

DEVELOPMENT OF AN EFFICIENCY CRITERION
FOR ADMINISTERING INCENTIVES TO
ENGINEERS AND SCIENTISTS

BY

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PREFACE

Management has attempted to induce motivated behavior in employees in a number of ways. Some methods have been more successful than others; some methods apply in general; some methods are restricted to special work situations. Regardless of the effectiveness of the various methods, very little can be claimed for their efficiency. This is largely because the utility of alternative strategies is not known before they are applied.

This study is concerned with developing a method for estimating the effectiveness and efficiency of various motivation strategies before their application. Specifically, a criterion is developed which enables management to formulate policies for the efficient administration of incentives to engineers and scientists. The basic approach is easily extended to apply to employee categories other than engineers and scientists.

The concept of composite desirability is developed to estimate effectiveness, and the change in composite desirability with employees over time is used to estimate efficiency. Measures of relative desirability for available

intrinsic inducements are obtained by a modified Q-sort technique.

As an experienced engineer, I have become accustomed to working with rather precise data, definite constraints, and applicable mathematical expressions. During the preparation of this thesis I have been introduced to the world of the behavioral scientist. At times it has been frustrating, but I feel that the experience has broadened my understanding of an area important to both "hard" and "soft" sciences.

The limited success that I have had in bridging the gap between the hard and soft sciences would not have been realized if it were not for the encouragement and guidance of a number of people. Foremost in this respect is Dr. Earl J. Ferguson, Chairman of my advisory committee. If it were not for Dr. Ferguson's desire to broaden the perspective of engineers, a study of this nature would have found little support in a Department of Industrial Engineering. I also am indebted to Dr. Ferguson for financial assistance to continue my studies in the form of a Graduate Assistantship, a Graduate Excellence Award, and subsequently, a part-time Instructorship.

I also wish to recognize the contributions made to my studies and research by the remaining members of my advisory committee; Dr. Kent Mingo, Dr. James E. Shamblin, and Dr.

Thomas B. Auer. Each of these members has served as a patient sounding board for many irrelevant ideas. I especially want to thank Dr. Mingo for his sincere interest and valuable counseling throughout the preparation of this thesis.

Special appreciation is extended to Dr. George C. Bucher, Deputy Associate Director for Science at NASA's George C. Marshall Space Flight Center, and Adjunct Associate Professor at the University of Alabama, Huntsville. Dr. Bucher introduced me to the study of motivation while I was a student of his at the University of Alabama. Throughout the remainder of my graduate studies and during the preparation of this thesis Dr. Bucher's suggestions and criticisms have significantly influenced my thinking, perhaps more than he realizes.

I am sincerely grateful to my wife, Bobbi, and to our children, Lindi, Rustin, Tambi, and Staci for their understanding and sacrifices during the past two years. With the culmination of my graduate studies, perhaps our children will once again have two parents instead of one.

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CHAPTER I

INTRODUCTION

Definition of Problem

Persuading members of an organization to adopt the organization's performance standards can be a very difficult task. The most challenging aspect of this problem for management is to achieve consistency between the personal aspirations of the members and the goals of the organization. The obvious (and simplistic) solution to this problem relates to the concept of motivation. This solution is simplistic because, although conceptually strong, it is operationally weak. Motivation is a vital aspect of management philosophy, yet the operational effectiveness of various strategies is not assured and their efficiency is virtually unknown.

All motivation theories are concerned with administering incentives of an objective or subjective nature. The nature and extent of the incentive varies with the employee, the organization, and the desired result. The effectiveness of a particular motivation strategy can be viewed in the

context of a break-even analysis of benefits versus burdens. To be effective for the employee and for the organization, the perceived benefits must be greater than the perceived burdens.

Effectiveness is not particularly difficult to measure although it does require a trial and error approach. If a motivation strategy produces the desired results in performance - it is effective. This in no way guarantees efficiency. In fact, the manner in which the degree of effectiveness is determined inherently leads to inefficiency.

In practice, managers must select bits and pieces of various motivation theories in an attempt to develop a strategy that "fits" their particular situation. The methods used in the development and implementation of these strategies are non-standard at best. Standardization is not a prerequisite for successful motivation strategies; however, the adoption of certain fundamental concepts or approaches would, in the writer's opinion, significantly increase the objective rationality of motivation strategies. Further, it is postulated that increased objective rationality in strategy development would enable the implementation of motivation theories with greater effectiveness and efficiency.

The operational weakness of current motivation strategies provides the impetus for this study. The objective of this study is to develop a fundamental criterion for the efficient administration of incentives to engineering and scientific personnel employed in a prescribed work environment.

It is recognized that there are differences in the motivational characteristics of engineers and scientists as a "type" or categorical grouping of personnel, and there are differences between the members within each subgroup. These differences can be very important and must be recognized during the actual implementation of any motivation strategy. However, these intercategory and intracategory differences represent one stage of refinement beyond that of interest in this study. It is also recognized that many of the concepts presented in this study are applicable to the development of an efficiency criterion for administering incentives to categories of personnel other than engineers and scientists. These similarities in motivational characteristics with other categories of personnel represent one stage of refinement below that of interest in this study.

To fulfill the overall objective of this study several specific subordinate objectives must be met:

1. Establish a philosophy of motivation for engineering

and scientific personnel including a precise delineation of the relative importance of organizationally derived (intrinsic) inducements.

2. Define the dimensions of complex organizations functioning in dynamic equilibrium with their environment and express these dimensions in terms of available intrinsic inducements.
3. Formulate the relationships between desirability and intrinsic inducements (potential incentives), wherein the magnitudes and durations of desirability are explicitly defined.

Statement of Hypotheses

There is a central global hypothesis for this study and several supportive global hypotheses. Each global hypothesis is based on a number of operational hypotheses. To facilitate subsequent referral, each global hypothesis is denoted with an H and a sequence number. Each operational hypothesis is denoted with an A, B, C, or D. In the listing of all hypotheses provided below, H-1 denotes the central global hypothesis for this study.

H-1

If a policy for administering incentives to employees is

to be effective and efficient, it must explicitly account for the effects of the magnitude and duration of an employee's desirability for intrinsic inducements.

- A. Management should emphasize the assessment of an employee's desirability for intrinsic inducements rather than the degree of satisfaction derived from receipt of the inducements.
- B. Management needs to reduce their reliance on ideological theories of human behavior and reemphasize leadership qualities to build mutual trust and understanding with employees.
- C. The ability to formulate motivation strategies which are viable for future implementation is critical to the effective and efficient administration of incentives.

H-2

Management seeks to provide a variety of intrinsic inducements in sufficient quantities to maintain a positive (but undefined) state of satisfaction among employees subject to the constraints of organizational equilibrium.

- A. With respect to evaluating motivation theories and techniques, management is primarily concerned with assessing measures of employee satisfaction.

- B. If an industrial organization is to survive, it must maintain equilibrium with its total environment. This requires the adoption of an equilibrium strategy which will largely determine the variety and magnitude of available intrinsic inducements.

H-3

The systems approach provides a viable construct for formulating an equilibrium strategy for industrial organizations.

- A. Successful implementation of the systems approach will be enhanced by adopting behavioral science philosophies.
- B. Adoption of the systems approach will necessitate structural modifications to the organization in order that functional modifications can be implemented. These modifications are compatible with project management philosophies.
- C. The nature of structural and functional modifications can be assessed by identifying the dimensions of an organization. That is, knowledge of the dimensions of an organization provides insight on its structure and management philosophies, which

in turn, provides insight on the variety of available intrinsic inducements.

- D. The dimensions of systems oriented organizations reflect intrinsic inducements which are indicative of those highly desired by engineers and scientists.

H-4

Composite desirability for intrinsic inducements is a viable efficiency criterion for administering incentives to employees.

- A. An employee's desirability for intrinsic inducements will change with the passage of time. This is evidenced by a change in the desirability for individual intrinsic inducements and by a change in composite (total) desirability for all inducements.
- B. Employees tend to seek combinations of intrinsic inducements which maximize their composite desirability. That is, an employee's composite desirability is dependent upon the relative desirability that he holds for individual intrinsic inducements.
- C. Those intrinsic inducements which engineers and scientists desire the most are not necessarily

equally desired by other categories of employees.

The extent to which the findings of this study verify stated hypotheses is discussed in the Implications Section of Chapters II through V and at the end of Appendix A.

Organization of Thesis

The Introduction presents the problem in broad terms, indicates an approach to the solution, and states the hypotheses for the study. Chapter II contains a comprehensive examination of pertinent literature on motivation theory and techniques, the systems concept, and organizational analysis methodology. Development of the theoretical basis for the study is extended in Chapter III with a discussion of critical factors which challenge management's existing philosophies on motivation and organization. Emphasis is placed on evaluating the relevance of traditional motivation theories, on the cognitive aspects of implementing change, and on the relationships between behavioral science and systems concepts.

The approach taken in this study for identifying the dimensions of complex organizations is presented in Chapter IV. In addition, an explanation of the test instrument and interpretation of results is given. Chapter V contains the development of a measure of composite desirability. This

constitutes the development of a conceptual framework, a theoretical formulation, an empirical approach, and analysis of results. The thesis is completed in Chapter VI with a brief summary of overall results and a statement of conclusions and recommendations.

CHAPTER II

DETAILED EXAMINATION OF THE LITERATURE

Motivation Theories and Techniques

A comprehensive application oriented summary of existing motivation theories and techniques, with emphasis on engineers and scientists, is given by Bucher and Gray (1). The bulk of the information presented in this section is based on that summary.

Psychologically Based Theories

The realization that man's behavior is governed to a great extent by his needs or desires is evidenced throughout recorded history. Classifications of needs and interpretations of their effects on man have changed with time, however the acknowledgement of their importance has not. The following quotation is a modern translation from the Greek philosopher, Aristotle, 384-322 B.C. (2).

All men seek one goal: success or happiness. The only way to achieve true success is to express yourself completely in service to society. First, have a clear, practical ideal - a goal, an objective. Second, have the necessary means to achieve your ends - wisdom, money, materials, and methods.

Third, adjust your means to that end.

Almost all early attempts to explain behavior made use of the animistic concept of soul. This is a doctrine wherein the soul is considered the vital principle of organic development. Descartes, 1596-1650, was perhaps the first philosopher to question this concept (3). He considered animals to possess fluid spirits which rushed through their nerves and acted as stimuli. However, for the case of humans, Descartes could not disregard the concept of soul. Thus, he postulated two radically different motivation theories - one for animals and one for humans.

With the influence of Darwin's theories as presented in his books, The Origin of Species (1859), and Expression of Emotions in Man and Animals (1872), Descartes' hypothesis was discarded (3). This resulted from Darwin's belief that there is a physiological and behavioral continuity between animal and human species.

As more biological concepts were related to Darwin's theories, the animistic soul concept was completely replaced by the instinct doctrine. This was not the first appearance of instinct, however. In fact, the instinct doctrine can be traced back to the Stoic philosophers of the first century A.D. (4). Even though the concept was ancient it was not until 1908 that a strong movement for this theory

of behavior was initiated in the United States. The primary instincts were escape, combat; repulsion, parental, appearance, mating, curiosity, submission, assertion, gregariousness, food seeking, acquisition, construction, and laughter (4).

By the early 1920's the instinct doctrine began to lose favor to a doctrine based on drives. By consensus of researchers associated with this doctrine, the primary drives were hunger, sex, thirst, and pain. This doctrine proposed that 1) an individual acts only to reduce his drives, 2) actions that reduce drives are strengthened, and 3) drive reduction is a necessary condition for learning (3).

The premise that an individual acts only to reduce a drive was severely criticized; however, these and subsequent attacks against the drive doctrine were partially repelled by combining the concept of motives with drives. In this manner, motivated behavior was defined to result from coordinated (rather than random) responses. Although this modified drive theory enabled a distinction between behavior and motivated behavior, it left much to be desired. Specifically, it provided nothing tangible that management could use to formulate techniques for inducing desired employee behavior. The next step in the evolution of motivation theory was to define a systematic relationship between the

various needs of employees.

