CONTROL PROCESS

### Instructions

Below are 35 items (numbered 46 through 80) which relate to the manner in which your work is guided, directed, supervised and evaluated. Read each item carefully and then decide to what extent you agree with each item. Indicate the extent of your agreement by choosing the statement below which best represents your opinion and "blacken in" the corresponding number of that statement on the separate response sheet for items numbered 46 through 80.

- |                                |                      |
|--------------------------------|----------------------|
| 1 = Strongly disagree          | 5 = Slightly agree   |
| 2 = Moderately disagree        | 6 = Moderately agree |
| 3 = Slightly disagree          | 7 = Strongly agree   |
| 4 = Neither agree nor disagree |                      |

46. My immediate supervisor frequently keeps a close check on what I am doing.
47. My immediate supervisor has a great influence on what I do in a typical work week.
48. In some jobs we receive more direction and/or guidance from our immediate supervisor, in other jobs we receive more direction and/or guidance by indirect means (e.g., established policies/procedures from top management). Most of my work is guided/directed by indirect means.
49. Most of my normal, daily work activities are guided by written manuals/directives/rules which set forth the way I am to perform my job.
50. With regard to those tasks that are guided by written manuals/directives, my supervisor is very strict in requiring that I always follow them.
51. It seems as though there is a written rule for everything here.
52. Many jobs have specified standards of work performance which prescribe such things as the quantity and/or quality of work to be performed (e.g., you must produce so much at a certain rate and/or your output must meet a minimum standard of quality). In my job I am provided with very few specified standards of work performance.
53. In my work it is very difficult to get anything done when I attempt to attain every standard of work performance which apply to my tasks.
54. In order to be successful in my job, if I had my way I would significantly reduce the number of specified standards of work performance which apply to my tasks.

1 = Strongly disagree  
2 = Moderately disagree  
3 = Slightly disagree  
4 = Neither agree nor disagree

5 = Slightly agree  
6 = Moderately agree  
7 = Strongly agree

55. I get my orders from the same person all the time.
56. The direction and guidance I receive on how to perform my job is always consistent from one day to the next.
57. In my job I often find myself in a bind trying to comply with the demands of more than one person.
58. It is nearly impossible to satisfy all the different requirements of my job.
59. On my job I have more than one boss telling me what to do.
60. Many jobs have a number of different rules prescribing how to proceed with your work. Regardless of how many different rules I must follow, in my job these rules are very inconsistent with one another--i.e., two or more rules seem to conflict extensively.
61. Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. Regardless of how many different standards I must attempt to attain in my job, these standards are very inconsistent with one another--i.e., two or more standards seem to conflict extensively.
62. Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. The standards of work performance in my job are very acceptable to me.
63. Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. The standards of work performance in my job are very realistic (i.e., they are achievable yet challenging).
64. Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. In my job I feel a great deal of commitment to achieving these standards.
65. Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. If I had my way, I would make some major changes in the prescribed standards pertaining to my job.

1 = Strongly disagree  
2 = Moderately disagree  
3 = Slightly disagree  
4 = Neither agree nor disagree

5 = Slightly agree  
6 = Moderately agree  
7 = Strongly agree

66. Many jobs have a number of different rules/procedures which guide or direct how to perform the work and how to behave on the job. The rules/procedures in my job are very acceptable to me.
67. Many jobs have a number of different rules/procedures which guide or direct how to perform the work and how to behave on the job. In my job I feel a great deal of commitment to following these rules/procedures.
68. Many jobs have a number of different rules/procedures which guide or direct how to perform the work and how to behave on the job. In my job the rules/procedures are very realistic.
69. My job permits me a great deal of discretion in deciding (on my own) how to go about doing the work.
70. My job denies me any chance to use my personal initiative or judgment in carrying out the work.
71. My job gives me considerable opportunity for independence and freedom in how I do the work.
72. When I encounter a difficult/complex problem which might involve the concerns of another work group(s), I almost always go directly to the people involved without first checking with my supervisor.
73. This job allows me to make most decisions on my own.
74. This job gives me a great deal of freedom in deciding which tasks to perform.
75. This job gives me a great deal of freedom in deciding in what order to perform tasks.
76. This job gives me a great deal of freedom in determining the pace at which I work.
77. When I am being evaluated in my job, a great deal of the weight is given to objective records which show specific output of the work performed.
78. A great deal of my work is evaluated on non-output measures such as how I go about doing the job, the manner in which I approach problems, etc.
79. My immediate supervisor checks on me frequently to see how I am doing my work.
80. My immediate supervisor is much more familiar with the final outcomes (output measures of my work) than with the day-to-day manner in which I go about performing it.