The Hierarchy of Needs

In the early 1940's, A.H. Maslow (5), a personality theorist and clinical psychologist, began the development of a theory of motivation that has become widely accepted in management literature. In practice, this theory provides a useful framework for understanding an individual's motivation to work. Maslow's theory led to the establishment of basic propositions from which the well known need-hierarchy concept of human motivation was formulated. In this concept higher needs are activated as lower ones are satisfied. It is based on the premise that once satisfied, a need no longer acts as a primary motivator, and that upon failing to satisfy a need, an individual automatically concentrates on the next lower need in the hierarchy. A brief discussion of these needs, starting with the lowest in the hierarchy, follows:

Physiological needs are defined in terms of the basic requirements for food, rest, exercise, shelter, and protection from the elements.

Safety needs relate to protection against danger, threat, or deprivation.

Belongingness and love needs are manifest in man's

needs for association, for acceptance by his associates, and for giving and receiving friendship and love.

Esteem needs relate to an individual's self-esteem; i.e., self-confidence, independence, achievement, competence and knowledge or to an individual's reputation; i.e., status, recognition, appreciation, and respect from fellow employees.

Self-actualization needs occupy the highest position in Maslow's hierarchy. Simply stated, these needs are for realization of one's potential, for continued self-development, and for being creative in the broadest sense.

Obviously man cannot completely separate and isolate his needs. Maslow suggests that the levels of needs are interdependent and overlapping, with the higher-need level emerging before the lower-need levels have been completely satisfied. To illustrate these points, Maslow pictured the average working adult as 85 percent satisfied in his physiological needs, 70 percent satisfied in his safety needs, 50 percent satisfied in his belongingness needs, 40 percent satisfied in his egoistic needs, and 10 percent satisfied in his self-fulfillment needs.

In addition, Maslow suggests that several additional needs should be considered for the specific case of scientifically oriented employees. Based primarily on observations, he identified the additional needs as; understanding

(philosophical, theological), sheer knowledge (curoosity), and aesthetic (beauty, symmetry, simplicity, and order). Thus, the scientifically oriented individual has the same needs as an average working adult plus some cognitive and aesthetic needs associated with his basic makeup, formal training, and job requirements.

Theory X and Theory Y

Any review of motivation theories and techniques that did not mention Douglas McGregor's (6) theories on human nature and motivation would surely be incomplete. These theories are simply denoted Theory X and Theory Y. Theory X is based on McGregor's interpretation of management's classical approaches and policies. By contrast, McGregor's Theory Y is based on management by objectives and subscribes to Maslow's hierarchy of needs.

The application of Theory X and Theory Y can be illustrated by two well known approaches to motivation (7). The "be strong" approach is the traditional answer to motivation in industry. This approach emphasizes authority and subscribes to the philosophy of Theory X. "Be strong" can be effective under conditions where a minimal work effort is acceptable; however, it creates no incentive for increased work and it ignores the importance of higher order needs.

An approach to motivation which illustrates the principles of Theory Y and supports Maslow's hierarchy of needs is denoted "internalized motivation". This approach emphasizes through-the-job satisfaction and de-emphasizes off-the-job and around-the-job needs satisfaction. Specifically, the needs that a policy of "internalized motivation" seeks to satisfy are: skill, autonomy, achievement, understanding, praise, acceptance, attention, self-confidence, and knowledge of where one stands with respect to one's expectations and requirements.

Theory Z

In the above discussion, reference was made to "internalized motivation" as a specific approach which attempts to operationalize Theory Y. Many of the objectives underlying "internalized motivation" have been incorporated into a new theory on motivation proposed by Urwick (8). This theory, Theory Z, was not formulated as a gross substitution for Theories X and Y but rather as a modern synthesis of the two dichotomous ideologies inherent in Theories X and Y.

Theory Z reflects the superimposition of the behavioral considerations of Theory Y on the classical management philosophies of Theory X. It accepts the doctrine of "Economic Man" as an observed fact, however, it asserts that this

characteristic is not an inherent behavioral trait of man, but rather a manifestation of the industrial work environment (9). In this respect Theory Z is directed to an exploitation of the underlying causes, not the visible effects of employee behavior.

Urwick professes that a major difficulty associated with McGregor's theories lie in their common statement of management's economic guidelines. This raises two questions. What are the economic guidelines? How are they determined? Urwick's response is that the economic process of the organization must be based on the relationships between individual producer and consumer economics in the work environment. That is, the altruistic qualities present in Theory Y-people can be aligned with organizational goals only if two conditions are met (8):

- i. Each individual must know clearly what those goals are and how his/her particular tasks contributes to them.
- ii. Each individual must be confident that in contributing to those goals he/she will satisfy his/her individual needs at the various levels in the hierarchy of needs, already quoted, and that none of those needs are threatened or frustrated by membership of the institution.

The realization of these conditions requires that management break the shackles which bind them to ideological theories of behavior. Instead, management must diligently

go about the task of creating technological, sociological, and psychological conditions which will allow the inherent potentialities of employees to be realized. Paralleling this effort, management must attempt to improve the quality and quantity of communications with employees so that an attitude of mutual understanding and trust can be developed in the work environment.

Industrial Surveys on Motivating Factors

A number of surveys to identify the factors affecting the performance of engineering and scientific personnel were conducted in the late 1950's and early 1960's. Results from these surveys help establish the practical significance of motivation theories and provide information that can be used for developing useful management policies and practices.

Pelz and Andrews

Over a period of years from 1951 to 1960, Donald Pelz and Frank Andrews (10) interviewed over 1300 scientists and engineers in 11 different organizations. This study group was comprised of personnel from private industry, government agencies, and universities. The guiding question for this study was - What constitutes a stimulating atmosphere for research and development?

The period from 1960 to 1965 was spent in analyzing the data and testing interpretations of emerging theories on a variety of technical audiences. The overall results of the study can be summarized in five statements.

1. Effective scientists are self-directed and value freedom on the job. However, they desire the opinions of management and colleagues in shaping the direction of their work.
2. Effective scientists maintain an interest in both pure and applied work.
3. The interests of effective scientists are not fully in agreement with organizational goals.
4. As a group, effective scientists are motivated by the same factors; however, there is considerable difference in the styles and strategies with which they approach their work.
5. Members of effective work groups prefer each other as collaborators, although they maintain individuality on technical strategies.

Herzberg and Myers

In the interval from 1954 to 1958, Frederick Herzberg (11) and his associates at the Psychological Service of Pittsburg interviewed approximately 200 engineering and

accounting personnel employed in industrial firms in and around the Pittsburg area. The primary purpose of the study was to gain insight into the relationship between job attitude and performance. Engineers and accountants were selected as the study group because Herzberg felt that the nature of their work was rich in technique and would enable participants to give vivid accounts of their experiences.

Information was gained by asking each individual to discuss a time when he felt exceptionally good or exceptionally bad about his job. Each response was analyzed to identify the factor (or factors) that was the source of the respondents feelings. Results clearly showed that achievement, recognition, work itself, responsibility, advancement, and growth (in that order) were the primary factors causing satisfaction on the job.

The last industrial survey to be summarized is that conducted by M. Scott Myers (12) at Texas Instruments in the early 1960's. Myers set out to determine: 1) What motivates employees to work effectively? 2) What dissatisfies workers? 3) When do workers become dissatisfied? This study was initiated from the knowledge of Herzberg's earlier work and was conducted using the same interview techniques.

Myer's results are particularly informative because he surveyed a much more diversified group of workers than did

Herzberg. Included in his survey group of 282 Texas Instruments employees were three salaried job classifications (engineer, scientists, and manufacturing supervisor) and two hourly classifications (technician and assembler, including 52 female assemblers). This enables a direct comparison of the attitudes of professionals and several types or categories of non-professionals toward their work when influenced by basically the same organizational environment.

Following the techniques of Herzberg, Myers identified 14 first level factors. A comparison of the relative importance of 10 of these factors to engineers, scientists, technicians, and assembly workers is shown in Table I. These data indicate the percent of total satisfaction derived from each factor.

The Systems Approach

The term "systems approach" represents a rather nebulous concept that can have different meanings for different people. In its most general connotation, the "systems approach" embodies both integrative and coordinative concepts (13). It implies a completeness of thought and action in which all things are combined into an entity. Further, it requires that the method of combination be such to assure that a coordinated (as opposed to an arranged, classified,

TABLE I
 COMPARISON OF FIRST-LEVEL FACTORS
 BETWEEN FOUR EMPLOYEE
 CLASSIFICATIONS*

First-Level Factor	Total Satisfaction (%)			
	SC	EN	TE	AW
Achievement	50	50	48	55
Recognition	13	9	15	24
Advancement	11	12	7	0
Responsibility	9	8	13	0
Work Itself	9	6	3	5
Competence of Supervision	3	3	4	5
Company Policy and Administration	5	6	4	0
Pay	0	6	6	3
Security	0	0	0	3
Friendly Supervision	0	0	0	5

* Scientists (SC) Technicians (TE)
 Engineers (EN) Assembly Workers (AW)

or randomized) entity results.

In this study, the "systems approach" is restricted to the integrative and coordinative concepts associated with problems arising in an industrial work environment. With this limited meaning, the "systems approach" is often described as having evolved from the much more limited but familiar concept of "integrated data processing". In addition, the "systems approach" has been used as a synonym for "consolidated functions approach", a "unified approach", and even a "real-time system".

The following definition for the "systems concept" by E. E. Dickey is considered representative of the literature by Spalding (14):

An approach to information system design that conceives the business enterprise as an entity composed of interdependent systems and subsystems, which, with the use of automatic data processing systems, attempts to provide optimum management decision making.

Thus, the "systems approach" stresses integration of associated systems and functions within an organization for the purpose of analyzing a problem and formulating a solution in the broadest possible context. The approach is all encompassing in that it attempts to transform the multidisciplined complex industrial organization into an integrated entity.

Systems personnel are not in general agreement on the relative importance of characteristics of such an entity.

Wendler (15) surveyed 110 persons considered knowledgeable in systems in an attempt to define the most important characteristics of the systems concept. Recipients of questionnaires were asked to rank nine stated characteristics and to indicate five characteristics which they considered of major significance to the systems approach. The results of Wendler's survey are summarized in Table II.

The extent to which an individual agrees or disagrees with the results of the survey is most likely a reflection of his experience in various organizational situations. That is, an individual will tend to emphasize those characteristics which have a direct relationship to problems that he may have encountered or is encountering.

Rational for Analyzing Organizations

For the purpose of this study, the analysis of organizations concerns a search for basic dimensions which "measure" the structural attributes of the organization under a prescribed equilibrium strategy; i.e., a systems approach (hypothesis H-3). A review of the literature reveals that two basic approaches have been used in an attempt to identify organizational dimensions. The basic techniques and significant results that have been obtained from each of these approaches will be examined in brief.

TABLE II
SUMMARY OF SYSTEMS CONCEPT CHARACTERISTICS

Characteristics	Major Significance
The system provides timely and accurate management planning and control information to facilitate the attainment of the company's objectives.	85%
The system generates information needed to fulfill the company's operating, legal, governmental, and financial requirements in the most effective manner.	77%
The various systems (or subsystems) are interlocked to attain a total system.	77%
The system is all encompassing - the company is viewed as an integrated entity.	68%
Integrated data processing techniques are employed in designing systems.	65%
The system is based on uniform identification and classification of data elements throughout the company.	57%
Management by exception is employed.	29%
The system is automated by computer.	27%
Data are analyzed by scientific methods.	17%

A Classificatory Scheme

Pioneering work in classifying organizations by their structural characteristics has been done at the University of Aston in Birmingham, England by Pugh (et al.) (16) (17) (18). Basic data were obtained during the early 1960's from 52 organizations in the Birmingham area of the English Midlands. In the initial study (16), five structural characteristics of organizations were analyzed; i.e., specialization, standardization, formalization, centralization, and configuration. These attributes were selected for analysis based on a heuristic interpretation of the literature on organizations. Using a factor analytic technique, in which 64 component variables were measured, it was possible to identify three operational dimensions from the data (16):

1. Structuring of activities - the degree to which the intended behavior of employees is overtly defined by task specialization, standard routines, and formal paper work.
2. Concentration of authority - the degree to which authority for decisions rests in controlling units outside the organization and is centralized at the higher hierarchial levels within it.
3. Line control of workflow - the degree to which control is exercised by line personnel instead of by

means of impersonal procedures.

To determine the relative significance of these dimensions, all organizations in the study were placed into five groups primarily on the basis of charter or function. These organizational groups were government manufacturing, corporate manufacturing, family manufacturing, public service, and family retail.