## JOB SATISFACTION

### Instructions

Below are 5 items (numbered 81 through 85) which relate to the degree to which you are satisfied with various aspects of your job. Read each item carefully and choose the statement below which best represents your opinion. "Blacken in" the corresponding number of that statement on the separate response sheet for items numbered 81 through 85.

- 1 = Delighted
- 2 = Pleased
- 3 = Mostly satisfied
- 4 = Mixed (about equally satisfied and dissatisfied)
- 5 = Mostly dissatisfied
- 6 = Unhappy
- 7 = Terrible

- 81. How do you feel about your job?
- 82. How do you feel about the people you work with--your co-workers?
- 83. How do you feel about the work you do on your job--the work itself?
- 84. What is it like where you work--the physical surroundings, the hours, the amount of work you are asked to do?
- 85. How do you feel about what you have available for doing your job--I mean equipment, information, good supervision, and so on?

## BACKGROUND INFORMATION

### Instructions

Below are 15 questions (numbered 86 through 100) which concern your background. This information is needed strictly to assess the representativeness of groups according to certain characteristics and NOT to identify you as an individual. On the separate response sheet please "blacken in" the number which corresponds to your response for each question numbered 86 through 100.

86. Total years in or working for the Air Force:

1. Less than 2 years.
2. More than 2 years, less than 4 years.
3. More than 4 years, less than 6 years.
4. More than 6 years, less than 8 years.
5. More than 8 years, less than 10 years.
6. More than 10 years, less than 12 years.
7. More than 12 years, less than 14 years.
8. More than 14 years, less than 16 years.
9. More than 16 years, less than 18 years.
10. More than 18 years.

87. Total months in present career field:

1. Less than 1 year.
2. More than 1 year, less than 2 years.
3. More than 2 years, less than 3 years.
4. More than 3 years, less than 4 years.
5. More than 4 years, less than 5 years.
6. More than 5 years, less than 6 years.
7. More than 6 years, less than 7 years.
8. More than 7 years, less than 8 years.
9. More than 8 years, less than 9 years.
10. More than 9 years.

88. Total months at this station:

1. Less than 6 months.
2. More than 6 months, less than 12 months.
3. More than 12 months, less than 18 months.
4. More than 18 months, less than 24 months.
5. More than 24 months, less than 30 months.
6. More than 30 months, less than 36 months.
7. More than 36 months.

89. Total months in present organization:

1. Less than 6 months.
2. More than 6 months, less than 12 months.
3. More than 12 months, less than 18 months.
4. More than 18 months, less than 24 months.
5. More than 24 months, less than 30 months.
6. More than 30 months, less than 36 months.
7. More than 36 months.



90. Total months in present work group:

1. Less than 6 months.
2. More than 6 months, less than 12 months.
3. More than 12 months, less than 18 months.
4. More than 18 months, less than 24 months.
5. More than 24 months, less than 30 months.
6. More than 30 months, less than 36 months.
7. More than 36 months.

91. Total months in present position:

1. Less than 6 months.
2. More than 6 months, less than 12 months.
3. More than 12 months, less than 18 months.
4. More than 18 months, less than 24 months.
5. More than 24 months, less than 30 months.
6. More than 30 months, less than 36 months.
7. More than 36 months.

92. How many people are there in your work group?

- |              |                 |
|--------------|-----------------|
| 1. 3 or less | 5. 13 to 15     |
| 2. 4 to 6    | 6. 16 to 18     |
| 3. 7 to 9    | 7. more than 18 |
| 4. 10 to 12  |                 |

93. How many people do you directly supervise?

- |         |                 |
|---------|-----------------|
| 1. None | 6. 5            |
| 2. 1    | 7. 6            |
| 3. 2    | 8. 7            |
| 4. 3    | 9. 8            |
| 5. 4    | 10. more than 8 |

94. For how many people do you write performance reports?

- |         |                 |
|---------|-----------------|
| 1. None | 6. 5            |
| 2. 1    | 7. 6            |
| 3. 2    | 8. 7            |
| 4. 3    | 9. 8            |
| 5. 4    | 10. more than 8 |

95. Does your supervisor actually write your performance reports?

- |        |       |             |
|--------|-------|-------------|
| 1. Yes | 2. No | 3. Not sure |
|--------|-------|-------------|