All organizations were then scored against the empirically derived dimensions and profiles were constructed within each organizational grouping. The results clearly show that (17): dimension one is dominant in corporate manufacturing firms and significant in government manufacturing organizations; dimension two is dominant in public service and government manufacturing organizations; and dimension three is dominant in family retail firms and significant in family manufacturing and public service organizations.

The utility of this approach is twofold. First, it represents a systematic method for classifying and comparing organizations in terms of common structural attributes. Second, the inherent factor analytic technique provides a means by which the underlying causal relationships can be examined. To illustrate the latter point, the results of Pugh indicate that certain types or classifications of organizations can be characterized by specific constructural

variables, denoted dimensions. The question is - why? What causes one type of organization to be predominantly of one dimension and another organization to be predominantly of another dimension? This problem is analogous to that of the psychologist who analyzes behavior in order to establish the dimensions of personality.

Pugh denoted these unknown causal variables to be the contextual factors which give meaning to the various dimensions that characterize organizations. It was found that the contextual factors were: origin and history; ownership and control; size; charter; technology; location; resources; and dependence on other organizations.

Upon performing product-moment correlations between the contextual factors and the structural dimensions, the following primary relationships were noted (18):

1. The size of an organization is a primary predictor for structuring of activities. As size increases so does the need for implementing formalized procedures for conduct and operations.
2. The amount of dependence on other organizations is a positive predictor for concentration of authority.
3. The dominance of external constraints creates the necessity for centralized decision making bodies.
4. The extent of integrated technology is a negative

predictor for line control of workflow. As the requirements for coordination of highly specialized tasks increase so does the need for administrative control, as opposed to line control.

A Survey Measurement Scheme

The second work of importance to the immediate study was accomplished by Hemphill and Westie at Ohio State University in the late 1940's. The work of these men was initiated with an investigation of situational factors pertaining to leadership. From this initial study, a tentative set of dimensions for the description of group differences was formulated.

In 1950, Hemphill and Westie (19) published an account of the development of a questionnaire designed to identify these dimensions. This prompted other researchers to work in this area, and by 1956 at least six separate group dimension studies had been undertaken.

Relying heavily on initial research conducted with Westie, Hemphill (20) prepared a comprehensive set of instructions for measuring and evaluating group dimensions. It was intended that the resulting research methodology serve two purposes; first, to provide a means by which data can be acquired to test hypotheses on group characteristics,

and second, to enable practitioners to gain insight into the nature and extent of morale and integrity within operating groups.

Implications

With respect to motivation theories, techniques, and results of industrial surveys on motivating factors, the following can be concluded:

1. A number of theories on human behavior have evolved, however, none have been universally accepted. Urwick's synthesis of McGregor's earlier work appears to offer a construct for developing motivation theories that minimize reliance on ideological theories of behavior (see H-1-B).
2. Attempts to identify intrinsic motivating factors have been based on industrial surveys of selected employee classifications. Surveys were conducted to reveal the extent of satisfaction or dissatisfaction that employees derived from receipt of intrinsic inducements. Researchers imply that the success of motivation strategies is directly related to the extent of employee satisfaction (see H-2-A).
3. Industrial survey results clearly show that all

employees desire certain common inducements, however, the extent of satisfaction derived from specific inducements is a function of the employee's training, background, and aspirations (see H-4-C).

Examination of the concepts and practices related to the systems approach and to rationale for analyzing organizations provides a basis for developing an argument in support of H-3. The basis for this argument is extended in Chapter III by illustrating how the systems approach can enhance management's ability to meet organizational and behavioral challenges in the future.

CHAPTER III

CHALLENGES FOR MANAGEMENT

Relevance of Traditional Motivation Theories

People are by nature dynamic beings. They continually change to adapt to their environment, thereby enhancing the attainment of their aspirations. Thus, it is not at all surprising to note that today's employees are different than their predecessors. These differences are manifest in their values, their needs, and their motivations.

In contrast with yesterday's employees, workers today are better educated; they are more aware of their political, social, and economic standing; they are more demanding; they are generally more sophisticated; and as a result of these differences, they are less responsive to traditional philosophies regarding human relations in an industrial setting.

One of the major criticisms of the traditional human relations approach is that it sought to instill high morale in employees through humanistic treatment while essentially ignoring the economic requirements of the organization.

Proponents of the behavioral sciences claim to have overcome this drawback by emphasizing the need to increase productivity through optimal use of human resources while maintaining basic humanistic philosophies. This rather difficult blending of the old and the new to form an economically sound and humanistic approach toward employee relations is accomplished by introducing basic changes in management philosophies, organizational constructs, and operating policies.

In an attempt to effect these changes, management has placed primary emphasis on open and free-flowing communications, participative decision making, and job enrichment practices. These are meaningful endeavors, well worth the effort expended. However it takes more than this - it takes a change in philosophy. Management must adopt an attitude which reflects a sincere effort to determine the real needs and desires of their employees in terms of the present work environment - not the all-encompassing needs and desires postulated by an ideological theory on human behavior.

Perhaps what is needed is a de-emphasis on the preoccupation with the vocabulary of motives, motivators, and motivation and a re-emphasis on basic qualities of leadership. Such qualities must surely include common sense, honesty,

fairness, and a sincere interest in the well-being of employees. This by no means implies that traditional motivation theories and techniques should be categorically disregarded. For the most part, traditional theories are as relevant today as they were when formulated. The underlying principles have not changed, however, the work environment, hence, the needs and desires of employees, has changed. This is a natural consequence of human adaptation.

Misinterpretation of motivation theories and inept or blind attempts to apply them with little regard for the employees or work situation involved will surely lead to failure. Traditional theories provide a wealth of basic understanding of behavioral characteristics, although they do not guarantee a successful motivation strategy. The pitfall of blind conformance to an established ideology can be illustrated in the context of the current economic situation in American industry.

In the economic climate of the early and middle 1960's, the physiological, safety, and belongingness needs were largely satisfied for most aerospace engineers and scientists. According to Maslow's theory this meant that management should concentrate on creating a work environment which would enable the satisfaction of the higher order needs; i.e., esteem and self-actualization. Applying the

results of the studies of Herzberg and Myers to this situation show that scientists and engineers placed primary value on achievement, recognition, advancement, responsibility, and the work itself. On the other hand, wages and job security were of little consequence as motivating factors.

By 1970 the situation in the aerospace industry had changed drastically. Due to economic uncertainties, technical unemployment was high and morale was low. A study by Bucher and Reece (21) shows that engineers and scientists place increasing emphasis on security-based motivators in times of economic uncertainty.

Bucher reports that prior to 1970, engineers and scientists in the non-government sector ranked security 10th in a list of 10 motivators. In 1970, security was ranked 3rd. Accomplishment (achievement) and recognition maintained their rankings of 1st and 2nd, respectively. Among engineers and scientists employed by the Government, the ranking of security had increased from 9th to 4th in importance. For these employees, accomplishment was ranked 1st and recognition 2nd before 1970, whereas, recognition ranked 1st and accomplishment ranked 2nd in 1970.

Do these findings indicate that the work of Maslow, Herzberg, and Myers is invalid or irrelevant? Clearly, they do not. The results substantiate traditional theories

and illustrate the importance of applying basic principles in light of the total work environment. In a situation such as described, management's failure to account for the psychological effects of the economic factor would surely lead to a dismal motivation strategy. This pitfall could be avoided by basic understanding of the theory plus the application of common sense, honesty, fairness, and a sincere interest in the well-being of employees.

An example of the misinterpretation of traditional motivation theories is in order to conclude this discussion. This concerns McGregor's Theories X and Y. Critics are quick to point out the apparent conclusiveness and mutual exclusivity of the theories. There is objection to the fact that Theory X is on one end of a conceptual continuum and Theory Y is on the other end with no apparent link between them. The literature also discloses that attempts to implement Theory Y in the business world has met with only marginal success, hence, it is concluded that there must be something wrong or lacking in the underlying behavioral assumptions.

Some of these criticisms are well-founded and some are not. First, it should be emphasized that McGregor did not contend that Theory X or Theory Y had been proven or were even capable of proof. He admitted that they were on

opposite ends of a conceptual continuum but stressed that they were concepts, only. As concepts, they were indeed mutually exclusive. In McGregor's view the concept of Theory X and Theory Y did not qualify them as managerial strategies, but rather as a basis for the development of styles of management. Thus, variations in managerial styles provides the link between Theory X and Theory Y. In McGregor's words (22):

Theory X and Theory Y are not managerial strategies: They are underlying beliefs about the nature of man that influence managers to adopt one strategy rather than another. In fact, depending upon other characteristics of the manager's view of reality and upon the particular situation in which he finds himself, a manager who holds the beliefs that I call Theory X could adopt a considerable array of strategies, some of which would be typically called 'hard' and some of which would be called 'soft'.

The same is true with respect to Theory Y.

Perhaps Theory Z will appease the critics of Theories X and Y by offering a realistic compromise and blending of such diverse behavioral philosophies. At any rate, Theory Z does place the burden on management to disavow strong reliances on conceptual theories of behavior in their attempts to formulate and implement motivation strategies.

Implementing Change

In tomorrow's organizations, management must become increasingly creative and participative. This effort will result by innovation rather than by evolution. It will not take place primarily by choice, but by the necessity to cope with environmental constraints placed on organizations.

America has passed the threshold from a society which was bound by lack of technology to one in which, for the most part, the potentialities of technology are not fully realized. It seems that only in cases of commitment to national goals (e.g., the Apollo program) are technological resources fully utilized. This general inability (or unwillingness) to vigorously seek the means by which all available knowledge can be utilized for improving the quality of human life represents an important challenge to management.

The adoption and implementation of a systems philosophy will aid management in meeting this challenge; however, a number of preliminary socio-technical problems must be overcome before the systems approach becomes a reality on a wide scale. In the writer's opinion, the major problems are associated with implementing and managing change, and acquiring a working knowledge of behavioral science philosophies. These problems will be briefly discussed in the

remainder of this chapter.

The first step that management must take in implementing organizational change is to adopt new attitudes toward leadership responsibilities in the area of employee motivation. Theory Z, although not a panacea, offers constructive guidance for effecting this transition in attitude. Second, management must attempt to change the attitudes and perspectives of employees to gain a common reference for understanding and trust. In other words, management should strive to condition employees for what lies ahead as members of a systems oriented organization. Third, managers must change the organizations structure to eliminate some of the rigidity of traditional hierarchy. This involves the adoption of a construct which emphasizes flexibility and adaptability under a wide range of environmental constraints. This is essentially a re-statement of the basis upon which the equilibrium strategy for this study has been developed (see H-3).

It is the writer's opinion that the most difficult problem to be encountered by management will be involved with the subjective aspects of change. Regardless of the "obvious" advantages of change in the eyes of the initiator, those who have not been preconditioned to unfamiliar situations or methods of operation will quite likely react with

apathy, skepticism, or open resistance. This is a basic characteristic of human nature, and as such, will be an inescapable aspect of attempts to implement systems concepts.

Fein (23) states, "...people do not resist change, only change that threatens them, not change that enhances their interests." The writer does not disagree with this statement except to point out that any major change in organizational policies which directly affects employees, and for which they do not have an adequate understanding, will be perceived as threatening. The knowledge that the change will enhance their interests only comes about after the various ramifications of the change are understood.

For the purpose of this discussion, it is convenient to classify change as innovative or transitive. Innovative change results from sudden or unanticipated action, whereas transitive change follows the processes of evolution in an orderly and predictable manner. It is concluded that since only the innovative (unexpected) changes have detrimental effects on organizations, management should strive to develop sufficient planning to insure that all changes are perceived to be evolutionary in nature.

It is apparent that the key to successful implementation of change lies with the development of a comprehensive strategy or plan well in advance of planned action. Hasty

or poorly planned changes within organizations may cause resentment toward management, frustration, loss of prestige due to reduced output, low levels of aspiration, increased absenteeism and turnover, and a general feeling of failure on the part of the majority of affected persons.

Behavioral Science and Systems Concepts

Any fully developed systems approach must be based on integrative and coordinative concepts (13). To comply with these requirements in an industrial work environment, a viable philosophy of behavioral characteristics must be adopted as a basis for developing employee relations. There are at least four traits of the behavioral science movement which qualify it as a viable and compatible policy for integration with organizationally oriented systems concepts (24). Management's challenge is to implement these behavioral and organizational concepts in a coordinative manner.