96. Your highest education level obtained is:

1. Non-high school graduate
2. High school graduate or GED
3. Less than two years college
4. Two years or more college
5. Bachelors Degree
6. Masters Degree
7. Doctoral Degree

97. Your work requires you to work primarily:

1. Alone
2. With one or two people
3. As a small group team member (3 to 5 people)
4. As a large group team member (6 or more people)
5. Other

98. Your sex is:

1. Male
2. Female

99. You are a (an):

1. Officer
2. Airman
3. Civilian (GS)
4. Civilian (Wage Employee)
5. Non-Appropriated Fund (NAF) Employee
6. Other

100. Your grade level is:

1. 1-2
2. 3-4
3. 5-6
4. 7-8
5. 9-10
6. 11-12
7. 13-14
8. 15-16
9. Higher than 16

SELECTED BIBLIOGRAPHY

- Albanese, Robert. Managing: Toward Accountability For Performance. Homewood IL: Richard D. Irwin, Inc., 1981.
- Andrews, Frank M., and Stephen B. Withey. Social Indicators of Well-Being: Americans' Perceptions of Life Quality. New York: Plenum Press, 1976.
- Applewhite, P.B. Organizational Behavior. Englewood Cliffs NJ: Prentice Hall, 1965.
- Bartol, K. "Sex Differences in Job Orientation: A Re-Examination," Proceedings of National Academy of Management, 1974.
- Bell, Gerald D. "Determinants of Span of Control," American Journal of Sociology, 29 (1967), pp. 100-109.
- \_\_\_\_\_. "The Influence of Technological Components of Work Upon Management Control," Academy of Management Journal, 8 (1965), pp. 127-132.
- Biddle, Derek, and Geoffrey Hutton. "Toward a Tolerance Theory of Worker Adaptation," Human Relations, 29 (1976), pp. 832-862.
- Blau, Peter M. Exchange and Power in Social Life. New York: John Wiley & Sons, Inc., 1964.
- Bobbitt, H. Randolph, Jr., and Jeffrey D. Ford. "Decision-Maker Choice as a Determinant of Organizational Structure," Academy of Management Review, 5 (1980), pp. 13-23.
- Brehm, Jack W. Responses to Loss of Freedom: A Theory of Psychological Reactance. Morristown NJ: General Learning Press, 1972.
- Brief, A.P., and R.L. Oliver. "Male-Female Differences in Work Attitudes Among Retail Sales Managers," Journal of Applied Psychology, 16 (1976), pp. 526-528.
- Burns, Tom, and G.M. Stalker. The Management of Innovation. London: Tavistock Publications, 1961.
- Campbell, J.P. "Research into the Nature of Organizational Effectiveness: An Endangered Species?" Unpublished paper, University of Michigan, Ann Arbor MI, 1973.

- Child, John. "Managerial and Organizational Factors Associated with Company Performance--Part II. A Contingency Analysis," The Journal of Management Studies, 12 (1975), pp. 12-27.
- \_\_\_\_\_. "Organizational Structure and Strategies of Control: A Replication of the Aston Study," Administrative Science Quarterly, 17(1972), pp. 163-177.
- \_\_\_\_\_. and Roger Mansfield. "Technology, Size and Organization Structure," Sociology, 6(1972), pp. 369-393.
- Church, Alexander Hamilton. The Science and Practice of Management. New York: Engineering Magazine Company, 1914.
- Comstock, Donald E., and W. Richard Scott. "Technology and the Structure of Subunits: Distinguishing Individual and Workgroup Effects," Administrative Science Quarterly, 22(1977), pp. 177-202.
- Cronbach, Lee J. "Coefficient Alpha and the Internal Structure of Tests," Psychometrika, 16(1951), pp. 297-334.
- Davis, Ralph C. Industrial Organization and Management. New York: Harper and Row, 1940.
- Diemer, Hugo. Industrial Organization and Management. Chicago: LaSalle Extension University, 1915.
- Dornbusch, Sanford M., and W. Richard Scott. Evaluation and the Exercise of Authority. San Francisco: Jossey-Bass, 1975.
- Duncan, R.B. "Multiple Decision-Making Structures in Adapting to Environmental Uncertainty: The Impact on Organizational Effectiveness." Human Relations 26(1973), pp. 273-291.
- Dunnette, M.D., J.P. Campbell, and M.D. Hakel. "Factors Contributing to Job Satisfaction and Dissatisfaction in Six Occupational Groups," Organizational Behavior and Human Performance, 2(1967), pp. 143-174.
- Emery, F.E., and E.L. Trist. "Socio-Technical Systems," in F.E. Emery, ed., Systems Thinking. London: Penguin, 1969.
- Fayol, Henri. General and Industrial Management. Translated by Constance Storrs. London: Pitman Publishing Company, 1949.