1. The behavioral science movement is humanistic and optimistic. The governing philosophy of the behavioral sciences is that the needs of people are of prime importance. In order for organizations to fulfill their role as social entities, they must place high value on the concept of individuals as thinking, feeling organisms. Closely following

McGregor's Theory Y, there is optimism about the innate potential of man to be independent, creative, productive, and capable of contributing positively to organizational objectives. Further, it is assumed that with proper organizational constructs and policies, these potentialities will be actualized.

2. The behavioral science movement is concerned with the climate of the total organization. This is evidenced by great concern for the creation of an atmosphere of effective supervision, the opportunity for the realization of personal goals, and a sense of accomplishment through work-related activities. Thus, behavioral scientists recognize that improving physical conditions by providing a satisfactory working environment and by offering adequate compensation to employees is necessary but not sufficient.
3. The behavioral science movement promotes a process in which change is inherent. In many respects, the real job of management in dynamic, heterogeneous organizations is to manage change. This can either be accomplished by acclimating employees to internally and externally created change, or more

efficiently, by creating an atmosphere in which innovation is encouraged and rewarded. Thus, the management of change becomes a self-perpetuating, ever-evolving phenomenon wherein new goals are established as old ones are met.

4. The behavioral science movement views the organization as a total system. This trait of the behavioral science movement has primary significance for the present study. In this respect, the organization is viewed as an enlarged version of the individual. The organization has individualistic qualities such as beliefs, modes of behavior, objectives, inputs, interactions, responses, and outputs. Attempts to improve the effectiveness of the organization by dealing with isolated factors results in minimal pay-off because of the overlapping, reinforcing, and interrelated nature of the systems components. Therefore, maximal effectiveness for the organization can only be gained by considering all of its components, including its people, as a totality. This appears to be a self evident conclusion, although it is only through the adoption of a systems philosophy that this approach can be made operational.

It is concluded that one of the most important attributes of future managers will be their appreciation for and understanding of the inherent relationship between behavioral science and systems concepts. Maintaining the balance between objective and subjective values such that all employees (not just engineers and scientists) will willingly contribute to the equilibrium requirements of the organization will be one of managements greatest challenges.

Implications

1. Sophisticated technological and social constraints have made it increasingly difficult for organizations to maintain equilibrium with their environment. Satisfaction of these internal and external environmental constraints requires the dynamic balancing of organizational inputs and outputs. The impact of the current economic situation on employees and on organizations vividly illustrates the importance of the equilibrium process in modifying the variety and magnitude of organizational inputs and outputs (see H-2-B).
2. To cope with technological and social constraints, a viable equilibrium strategy must be comprehensive and flexible. For example; such a strategy must be

responsive to humanistic problems; it must be concerned with all facets of the organization; it must view the organization as a complete system within the total environment; and it must promote a philosophy of innovative change. These are established traits of the behavioral science approach (see H-3-A).

Chapters I, II, and III examined pertinent literature and presented key aspects of the systems oriented philosophy which underlies this study. Chapter IV begins to operationalize that philosophy by presenting the method used to identify the dimensions of organizations that employ systems concepts.

CHAPTER IV

DIMENSIONS OF COMPLEX ORGANIZATIONS

Experimental Methodology

In Chapter I, H-3 emphasizes the need to adopt a systems approach to maintain organizational equilibrium, and H-3-B asserts that a structural modification of organizations is required in order to implement systems concepts. The nature of the structural modification is largely dependent upon changes in management functions (e.g., planning, controlling, communicating, etc.) resulting from the adoption of systems concepts. An examination of the impact of systems concepts on the structure of an organization and on critical management functions, is provided in Appendix A.

After required modifications to organizational structure have been determined, it is convenient to classify structural characteristics according to their dominant attributes. This leads to the search for the dimensions of organizations. Attainment of these dimensions enables the "measurement" of organizations against a predetermined standard. Hence, a fundamental tenet of this study is that

organizations can be classified according to their basic structural attributes; i.e., dimensions.

Research Plan

The experimental phase of this portion of the study was designed to detect the presence of basic characteristics of the proposed systems construct within existing organizations, and to express those characteristics as organizational dimensions. After carefully studying Hemphill's monograph (20), it was felt that the basic questionnaire could be easily modified to provide an instrument for testing hypotheses on organizational characteristics. This approach eliminates the need for a costly and time consuming verification of a new test instrument.

It was decided that primary objectives could be accomplished by limiting the survey to a small scale study of selected organizations. In this manner a partially closed or controlled environment could be used as the initial test media. This technique minimizes the occurrence of higher order organizational variations which are not relevant to verification of the basic theory.

Criteria for Selection of Study Population

Since primary emphasis in this phase of the study is on

identifying the distinguishing characteristics between organizations, as opposed to identifying the variation of characteristics within an organization, solicited responses were limited to one or two carefully selected individuals in each test organization. Taken collectively, the resulting population essentially forms a committee of experts which function in a manner closely resembling the Delphi Technique. The following criteria was used for selecting the initial study population:

1. Test organizations were limited to those that were, in the writer's opinion, highly systems oriented or highly non-systems oriented as judged by the constructs formulated in Chapter III and Appendix A.
2. Responses were requested from employees of the respective organizations that are personally known by the writer. In every case, the recipient of a questionnaire occupied a middle or top management position in his company; possessed a thorough knowledge of his company's functions and policies; and had a minimum of 10 years experience in his profession.
3. The prospective respondents were given no special instructions or information other than that which

appears on the questionnaire (Appendix B) and the fact that the results would be used in conjunction with research conducted by the writer.

Test Instrument Design

Initial Test Instrument

The basic questionnaire developed by Hemphill (20) contains 150 statements designed to identify 13 group dimensions. Statements pertaining to four of these dimensions (hedonic tone, intimacy, permeability, and viscosity) were excluded from the test instrument because they were considered irrelevant or ineffective for use in the present study. The remaining nine dimensions (control, stability, autonomy, stratification, potency, participation, polarization, flexibility, and homogeneity) were interpreted in terms of the constructs formulated in Chapter III and Appendix A, and the statements contained in the questionnaire, Appendix B.

A listing of these interpretations is given below:

1. (Control) Personnel are subjected to fewer or less stringent behavioral constraints as members of groups which employ systems concepts (statements 1-12, Appendix B).
2. (Stability) Groups which employ systems concepts tend to be less stable (statements 13-17,

Appendix B).

3. (Stratification) Stratification of personnel; i.e., development of status hierarchies, tends to be less evident in groups which employ systems concepts (statements 18-29, Appendix B).
4. (Autonomy) Groups which employ systems concepts tend to be more autonomous within their environment (statements 30-42, Appendix B).
5. (Potency) Groups which employ systems concepts tend to offer their members more potency; i.e., feeling of significance for the group (statements 43-57, Appendix B).
6. (Participation) Groups which employ system concepts tend to require more participation from members (statements 58-67, Appendix B).
7. (Polarization) Groups which employ systems concepts tend to be more polarized; i.e., goal oriented (statements 68-79, Appendix B).
8. (Flexibility) Groups which employ systems concepts tend to be more flexible; i.e., less standardized or formalized (statements 80-92, Appendix B).
9. (Homogeneity) Personnel assigned to groups which employ systems concepts tend to be less homogeneous with respect to social characteristics (statements

93-107, Appendix B).

Modification of Hemphill's basic questionnaire was completed with the addition of two more statement groupings. Statements 108-115 were designed to test the validity and relevance of constructs concerning the relationship of management and non-management employees in a projectized organization. The final grouping of statements, 116-120, was designed to measure the presence of systems attributes as defined by systems experts throughout industry (based on Wendler's survey results).

Refined Test Instrument

After analyzing the results obtained with the initial test instrument, it was evident that a reduction and restructuring of statements would result in a more viable instrument. This refined instrument (Appendix C) is composed of 37 statements, a reduction of 83 statements from the initial test instrument.

Statements in the refined test instrument were designed to measure the relative strengths of four basic dimensions of organizations in light of the adoption of systems concepts. Statements associated with each dimension and with systems characteristics are identified as follows:

1. Autonomy - the degree to which an organization

functions independently of other organizations.

Autonomy is reflected by the extent to which an organization determines its own activities, by its absence of allegiance or dependence relative to other organizations. Members of autonomous organizations are afforded the opportunity to exhibit a sense of responsibility in their activities (statements 1-8, Appendix C).

2. Homogeneity - the degree to which members of an organization are similar with respect to socially and technically relevant characteristics. Homogeneity is reflected by the relative uniformity of members with respect to interests, attitudes, and technical training. Low homogeneity affords high recognition for members (statements 9-16, Appendix C).
3. Participation - the degree to which members of the organization apply time and effort to organizational activities. Effective participation is reflected by the number and complexity of duties performed by individual members with respect to the total group effort. High participation affords achievement and advancement for members of the organization (statements 17-24, Appendix C).

4. Polarization - the degree to which an organization is oriented and works toward an overall single goal which is clear to all members. Members of a polarized organization perceive clear and distinct goals in their personal work activities as they pertain to the fulfillment of the organizations mission. This attitude fosters a feeling of achievement through the accomplishment of meaningful work (statements 25-32, Appendix C).
5. Systems philosophies - as stated in terms of the system attributes of an organization (statements 33-37, Appendix C).

Notice that statements providing for project scores (included in the initial test instrument) are not included in the refined test instrument. This was done for the sake of brevity and because systems concepts represent the real basis upon which organizational constructs have been formulated.

Analysis of Results

Initial Survey

Out of the 17 potential respondents on the initial survey, 16 returned completed questionnaires. In addition to basic survey data, two respondents provided supplementary

information concerning their particular organizational setting and suggestions for modifying the research instrument for subsequent use. A listing of those organizations that participated in the initial survey is provided in Table III.

A brief word concerning the justification for obtaining data from mailed questionnaires is in order. The writer is aware of the inherent disadvantages of obtaining data in this manner; namely, potentially low return rates and possible misinterpretation of statements. In the initial survey, the return rate (94 percent) was more than adequate, primarily due to the process of sampling used.

The best way to avoid or minimize the occurrence of misinterpreted statements is to keep the statements simple and clear and to make sure that the respondent is fully qualified to answer the statements. Both of these precautions were taken during the course of this study. Thus, it is felt that misinterpretations have been minimized, although it would be naive to assume that they did not exist.

The procedure for coding and scoring questionnaire data is thoroughly documented in Hemphill's manual (20). Basically, the five alphabetic response keys given on the questionnaire are converted into a numeric score ranging from one to five. The exact correlation between alphabetic keys and numeric scores depends on the statement. For

TABLE III

LISTING OF PARTICIPATING ORGANIZATIONS
ON THE INITIAL SURVEY

Organizations	Location
AiResearch Manufacturing Co.	Phoenix, Arizona
Auburn University	Auburn, Alabama
The Boeing Company	Houston, Texas
Brown Engineering Company	Huntsville, Alabama
Construction & Mining Supply Co.	Phoenix, Arizona
Frigidaire	Fullerton, California
IBM	Huntsville, Alabama
NASA-Launch Operations	Cape Kennedy, Florida
NASA-Office of Director for Science	Marshall Space Flight Center
NASA-Reliability Laboratory	Marshall Space Flight Center
Scientific Data Systems	Huntsville, Alabama
Texas Tech. University	Lubbock, Texas
Twin Disc Inc.	Rockford, Illinois
U. S. Army Missile Command	Redstone Arsenal, Alabama
U. S. Soil Conservation Office	Stillwater, Oklahoma
Wyle Laboratories	Huntsville, Alabama

NOTE: The alphabetic listing of participating organizations does not correspond with the numerical sequence of organizations shown in Tables IV and V. This is in keeping with the writer's guarantee that an organization's identity would not be associated with specific survey results (Appendix B).

example, in some statements "A" corresponds to "1" whereas in other statements "A" corresponds to "5". Statements not answered were given a numeric score of "3", which indicates no preference on the part of the respondent. To determine the total raw score for a dimension, the scores for each statement pertaining to that dimension are summed. The results of each respondent's total raw scores for the nine group dimensions associated with the initial survey are given in Table IV.

Notice that "Project" and "System" appear at the bottom of the list of group dimensions. This was done merely for convenience in evaluating the scores associated with statements 108-120. It is not meant to imply that these are group dimensions in the sense that control, stability, etc., are group dimensions.

In order to facilitate the interpretation and comparison of the total raw scores, they can be normalized. The particular normalization technique used by Hemphill yields "stanine" or standard nine scores which are based on a distribution of raw scores describing 950 groups on each of the dimensions. The use of stanine scores is particularly helpful in determining the relative strength or weakness of a dimension. Normalized raw scores (stanine scores) are shown in Table V.

TABLE IV

RAW SCORES OF INDIVIDUAL RESPONDENTS ON THE INITIAL SURVEY

Group Dimension	Respondents															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Control	21	34	31	33	45	29	35	39	27	33	24	23	27	36	38	35
Stability	11	16	21	19	12	12	16	14	18	17	25	14	16	19	18	7
Stratification	46	47	47	42	34	43	56	49	50	45	47	43	48	41	44	38
Autonomy	34	30	45	27	26	27	52	30	61	40	40	31	27	32	00	40
Potency	46	50	51	54	44	53	53	54	51	53	58	56	48	51	00	39
Participation	38	39	43	41	33	34	38	35	45	38	38	42	34	35	30	36
Polarization	25	39	51	41	25	21	46	26	55	36	39	49	54	49	49	37
Flexibility	48	28	37	28	35	39	33	32	52	39	40	33	27	34	38	38
Homogeneity	22	20	36	21	48	19	15	24	20	30	32	30	16	40	49	39
Project	31	30	32	28	23	24	40	27	35	34	19	29	32	29	26	29
System	23	22	20	16	15	16	20	21	20	20	14	21	20	23	20	16

TABLE V

STANINE SCORES OF INDIVIDUAL RESPONDENTS ON THE INITIAL SURVEY

Group Dimension	Respondents																A*	B**
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
Control	2	6	5	5	9	4	6	7	4	5	3	3	4	6	7	6	5.0	5.3
Stability	4	6	9	8	4	4	6	5	7	7	9	5	6	8	7	2	6.7	5.7
Stratification	8	8	8	7	4	7	9	8	8	7	8	7	8	6	7	6	8.0	6.3
Autonomy	5	4	7	3	3	3	8	4	9	6	6	4	3	4	-	6	7.7	4.0
Potency	5	6	6	6	4	6	6	6	6	6	7	7	5	6	-	3	6.0	5.7
Participation	6	6	8	7	4	5	6	5	9	6	6	7	5	5	3	5	7.0	5.0
Polarization	2	5	7	5	2	1	6	2	8	4	5	7	8	7	7	4	6.0	2.7
Flexibility	8	3	5	3	5	6	4	4	9	6	6	4	3	5	6	4	6.3	5.7
Homogeneity	2	1	5	2	8	1	1	2	1	4	4	4	1	6	8	6	2.0	4.3

* Based on the three highest raw scores for project characteristics.

** Based on the three lowest raw scores for project characteristics.

The magnitude of the stanine score also indicates the strength of the dimension in terms of the standard population of 950 groups. To illustrate (20):

Stanine Score 9 is assigned to raw scores that are earned by the highest 4 per cent of the standard population.

Stanine Score 8 is assigned to raw scores that are earned by the next lower 7 per cent of the standard population.

Stanine Score 7 is assigned to raw scores that are earned by the next lower 12 per cent of the standard population.

Stanine Score 6 is assigned to raw scores that are earned by the next lower 17 per cent of the standard population.

Stanine Score 5 is assigned to raw scores that are earned by the next lower 20 per cent of the standard population.

Stanine Score 4 is assigned to raw scores that are earned by the next lower 17 per cent of the standard population.

Stanine Score 3 is assigned to raw scores that are earned by the next lower 12 per cent of the standard population.

Stanine Score 2 is assigned to raw scores that are earned by the next lower 7 per cent of the standard population.

Stanine Score 1 is assigned to raw scores that are earned by the lowest 4 per cent of the standard population.

Statements 108-120, Appendix B, were formulated to yield high raw scores for those organizations employing project management and/or systems concepts. To test the

usefulness of these statements as part of the basic survey instrument, "project" and "system" scores were analyzed in separate frequency distributions. It can be seen from Table IV that "project" scores range from 19 to 40 whereas "system" scores range from 14 to 23. It was observed that the "project" scores of 3 respondents were grouped at the high end of the distribution (score ≥ 34). In a similar manner, there was a grouping of 3 scores at the low end of the distribution (scores ≤ 24). The remaining 10 "project" scores varied between 26 and 32, being slightly skewed toward the high end of the distribution.

It is significant to note that the relative distribution between "project" and "system" scores compares favorably for respondents at either end of the frequency distributions. That is, those respondents who had the higher (or lower) "project" scores tended to have the higher (or lower) "system" scores. This relationship was instrumental in formulating the refined test instrument.

In order to emphasize the trends in the data, average stanine scores were calculated across dimensions for the three raw scores at either end of the "project" distribution. The resulting average stanine scores are given in the last two columns of Table V. To further facilitate the interpretation of these results, profiles of the average stanine

scores for each dimension are shown in Figure 1.

It is encouraging to note that seven of the nine predictions concerning the relationships between group dimensions and organizational constructs were substantiated. That is, groups which are highly system oriented also tend to rate relatively high on dimensions of autonomy, flexibility, participation, potency, and polarization, and low on homogeneity.

The two predictions that were not supported by survey results relate to the group dimensions, stability and stratification. For each dimension it was hypothesized that system oriented groups would rate lower than non-system groups; however, the data indicated the reverse. This could be a reflection of the effects of project duration that was not accounted for in the theoretical construct. That is, for long term projects, differential distributions of power, privileges, and obligations; i.e., status systems, may become more prevalent than in short term projects. Since the vast majority of the organizations surveyed in this study were well established in long term projects (3 to 5 years, typically) it is conceivable that significant stratification of group members may have taken place.

The impact of the present economic situation should also be considered when analyzing these data. For example,

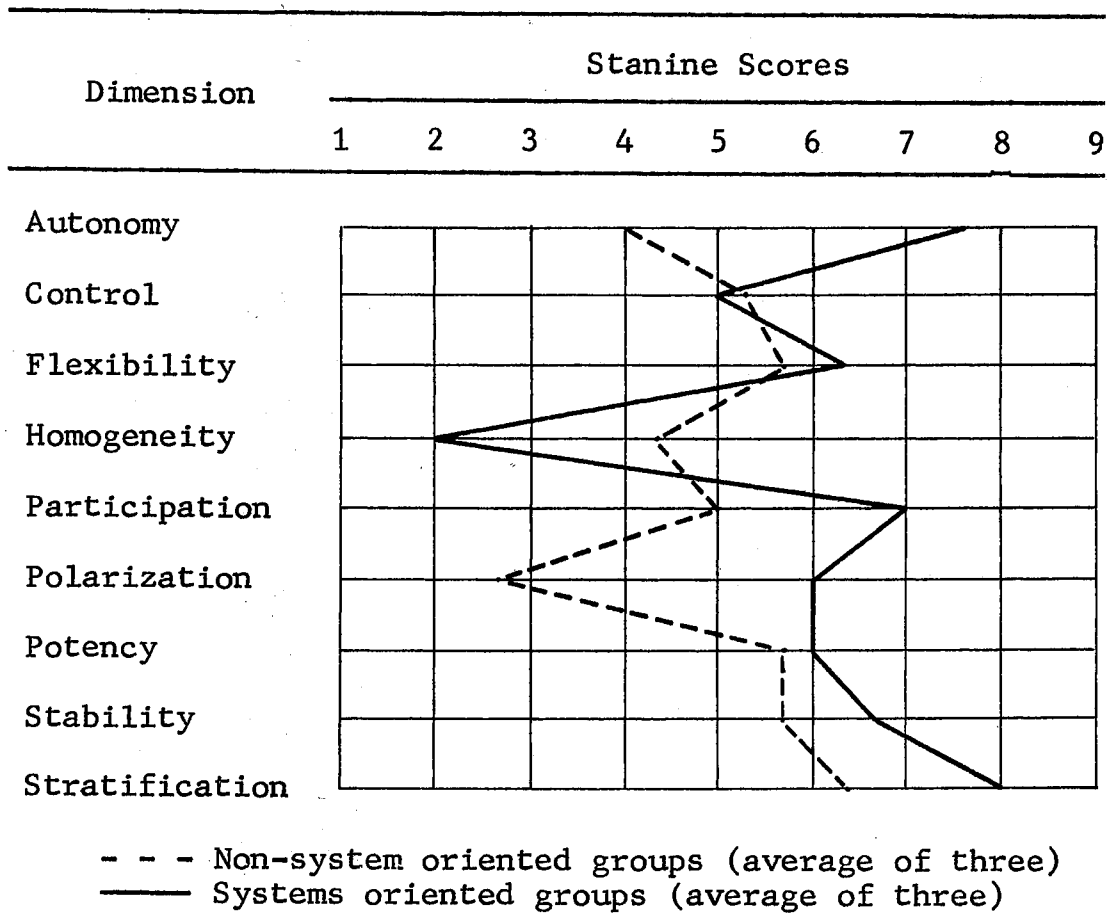


Figure 1. Group Dimensions Profile

statements in the questionnaire relating to the dimension of stability were formulated in a manner which measured the extent of group turn over and size variation. With relatively long term projects and a scarcity of jobs, it is quite likely that the indicated degree of stability has resulted, in part, from short term economic constraints.

Refined Survey

Figure 1 clearly shows that major differences between systems and non-systems oriented groups are "measured" by four dimensions; autonomy, homogeneity, participation, and polarization. The strengths of these dimensions plus their intuitive relationships with motivational factors considered important for engineers and scientists; i.e., recognition, achievement, advancement, responsibility, and meaningful work, led to the development of the refined test instrument (Appendix C).

To determine the viability of the refined instrument, a survey of a portion of the initial test population was conducted. The major interests in the refined survey were to determine if the relationships between systems and non-systems oriented groups would remain the same across the four critical dimensions, and to estimate the reliability of the test instrument.

The raw scores of the individual respondents, comprising the two groups of three previously found at opposite ends of the system continuum, are shown in Table VI.

TABLE VI
RAW SCORES OF INDIVIDUAL RESPONDENTS
ON THE REFINED SURVEY

Organizational Dimension	Respondents					
	1	2	3	4	5	6
Autonomy	22	38	33	20	31	21
Homogeneity	30	17	22	18	13	27
Participation	21	30	30	24	28	26
Polarization	24	31	28	26	26	22
Systems	18	20	19	17	17	14

Following the previously adopted analysis techniques, raw scores of respondents were normalized (Table VII). In this case, however, the results of normalization do not produce stanine scores because the structure of the test instrument is significantly different from the structure of

Hemphill's basic instrument.

TABLE VII
 NORMALIZED SCORES OF INDIVIDUAL RESPONDENTS
 ON THE REFINED SURVEY

Organizational Dimensions	Respondents							
	1	2	3	4	5	6	A*	B**
Autonomy	5	9	8	4	8	5	8.3	4.7
Homogeneity	9	5	7	5	3	9	5.0	7.7
Participation	3	6	6	4	6	5	6.0	4.0
Polarization	5	7	6	5	5	4	6.0	4.7

* Denotes average normalized score for the three respondents that had the highest raw scores for project characteristics on the initial survey.

** Denotes average normalized score for the three respondents that had the lowest raw scores for project characteristics on the initial survey.