- Fiedler, F.E., M.M. Chemers, and L. Mahar. Improving Leadership Effectiveness: The Leader Match Concept. New York: John Wiley & Sons, 1976.
- Ford, Jeffrey D., and John W. Slocum, Jr. "Size, Technology, Environment and the Structure of Organizations," Academy of Management Review, 2(1977), pp. 561-575.
- Ford, R.N. Motivation Through the Work Itself. New York: American Management Association, 1969.
- Galbraith, Jay R. Organizational Design. Reading MA: Addison-Wesley Publishing Company, 1977.
- Gerwin, Donald. "The Comparative Analysis of Structure and Technology: A Critical Appraisal," Academy of Management Review, 4(1979), pp. 41-51.
- Gibson, J.L., and S.M. Klein. "Employee Attitudes as a Function of Age and Length of Service: A Reconceptualization," Academy of Management Journal, 13(1970), pp. 411-425.
- Glenn, W.D., P.A. Taylor, and C.N. Weaver. "Age and Job Satisfaction Among Males and Females: A Multivariate, Multisurvey Study," Journal of Applied Psychology, 62 (1977), pp. 189-193.
- Gruneberg, Michael M. Understanding Job Satisfaction. New York: John Wiley & Sons, 1979.
- Gulowsen, J. "A Measure of Work Group Autonomy," in L.E. Davis and J.C. Taylor, eds., Design of Jobs. Middlesex, England: Penguin, 1972.
- Hackman, J.R., and E.E. Lawler. "Employee Reaction to Job Characteristics," Journal of Applied Psychology Monograph, 55(1971), pp. 259-286.
- Hackman, J.R., and G.R. Oldham. Work Redesign. The Philippines: Addison-Wesley, 1980.
- Hage, Jerald, and Michael Aiken. "Routine Technology, Social Structure, and Organization Goals," Administrative Science Quarterly, 14(1969), pp. 366-376.
- Hall, Richard H. Organizations: Structure and Process. 2d ed. Englewood Cliffs NJ: Prentice-Hall, Inc., 1977.
- Harvey, Edward. "Technology and the Structure of Organizations," American Sociological Review, 33(1968), pp. 247-259.

- Hendrix, W.H., and V.B. Halverson. Organizational Survey Assessment Package for Air Force Organizations. Air Force Human Resources Laboratory Technical Report, AFHRL-TR-78-93. Brooks AFB TX: Occupation and Manpower Research Division, Air Force Human Resources Laboratory, 1979.
- Herbst, P.G. Autonomous Group Functioning. London: Tavistock, 1962.
- Herzberg, F. Work and the Nature of Man. Cleveland: World Press, 1966.
- \_\_\_\_\_, B. Mausner, R.O. Peterson, and D.F. Capwell. Job Attitudes: Review of Research and Opinion. Pittsburgh: Psychological Services of Pittsburgh, 1957.
- \_\_\_\_\_, B. Mausner, and B. Snyderman. The Motivation to Work. New York: John Wiley & Sons, 1959.
- Hickson, David J., D.S. Pugh, and Diana C. Pheysey. "Operations Technology and Organization Structure: An Empirical Reappraisal," Administrative Science Quarterly, 14(1969), pp. 378-397.
- Hinton, B.L. "An Empirical Investigation of the Herzberg Methodology and Two-Factor Theory," Organizational Behavior and Human Performance, 3(1968), pp. 286-309.
- Holden, Paul E., Lounsbury S. Fish, and Hubert L. Smith. Top-Management Organization and Control. Stanford CA: Stanford University Press, 1941.
- Hoppock, R. Job Satisfaction. New York: Harper and Row, 1935.
- Hrebiniak, Lawrence G. "Job Technology, Supervision, and Work-Group Structure," Administrative Science Quarterly, 19(1974), pp. 395-410.
- Hulin, C.L. "Individual Differences and Job Enrichment," in J.R. Maher, ed., New Perspectives in Job Enrichment. New York: Van Nostrand-Reinhold, 1971.
- \_\_\_\_\_. "Job Satisfaction and Turnover in a Female Clerical Population," Journal of Applied Psychology, 50(1966), pp. 280-285.
- \_\_\_\_\_ and M.R. Blood. "Job Enlargement, Individual Differences, and Worker Responses," Psychological Bulletin, 69(1968), pp. 41-65.