A profile of average normalized scores for each dimension is shown in Figure 2. Comparison with Figure 1 shows complete agreement between initial and refined test data. It is concluded that the refined test instrument provides

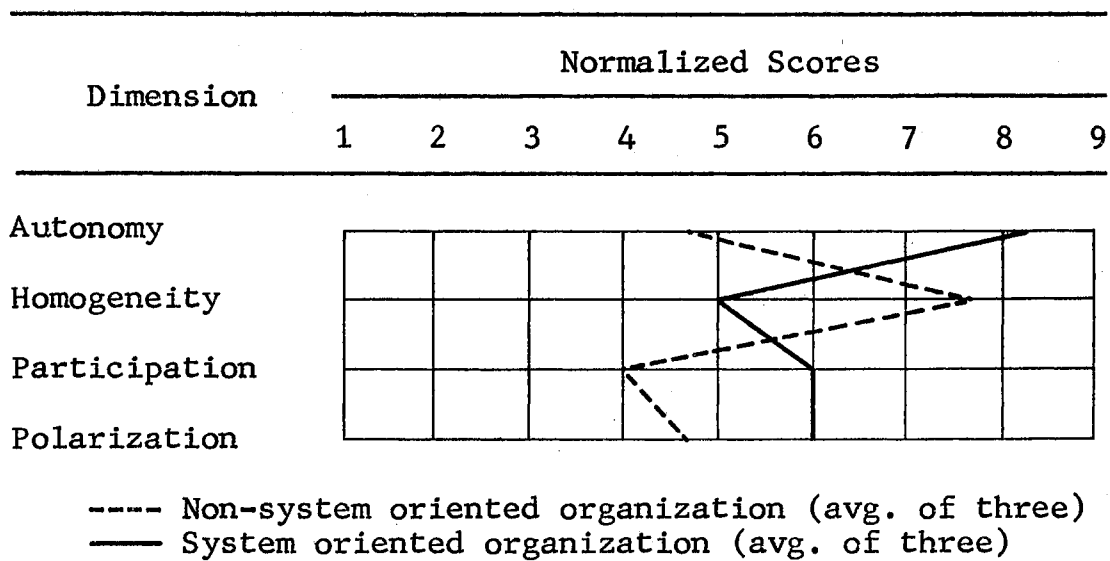


Figure 2. Organizational Dimensions Profile

as much useful information as the initial test instrument in a much more efficient manner; i.e., with approximately one-third the time and effort on the part of the respondent.

It is not possible to assess a quantitative estimate of reliability between the two test instruments because of the complete restructuring of statements on the refined questionnaire. However, it is possible to get a direct estimate on the reliability of responses to statements relating to systems concepts since these statements were included on both test instruments.

Using the Spearman rank correlation coefficient with adjustment for ties, the estimated reliability of responses to system concepts on the basis of individual statement rankings was .85 (25). On the basis of a categorical ranking; i.e., a ranking across all statements, the estimated reliability was .92. These reliability estimates are significant at the $p < .05$ level; hence, the indicated value of the correlation coefficient is 95 percent certain.

Based on the quantitative estimate of reliability obtained over a portion of the refined test instrument, and on the general level of agreement between data acquired by both test instruments, it is concluded that the refined questionnaire is a viable test instrument. Comprehensive statistical verification of instrument reliability would

require retesting of a large sample of organizations over an extended period of time. Such an exercise far exceeds the level of effort that this study devotes to organizational analysis.

Implications

1. The Organizational Dimensions Questionnaire, Appendix C, provides a viable research instrument for analyzing the structural and functional attributes of organizations. The instrument indicates that the most significant dimensions of systems oriented organizations are autonomy, homogeneity, participation, and polarization. The strength of each of these dimensions is determined by responses to statements which indicate the presence of various intrinsic inducements (see H-3-C).
2. The dimensions of systems oriented organizations (identified above) reflect organizational attributes which indicate the capability for providing many of the intrinsic inducements desired by engineers and scientists. For example; significant autonomy affords opportunity for acquiring responsibility; low homogeneity presents conditions for achieving recognition; active participation affords

the opportunity for achievement and advancement; and a high degree of polarization affords the opportunity for achievement through the accomplishment of meaningful work (see H-3-D).

Up to this point, the supportive research for this study has been concerned with developing the underlying philosophy in the writer's approach to the study of motivation. The objective of this systems oriented philosophy is to formulate a construct which will enhance the operationalism of motivation theory. Major concepts which have been synthesized include:

1. Operationalism is enhanced if management can assess the effectiveness and efficiency of intrinsic inducements.
2. Organizations must adopt an equilibrium strategy if they are to survive.
3. The variety and magnitude of available intrinsic inducements is largely determined by the organizations equilibrium strategy.
4. Adoption of the equilibrium strategy may require functional and structural modifications of the organization.
5. The nature of these modifications can be assessed by identifying the dimensions of organizations.

That is, knowledge of the dimensions of an organization provides insight on its structure and management philosophies, which in turn, provides insight on the variety of available intrinsic inducements.

6. The systems approach is a viable equilibrium strategy for industrial organizations.
7. The adoption of behavioral science and project management philosophies will enhance the implementation of the systems approach.
8. Knowing what employees want is not enough - the organization's ability for providing specific inducements must also be known.
9. The dimensions of systems oriented organizations identify attributes which reflect the capability for offering intrinsic inducements that are highly desired by engineers and scientists.

Two major concepts required to attain the objective of this study have yet to be developed:

1. A measure of the effectiveness of intrinsic inducements as potential incentives can be gained with the knowledge of an employee's desirability for the inducements. A measure of the effectiveness of incentives after they have been administered can be

gained through knowledge of an employee's satisfaction.

2. A measure of the efficiency of incentives requires knowledge of the change in an employee's relative desirability for intrinsic inducements over time.

The development and synthesis of these concepts into an operational approach for studying motivation theory is accomplished in Chapter V.

CHAPTER V

A MEASURE OF COMPOSITE DESIRABILITY

Conceptual Framework

Previous studies, designed to identify the factors or conditions which act as motivators of behavior, have been concerned with assessing a measure of perceived satisfaction (11) (12). This involves asking a subject to relate a situation in which he felt especially good or bad about his job. The subjects feelings reflect a satisfactory or an unsatisfactory attitude toward the factors which caused the situation.

This approach clearly places emphasis on the past. It determines what factors or incentives have created the greatest amount of satisfaction during previous work experiences. The resulting information is very valuable for control purposes, in that it shows past attitudes and indicates possible reasons for them. However, in the writer's opinion, management should place more emphasis on the future - on planning.

To provide input for policy formulation, management

must attempt to ascertain employee's perceived future satisfaction. This reflects an employee's desirability for various incentives. To be practical, these incentives must be intrinsic (organizationally derived) and, as such, would be limited in variety and magnitude. Thus, management should be primarily concerned with the relative desirability that intrinsic inducements hold for employees. After formulating and implementing an inducements package in accordance with H-3, it is quite logical that a follow-up (control) program be initiated to assess derived satisfaction.

Concentration on determining the desirability of incentives has several significant advantages for management and for non-management employees:

1. The tendency to adopt behavioral ideologies is reduced. There is little merit in attempting to classify employees for the purpose of predetermining their needs and desires when it is much simpler and more accurate to ask them.
2. The chance of providing costly but ineffective incentives is reduced. If management knows in advance what incentives are most likely to maximize employee satisfaction, then it is much easier to formulate an inducements package which reflects

concern for effectiveness and efficiency.

3. Concern for the future emphasizes concern for predictive capabilities. Management must continually strive to extend and expand predictive capabilities in the behavioral sciences as in all other areas of endeavor.

Before the overall, or composite, efficiency of an incentive can be ascertained, the duration of the intended effect must be known. For example, the administration of a particular incentive may be considered effective if it results in the desired performance for time T but ineffective if its desired effect only lasts for time $T/4$. Thus, it is postulated that the development of an efficiency criterion requires the addition of a time factor to the desirability-incentives continuum.

Lohmann (26) postulates that the application of incentives in an industrial setting follows the law of diminishing returns. This simply means that repeated applications of a constant amount of a given incentive will realize ever decreasing amounts of satisfaction. A non-rigorous illustration of this phenomena is shown in Figure 3.

Obviously, the exact shape of the satisfaction-incentive curve is not known, however, it can heuristically be argued that it will change for each type of incentive and

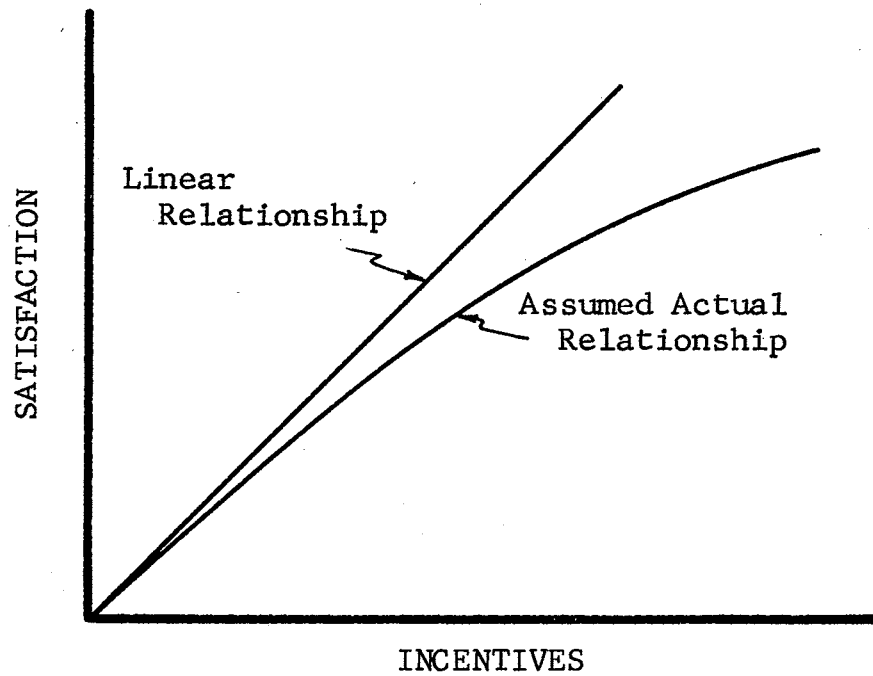


Figure 3. General Relationships of
Incentives to
Satisfactions

each "type" of employee. For the purpose of this study, "type" refers essentially to occupational classification; i.e., engineer, scientist, accountant, production worker, etc. Previous studies have shown that the effectiveness of motivation strategies is a function of the occupational classification (or training) of the employee (10) (11) (12). Differences in the effectiveness of motivation strategies when applied to different employees within a given employee "type" are not explicitly considered in this study. These differences, although present, are considered of secondary importance to the development of a strategy for efficiently administering incentives to a particular employee category; i.e., engineers and scientists.

Time is an implicit variable in the relationships shown in Figure 3. This study recognizes the heuristic merit of these basic relationships and proposes (H-1) that a similar relationship can be established between desirability and time for specified incentives wherein time is an explicit variable. Once measures of relative desirability are obtained for individual incentives, it is necessary to establish a measure of desirability for all incentives, taken collectively, subject to the constraints of H-2.

A Theoretical Formulation

To facilitate the theoretical development, two simplifying assumptions will be made. The constraints of either assumption can be relaxed to refine the final relationships.

Assumptions

1. Organizations have sufficient resources to comply with employee requirements as to type and quantity of incentives.
2. Employee desirability for inducements is constant with time. That is, the composite desirability function is invariant during the time frame of concern.

Mathematical Development

Let D_k denote the desirability that employee k associates with the attainment of inducements I_1, I_2, \dots, I_n . That is, $D_k = D_k(I_1, I_2, \dots, I_n)$. In a similar manner, let $C = C(D_1, D_2, \dots, D_k)$ be the composite desirability function for an organization as perceived by K employees.

The change in C with I_n is given by

$$\frac{\partial C}{\partial I_n} = \frac{\partial C}{\partial D_1} \frac{\partial D_1}{\partial I_n} + \dots + \frac{\partial C}{\partial D_k} \frac{\partial D_k}{\partial I_n} \quad (1)$$

where $n = 1, 2, 3, \dots, N$.

If the composite desirability function is to directly reflect fluctuations associated with changes in desirability for a particular inducement, then the change in desirability levels for the $N-1$ inducements must be held constant. Under these conditions the change in C with I becomes

$$\frac{dC}{dI} = \frac{\partial C}{\partial D_1} \frac{dD_1}{dI} + \dots + \frac{\partial C}{\partial D_K} \frac{dD_K}{dI}$$

or,

$$dC = \frac{\partial C}{\partial D_k} dD_k \quad k=1,2,3,\dots,K. \quad (2)$$

Equation (2) presupposes that C exists and can readily be manipulated. However, initially it can only be assumed that the change in composite desirability is of the form

$$G_1(D_1, D_2, \dots, D_K) dD_1 + \dots + G_K(D_1, D_2, \dots, D_K) dD_K \quad (3)$$

where the G 's are, as yet, unspecified functions. This relationship assumes that the change in composite desirability is equal to the algebraic sum of change in individual desirability functions, each of which is represented by a curvilinear relationship similar to Figure 3.