- \_\_\_\_\_ and P.C. Smith. "A Linear Model of Job Satisfaction," Journal of Applied Psychology, 49(1965), pp. 209-216.
- Hunt, J.W., and P.N. Saul. "The Relationship of Age, Tenure, and Job Satisfaction in Males and Females," Academy of Management Journal, 18(1975), pp. 690-702.
- Hunt, Raymond G. "On the Work Itself: Observations Concerning Relations Between Tasks and Organizational Processes," in Eric Miller, ed., Task and Organization. London: Wiley, 1976.
- \_\_\_\_\_ and Janet P. Near. "On the Technology Connection: Conceptual and Empirical Choice Points." Working paper. State University of New York, Buffalo NY, 1980.
- Kast, Fremont E., and James E. Rosenzweig. Organization and Management. 3d ed. New York: McGraw-Hill Book Company, 1979.
- Khandwalla, Pradip N. "Mass Output Orientation of Operations Technology and Organizational Structure," Administrative Science Quarterly, 19(1974), pp. 74-97.
- King, N. "A Clarification and Evaluation of the Two-Factor Theory of Job Satisfaction," Psychological Bulletin, 74 (1970), pp. 18-31.
- Klein, S.M. and J.R. Maher. "Educational Level and Satisfaction with Pay," Personnel Psychology, 19(1966), pp. 195-208.
- Korman, A.K. Organizational Behavior. Englewood Cliffs NJ: Prentice-Hall, 1977.
- Kovach, K.A. Organization Size, Job Satisfaction, Absenteeism and Turnover. Washington D.C.: University Press of America, 1977.
- Lawler, E.E. "Measuring the Psychological Quality of Working Life: The Why and the How of It," in L.E. Davis and A.B. Clerns, eds., The Quality of Working Life. New York: Free Press, 1975, pp. 123-133.
- Lawrence, Paul R., and Jay W. Lorsch. Organization and the Environment. Boston: Graduate School of Business, Harvard University, 1967.
- Locke, E.A., and D.M. Schweiger. "Participation in Decision-Making: One More Look," in B.M. Shaw, ed., Research in Organizational Behavior. Greenwich CN: JAI Press, 1979.



Lynch, Beverly P. "An Empirical Assessment of Perrow's Technology Construct," Administrative Science Quarterly, 19(1974), pp. 338-356.

\_\_\_\_\_. "Library Technology: A Comparison of the Work of Functional Departments in Academic Libraries." Unpublished doctoral dissertation, University of Wisconsin, Madison WI, 1972.

Manhardt, P.J. "Job Orientation of Male and Female College Graduates in Business," Personnel Psychology, 25(1972), pp. 361-368.

March, James G., and Herbert A. Simon. Organizations. New York: John Wiley & Sons, 1958.

McClave, J.T., and P.G. Benson. Statistics for Business and Economics. San Francisco: Dellen Publishing Co., 1979.

Mohr, Lawrence B. "Organizational Technology and Organizational Structure," Administrative Science Quarterly, 16 (1971), pp. 444-459.

Mott, P.E. The Characteristics of Effective Organizations. New York: Harper and Row, 1972.

Near, J.P. "Managerial Choice of Control Processes." Unpublished report, Indiana University, Bloomington IN, 1982.

Nie, Norman H., C. Hadlai Hull, Jean G. Jenkins, Karin Steinbrenner, and Dale H. Bent. SPSS: Statistical Package for the Social Sciences. New York: McGraw-Hill Book Company, 1975.

Nunnally, Jum C. Psychometric Theory. New York: McGraw-Hill Book Company, 1967.

Oldham, G.R. "Job Characteristics and Internal Motivation: The Moderating Effect of Interpersonal and Individual Variables," Human Relations, 29(1976), pp. 559-569.

Ouchi, William G. "The Relationship Between Organizational Structure and Organizational Control," Administrative Science Quarterly, 22(1977), pp. 95-113.

\_\_\_\_\_. "The Transmission of Control Through Organizational Hierarchy," Academy of Management Journal, 21(1978), pp. 173-192.

\_\_\_\_\_ and Mary Ann Maguire. "Organizational Control: Two Functions," Administrative Science Quarterly, 20(1975), pp. 559-569.