Assuming that the individual desirability functions are unimodal and concave for plausible magnitudes of positive inducements, their maximum contribution to a change in composite desirability is found by setting Equation (3) to zero. That is,

$$G_k(D_1, D_2, \dots, D_K) dD_k = 0. \quad (4)$$

If $\partial G_i / \partial D_j = \partial G_j / \partial D_i$ for $i \neq j$, then Equation (4) is an exact differential and maxima for individual desirability functions are readily obtained.

In general, Equation (4) will not be an exact differential. Thus, a suitable integrating factor of the form $R(D_1, D_2, \dots, D_k)$ must be found such that multiplication by R reduces Equation (4) to an exact differential of some function $C(D_1, D_2, \dots, D_k)$. It follows that

$$dC = R G_k dD_k \quad (5)$$

and the loci of maxima will generate surfaces of the form

$$C(D_1, D_2, \dots, D_k) = \text{constant}. \quad (6)$$

If R is the integrating factor which transforms Equation (4) into an exact differential like Equation (5), then from Equations (2) and (5),

$$\frac{\partial C}{\partial D_k} = R G_k.$$

By definition of the exact differential, the partial derivatives of C , $\partial C / \partial D_k$, are continuous in the region of the maxima. This implies that $\partial C / \partial D_k$ are themselves functions of C ; hence, may also have partial derivatives (26). It follows that

$$\frac{\partial}{\partial D_j} \left(\frac{\partial C}{\partial D_k} \right) = \frac{\partial}{\partial D_k} \left(\frac{\partial C}{\partial D_j} \right) \\ k \neq j$$

and

$$\frac{\partial}{\partial D_j} (RG_k) = \frac{\partial}{\partial D_k} (RG_j). \quad (7)$$

Equations (7) can be expanded into

$$R \left(\frac{\partial G_k}{\partial D_j} - \frac{\partial G_j}{\partial D_k} \right) + G_k \frac{\partial R}{\partial D_j} - G_j \frac{\partial R}{\partial D_k} = 0 \quad (8)$$

where $j = 1, 2, \dots, K$ $k = 1, 2, \dots, K$ $k \neq j$.

Since

$$R = \frac{1}{G_k} \frac{\partial C}{\partial D_k}$$

then
$$G_k \frac{\partial R}{\partial D_j} = \frac{\partial^2 C}{\partial D_k \partial D_j} + G_k \frac{\partial C}{\partial D_k} \frac{\partial}{\partial D_j} \left(\frac{1}{G_k} \right) \quad (9)$$

and
$$G_j \frac{\partial R}{\partial D_k} = \frac{\partial^2 C}{\partial D_j \partial D_k} + G_j \frac{\partial C}{\partial D_j} \frac{\partial}{\partial D_k} \left(\frac{1}{G_j} \right). \quad (10)$$

Subtracting Equations (10) from Equations (9) and simplifying gives

$$R \left[G_k^2 \frac{\partial}{\partial D_j} \left(\frac{1}{G_k} \right) - G_j^2 \frac{\partial}{\partial D_k} \left(\frac{1}{G_j} \right) \right]$$

By substitution, Equations (8) become

$$R \left\{ \left[\frac{\partial G_k}{\partial D_j} + G_k^2 \frac{\partial}{\partial D_j} \left(\frac{1}{G_k} \right) \right] - \left[\frac{\partial G_j}{\partial D_k} + G_j^2 \frac{\partial}{\partial D_k} \left(\frac{1}{G_j} \right) \right] \right\} = 0. \quad (11)$$

Since R cannot be identically zero, Equations (11) become

$$\left\{ \frac{\partial G_k}{\partial D_j} + G_k^2 \frac{\partial}{\partial D_j} \left(\frac{1}{G_k} \right) - \frac{\partial G_j}{\partial D_k} - G_j^2 \frac{\partial}{\partial D_k} \left(\frac{1}{G_j} \right) \right\} = 0. \quad (12)$$

Examination reveals that Equation (12) specifies $\binom{K}{2}$ conditions which the G 's must satisfy. This is a very severe restriction since there are only K independent functions of G .

It is concluded that a general expression for the composite desirability function, $C = C(D_1, D_2, \dots, D_K)$, can not be formulated for more than three employees. This is a direct consequence of the condition that $\binom{K}{2} \leq K$. With this restriction it appears rather futile to attempt to find a functional form for R . Instead, emphasis will be placed on manipulating G functions into constants such that the restrictions on K are removed and the parameters of Equation (3) are made operational. The method for doing this is empirically based, however, the results will be related to the basic theory formulated herein.

An Empirical Approach

Selection Criteria

Based on the limited applicability of a mathematical expression for composite desirability, it is necessary to resort to an empirical approach to obtain an estimate of Equation (3). Several approaches for accomplishing this were considered.

1. Acquire data in an industrial environment on a

real-time basis. The greatest advantage of this approach is that the affects of time on satisfaction-incentive relationships can be measured directly. It is estimated that this approach would require a minimum of three years to complete, and would not directly yield information on the desirability for incentives.

2. Acquire data from mailed questionnaires. Although this approach could be completed within a reasonable time frame, it is not felt that a realistic questionnaire could be designed that would yield all of the desired information.
3. Acquire data under laboratory conditions. This approach consists of a combined questionnaire, interview, and task assignment technique. Characteristics of the inducement; i.e., type, amount, and duration, could be carefully controlled. An individual's performance to specified tasks could be determined through carefully structured questionnaire-interview sessions.
4. Acquire data from a simulated work environment. The basic research technique would involve an adaptation of Q-sort methodology used so successfully in psychometric theory (27). The primary

modification to existing methodology would be to replace the dependency on congruence between "self" and "ideal" with an explicit dependency on the duration of various levels of desirability for specified types and magnitudes of incentives. The ability to measure degrees of desirability or undesirability on an ordinal scale is inherent in this approach.

The first and second approaches discussed were rejected for the stated reasons. The third approach (in which data are acquired under laboratory conditions) appears to have great potential. It is estimated that a maximum of two hours would be required to administer the tests and conduct the interview for each subject. It follows that it would take approximately two weeks of constant testing to acquire data on 35 or 40 subjects. This is certainly an improvement over the time requirement associated with the first approach.

The last approach discussed (in which data are acquired from a simulated work environment) was selected for immediate development and implementation. Although this approach does not afford the degree of control associated with the laboratory approach, it does offer a much higher probability of success on the basis of previous verification of the

underlying technique. Other advantages of the simulation technique are that it is extremely flexible, and a large quantity of relevant data can be acquired in a relatively short time.

Modification of Q-Sort Methodology

The Q-sort method of assessing the preferences of individuals became popular in the fields of social and clinical psychology in the early 1950's (27). Since then it has been used successfully in a wide range of applications (28) (29) (30). The Q-sort is a comparative rather than an absolute rating method. Subjects are forced to make a decision between available alternatives, whether they happen to like all, some, or none of the alternatives in an absolute sense. Comparative responses are enforced by requiring subjects to rank their attitudes toward alternatives according to a fixed distribution which usually approximates the normal. The distribution is physically expressed as a number of attitude categories of varying size. Although the measured attitudes usually range from extremely favorable to extremely unfavorable states, the exact number and size of the categories within the distribution is optional.

Traditional Q-sort methodology was modified for use in this study by explicitly including the time dimension.

Instead of performing Q-sorts to determine the congruence (degree of correlation) between self and ideal perceptions, sorts were made to determine the desirability for specified alternatives with specified passages of time. Theoretically, the number of sorts (discrete points in time) and the simulated duration between sorts (distance between points in time) could be quite large. However, in practice both must be held to a bare minimum if any semblance of cooperation is to be expected from test subjects.

Q-Sort Design

Fifty statements are included in the Q-sort, 5 in each of 10 categories (Appendix D). Each category represents an inducement (potential motivating factor) considered pertinent by the writer for use in studying the attitudes of engineers and scientists. It is quite conceivable that this list of inducements would not be appropriate for studying another employee "type". Eight of the 10 inducements have been significant on previous studies in this area (11) (12). The remaining inducements, leisure and working conditions, were added to check the significance of current movements such as the four-day work week.

After composing the initial list of 50 Q-sort statements, a small scale pilot study was conducted with senior

engineering students. Each student was asked to review the complete list and to note any ambiguities or omissions. As a result of this review, 11 of the original 50 statements were modified or replaced; hence, it is the modified list of Q-statements which appears as Appendix D. The complete Q-sort instrument, including instructions for use and data sheets (minus the Q-sort deck of cards) is provided as Appendix E.

In each of the 10 inducement categories, 3 of the statements are positive and 2 are negative. This is partially in keeping with Goodling's (31) suggestion to maintain a balanced Q-sort. A complete balance could be achieved by merely increasing or decreasing the total number of alternatives until an even number is associated with each category. In the writer's opinion it is more realistic to maintain a slightly positive bias to conform to the concept of the "zone of indifference", originally coined by Barnard (32) in his discussions on authority. In the context of the present study, "zone of indifference" takes on more of the meaning given by March and Simon (33) in their treatment of internal organizational equilibrium.

The midpoint of the "zone of indifference" is interpreted to coincide with some positive value on the desirability scale. It is further postulated that the "zone of

indifference" will change with a change in the quality and quantity of perceived alternatives. As the number of alternatives decreases or become less desirable, the "zone of indifference" tends to expand, hence, there is less distinction between desirability and undesirability. Conversely, as more alternatives become available or as the desirability of alternatives increases, the distinction between desirability and undesirability becomes clearer.

Since a constant number of statements (alternatives) is provided in this Q-sort (Appendix D), the size of the "zone of indifference" has been fixed. Thus, the location for the "zone of indifference" on the desirability scale has been established. A quantitative measure of the midpoint of the "zone of indifference" is obtained by the method of scoring Q-sort responses.

Each response to a positive statement is scored according to its categorical ranking. That is, a positive statement ranked under category one receives a score of one; a positive statement ranked under category seven receives a score of seven, etc. Each negative statement is scored so that it carries equal weight with its equivalent positive statement. Thus, a negative statement ranked under category one receives a score of nine; a negative statement ranked under category nine receives a score of negative nine

(refer to Appendix E for the significance of categories one and nine).

In accordance with Equation (3), a measure of composite desirability for any category of inducement (potential motivating factor) is simply the algebraic sum of statement desirability measures. This assumes that the relationships of Equation (3) apply on the individual as well as on the organizational level.

With this scoring convention a maximum score of 44 could be obtained for any one category on each Q-sort. Similarly, the largest negative score would be negative 14, and a completely neutral ranking of all five Q-statements would yield a score of five. This neutral ranking score of five corresponds to the midpoint of the "zone of indifference". It follows that category scores (composite motivating factor scores) greater than or equal to five denote desirable attitudes and scores less than five denote undesirable attitudes.

Acquisition of Data

Data were acquired from two basic groups of individuals. One group was comprised of 26 senior and graduate level students in the College of Engineering at Oklahoma State University. The second group was comprised of 13

engineers with practical industrial experience ranging from 1 to 30 years and averaging 9 years. All participants were given a Q-sort deck and asked to perform three Q-sorts in accordance with the information provided in Appendix E. Data received from the 39 subjects represents a 78 percent return rate.

Analysis of Results

General Relationships

Average Q-scores for the 26 student respondents in each of 10 Q-sort categories are presented in Table VIII, Appendix F. To facilitate analysis and interpretation, these data are shown as separate Q-score profiles for each Q-sort in Tables VIX, X and XI, Appendix F.

Data indicates that students perceive their first job to represent a situation in which the "work itself", "achievement", "advancement", "working conditions", and "supervisory relationships" (in that order) are of primary importance. "Recognition" and "responsibility", ranked near the top as positive motivators for engineers and scientists in previous studies (11) (12), are ranked sixth and eighth, respectively, for beginning engineers.

With the simulation of more experience, the desire for "responsibility" increased significantly and the desire for

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evidenced, although "achievement" and the "work itself" are by far the most desirable Q-sort categories for the industrial respondents. It is important to note that "supervisory relationships" and "working conditions" ranked among the top five categories for the first and second Q-sorts, dropped to sixth and eighth, respectively, in the final sort. As with the student data, this relatively strong ranking of "working conditions" and "supervisory relationships" departs from previous results, Table I.