- Ovalle, N.K. "Organizational Technology, Control, and Performance: A Study of the Relationships at the Subunit Level." Unpublished doctoral dissertation. Graduate School of Business, Indiana University, Bloomington IN, 1981.
- Overton, Peggy, Rodney Schneck, and C.B. Hazlett. "An Empirical Study of the Technology of Nursing Subunits," Administrative Science Quarterly, 22(1977), pp. 203-219.
- Perrow, Charles. "A Framework for the Comparative Analysis of Organizations," American Sociological Review, 32 (1967), pp. 194-208.
- Porter, L.W., and R.M. Steers. "Organizational, Work, and Personal Factors in Employee Turnover and Absenteeism," Psychology Bulletin, 80(1973), pp. 151-176.
- Pugh, D.S., D.J. Hickson, C.R. Hinings, and C. Turner. "The Context of Organization Structure," Administrative Science Quarterly, 14(1969), pp. 91-114.
- Pugh, D.S., D.J. Hickson, and C. Turner. "Dimensions of Organization Structure," Administrative Science Quarterly, 13(1968), pp. 65-105.
- Reeves, T., and J. Woodward. "The Study of Managerial Controls," in J. Woodward, ed., Industrial Organization: Behavior and Control. London: Oxford Press, 1970.
- Reimann, B.C. "Organization Structure and Technology in Manufacturing: System Versus Work Flow Level Perspectives," Academy of Management Journal, 23(1980), pp. 61-77.
- Roethlisberger, F.J., and W.J. Dickson. Management and the Worker. Cambridge MA: Harvard University Press, 1939.
- Scott, William G., and Terence R. Mitchell. Organization Theory: A Structural and Behavioral Analysis. 3d ed. Homewood IL: Richard D. Irwin, Inc., 1976.
- Simon, Herbert A. Administrative Behavior. 3d ed. New York: Macmillan Publishing Company, Inc., 1976.
- Skinner, B.F. Beyond Freedom and Dignity. New York: Alfred A. Knopf, Inc., 1971.
- Slocum, J.W., Jr., and H.P. Sims, Jr. "A Typology for Integrating Technology, Organization, and Job Design," Human Relations, 33(1980), pp. 193-212.

- Stanfield, Gary G. "Technology and Organization Structure as Theoretical Categories," Administrative Science Quarterly, 21(1976), pp. 489-493.
- Susman, G.I. Autonomy at Work: A Sociotechnical Analysis of Participative Management. New York: Praeger, 1976.
- Tannenbaum, Arnold S. Control in Organizations. New York: McGraw-Hill Book Company, 1968.
- \_\_\_\_\_. Hierarchy in Organizations. San Francisco: Jossey-Bass, 1974.
- Taylor, F.W. The Principles of Scientific Management. New York: Harper and Row, 1911.
- Thompson, James D. Organizations in Action. New York: McGraw-Hill Book Company, 1967.
- \_\_\_\_\_ and Frederick L. Bates. "Technology, Organization, and Administration," Administrative Science Quarterly, 2(1957), pp. 325-343.
- Trist, E.L., and K.W. Bamforth. "Some Social and Psychological Consequences of the Longwall Method of Goal-Setting," Human Relations, 4(1951), pp. 3-38.
- Trist, E.L., G.W. Higgins, H. Murray and A.B. Pollock. Organizational Choice. London: Tavistock, 1963.
- Turner, A.N., and P.R. Lawrence. Industrial Jobs and the Worker. Cambridge MA: Harvard University Press, 1965.
- Van de Ven, A.H., and A.L. Delbecq. "A Task Contingent Model for Work-Unit Structure," Administrative Science Quarterly, 19(1974), pp. 183-197.
- Vollmer, H.M., and J.A. Kinney. "Age, Education, and Job Satisfaction," Personnel, 32(1955), pp. 38-43.
- Vroom, V.H. Work and Motivation. New York: John Wiley & Sons, 1964.
- Walker, Charles, and Robert Guest. The Man on the Assembly Line. Cambridge MA: Harvard University Press, 1952.
- Webb, R.J. "Organizational Effectiveness and the Voluntary Organization," Academy of Management Journal, 17(1974), pp. 663-677.

Woodward, Joan. Industrial Organization: Behavior and Control. London: Oxford University Press, 1970.

\_\_\_\_\_. Industrial Organization: Theory and Practice.  
London: Oxford University Press, 1965.

Zwerman, William L. New Perspectives on Organization Theory.  
Westport CN: Greenwood Publishing Company, 1970.