"Wage level" and "leisure" were consistently ranked ninth and tenth, respectively, on all industrial sorts. This would indicate that increased leisure, without a guaranteed wage, does not represent a desirable incentive for engineers. To illustrate, statement number 15 (thirty two hour work week with a 20 percent reduction in pay) was ranked "extremely undesirable" by 7.69 percent of the industrial respondents, while none ranked it as "extremely desirable".

The desire for increased responsibility and recognition with the passage of time, present in student data, was also clearly evident in industrial data. This is considered to be a natural consequence of professional growth and maturity. Closely associated with this trend is the increased desire for advancement with time. This increase was very significant for student respondents. Analysis of individual

Q-sort results indicates that statement number 34 (promotion within administrative ranks) was ranked "extremely desirable" by 12.82 percent of the student respondents. Extreme desire for promotion within technical ranks (statement number 42) was approximately one-half as great. Perhaps more significant is the extent of extremely undesirable attitudes toward statement number 71 (accept demotion to remain employed). This statement was ranked "extremely undesirable" by 17.30 percent of the student respondents and 21.79 percent of the industrial respondents. Many engineers in the aerospace industry have been faced with this alternative in recent years.

Detailed Comparison

Data appearing in Tables VIII and XII are combined in Figures 4-13, Appendix G. General trends in the data have been discussed, however, the relative spread in Q-score magnitudes is worthy of comment. Since average Q-scores are used in this analysis, samples from the same population should give similar results. The consistency of the difference between average Q-scores indicates that student and industrial samples are not representative of the same population. This implies that student and industrial data can not be combined to express a composite desirability function.

It is felt that the major reason for the difference in average Q-score magnitudes between the two samples lies with the inconsistency of student data. Examination of the Tables in Appendix G reveals that student desirability profiles vary considerably between sorts, whereas, industrial desirability profiles are relatively stable. In the writer's opinion, this reflects difficulty on the part of the student to project himself into the three and five year Q-sort time frames.

To test this assumption the Kendall coefficient of concordance (W) was computed for student and industrial samples (25). As computed, W_i expresses the degree of agreement between respondents in ranking 10 Q-sort categories for the i th Q-sort. For the student sample; $W_1=.345$, $W_2=.278$, and $W_3=.264$. For the industrial sample; $W_1=.422$, $W_2=.449$, and $W_3=.471$. In either case $d.f.=9$, $\chi^2_{.01} > 27.88$ at $p=.001$ and W_i is significant. All values for W are relatively low, indicating that respondents experienced difficulty in perceiving a consistent standard for ranking inducements. This difficulty is pronounced in student sample data. Values for W support the explanation given for differences observed in average Q-score magnitudes.

In representative applications of the Q-sort method, reliability coefficients for multiple sorts have been

reported in the range from .72 to .75 (29) (30). Using the Spearman rank correlation coefficient and data acquired by means of the test-retest approach, the estimated reliability coefficient for ranking the 50 Q-sort statements is .85.

In a similar manner, the estimated reliability coefficient for ranking the 10 inducements is .96 ($p < .01$).

In the mathematical development of the composite desirability function, two assumptions were imposed. First, it was required that sufficient resources be available to provide desired intrinsic inducements, and second, it was required that the desirability function be time invariant. The first assumption is applicable to the extent defined by H-3. The second assumption is no longer applicable because the empirically based Q-sort method (as modified herein) explicitly accounts for variation in composite desirability with time. It follows that a direct measure of composite desirability for an organization is given by the sum of N inducement desirabilities for K employees where desirability levels are expressed as ranked Q-scores. For the Q-score data acquired during this study, the measures of composite desirability for 10 intrinsic inducements are given in Figure 14, Appendix G. The indicated Q-score magnitude has no significance in the absolute sense because it is strictly dependent upon the scoring criteria used. However, relative

changes in magnitude with time and/or employees is a direct measure of the change in employee desirability for available intrinsic inducements. The change in employee desirability for intrinsic inducements over time provides management with information needed to administer incentives in an effective and efficient manner.

Implications

1. Clearly, satisfaction derived from the receipt of intrinsic inducements is a measure of need fulfillment after the fact. A motivation strategy based on maximizing employee satisfaction relies essentially on trial and error. If the desired inducement in the desired amount for the desired duration is offered to an employee, in all probability the employee will be satisfied. If these conditions are not met, in all probability the employee will not be satisfied and the organization will have to change their inducements or find employees who will be satisfied with presently available inducements. In either case, significant costs may be incurred by the organization. It appears to the writer that a much more logical and economically sound approach would be to emphasize assessment of the relative

desirability for available intrinsic inducements. In this manner, management could acquire the information necessary to formulate an inducements package that is responsive to the future needs of present employees at minimum risk to the organization (see H-1-A and H-1-C).

2. Q-sort data collected from student and industrial samples clearly illustrates that the relative magnitudes of an individual's desirability for intrinsic inducements changes with time on the job. That is, as an individual's career develops, his needs and desires for intrinsic inducements change to reflect a redirection in personal and professional aspirations (see H-4-A).
3. The redirection in personal and professional aspirations results from a combination of professional growth, experience, and personal maturity. As a result, an individual's aspirations tend to become polarized. This channeling of interests causes an individual to focus his needs and desires on a rather select grouping of inducements; hence, the desirability for those inducements will increase in magnitude. Since composite desirability is measured by the sum of desirability levels for individual

inducements, as defined by Equation (3), composite desirability will also increase in magnitude. This tendency to maximize composite desirability with increased professional growth, experience, and personal maturity is illustrated by comparing data acquired from student and industrial samples. An overall trend of this relationship is shown in Figure 14 (see H-4-B).

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

During the early part of this century, management placed emphasis on maximizing employee efficiency in accordance with the principles of scientific management. Although a stated aim of the scientific management movement was to achieve maximum prosperity for the employee, the real needs of employees were virtually ignored.

Scientific management philosophies gave way to a human relations approach. This philosophy was based on the premise that humanistic treatment of employees would increase morale with attendant increases in productivity. The human relations approach has been primarily criticized because it did not provide for the economic requirements of the organization.

Proponents of the behavioral science movement claim to have overcome the shortcomings of early philosophies while maintaining their advantages. Thus, a management philosophy

has been formulated which, in theory, is economically sound and responsive to employee needs. The systems approach enables behavioral science principles to be made operational within the construct of equilibrium strategies for complex organizations.

The integration and coordination of systems and behavioral science concepts presents a number of challenges for management; including concern for the relevance of traditional motivation theories, and the impact on structural and functional attributes of the organization. Development of a method for identifying and analyzing these attributes requires the definition of the dimensions of organizations. These dimensions are expressed in terms which directly relate to available intrinsic inducements.

The effectiveness of the intrinsic inducements is estimated in terms of their desirability as perceived by specified categories of employees (engineers and scientists in this study). Knowledge of the change in composite desirability with employees over time enables management to formulate policies for efficiently administering incentives. An application of modified Q-sort methodology provides data necessary to implement the efficiency criterion.

Conclusions

The prerequisites for developing an efficiency criterion for administering incentives for engineers and scientists are:

1. the selection and implementation of an equilibrium strategy for the organization which, in turn, largely determines the nature of management functions and the organization's structure;
2. the identification with a general philosophy on human behavior which relates to engineers and scientists in the work environment, and which is compatible with functional and structural modifications to the organization; and
3. the inclusion of time as a parameter in any method which is used for assessing employee desirability for specified intrinsic inducements.

It is concluded that these prerequisites are satisfied through the application of systems concepts, behavioral science concepts, and composite desirability concepts. This study has shown that behavioral science and systems concepts form a compatible construct for use in developing and implementing motivation strategies. Further, it has been shown that traditional Q-sort methodology can be modified to provide a time-based measure of an employee's relative

desirability for a variety of plausible inducements. The basic concepts developed and demonstrated in this study are considered viable for ascertaining measures of composite desirability from individual employees or from categorical groupings of employees.

Recommendations

Suggestions for further study in this area are logically made in terms of applications and theoretical development. With respect to applications, the following specific suggestions are offered:

1. The modified Q-sort technique could be used in studying other categories of employees including production and assembly personnel. This would allow further comparison with previous studies.
2. Experiments could be conducted to see if variations in Q-sort time frames significantly affect data. Perhaps meaningful data could be acquired by extending or shortening the simulated time between sorts.
3. A measure of satisfaction could easily be obtained by asking respondents to perform a Q-sort in which some previous time frame is simulated. This is one way of increasing the accuracy for the estimated

duration of an attitude.

4. Ultimately, the technique should be applied on-the-job over a period of years. This is the only way the real utility of the technique can be determined.

With respect to theoretical development, the major recommendation is to extend the formulation to the third dimension. As formulated in this study, measures of composite desirability are obtained for equal amounts of inducements over time. If the magnitude of specific inducements were varied, an entirely different overall result might occur. For example, a four percent raise may not be considered extremely desirable with respect to other inducements, but an eight percent raise may be considered the most desirable of any inducement offered.

The resulting model is envisioned as a surface in incentive-desirability-time space, wherein, the loci of desirability functions is given by Equation (6), Chapter V. Generation of the necessary data would require a rather elaborate Q-sort or a series of Q-sorts in which each sort relates to a specified set of inducement magnitudes.

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APPENDIX A

THE IMPACT OF SYSTEMS CONCEPTS
ON ORGANIZATIONS

THE IMPACT OF SYSTEMS CONCEPTS ON ORGANIZATIONS

The structure of an organization has a tremendous impact on the efficiency of traditional management functions; e.g., planning, controlling, and communicating, etc. It is concluded by the writer that an organization's structure is a strategic factor to the organizations efficiency, success, and ultimate survival.

If the organization is inflexible, traditional management functions will be restricted. If, on the other hand, the organization is flexible and responsive to a dynamic environment, the possibility of successful operation within the realm of the traditional management functions will be greatly enhanced.

Organizational Structure

Traditional organizations were characterized by a well defined, rigid framework (structure) of concepts which include the scalar principle of superior-subordinate relationships; strong, centralized authority; specialization of work; relatively narrow span of control; and clear delineation between line and staff relationships. Organizations of this type stressed formal authority as a means of controlling the actions of contributors to the organization. This

results in a theory of motivation that Douglas McGregor called Theory X. The result of applying Theory X is that people will likely do what is necessary and nothing more. There will be no incentive to promote personal or organizational goals.

The size, complexity and diversification of modern organizations has created a situation in which it would be very difficult to enforce a policy of strong control even if it were desired. Thus, an alternative approach to controlling employee contributions must be adopted. It has been suggested that one means is through internalized motivation wherein individual goals are integrated with organizational goals. This parallels the concepts of McGregor's Theory Y.

Associated with and complementary to this approach in controlling employees, is the somewhat more realistic systems oriented concept of organization. In this approach the individual, the informal work groups, the formal structure, and the environmental system are viewed as a series of interconnected elements. One means of approaching the desired result, wherein the individual and his work are a part of the same integrated entity, is to establish a project management type of organization. In this context, project management should be viewed as a means to an end - the end being a systems oriented organization.

In theory, a project management organization can be characterized as an organization within an organization headed by one man who has complete responsibility for all phases of the project. The members of the project organization comprise a team of diversified specialists who, ideally, have the training and experience necessary to accomplish the project objectives with minimal reliance on other elements of the parent organization. In practice, most project organizations fall far short of complete independence; hence, to function, they must cut across the structure of the parent organization. This creates a certain amount of conflict with normal operating procedures.

The extent of conflict surrounding a project organization is normally determined by the parent organizations attitude and understanding of the project function, and by involved personalities. Since the project manager has no direct authority outside of the project organization (unless the project is very small or the company is small), he must rely primarily on personal relationships in acquiring assistance from members outside of the project organization.

The lack of a broad base of authority for project managers can be a serious drawback and may ultimately contribute to failure of the project. However, in the writer's opinion, the major cause of project failure lies with poor

support from top management and not with inherent weaknesses of project management techniques. Partial support for this opinion is given by Stewart¹.

Understandably; project managers face some unusual problems in trying to direct and harmonize the diverse forces at work in project situations. Their main difficulties, observation suggests, arise from three sources; organizational uncertainties, unusual decision pressures, and vulnerability to top-management mistakes.

In an attempt to alleviate some of the conflicts between project and functional managers, without sacrificing the major benefits of project organizations, some companies have instituted a matrix form of management. This type of organization is characterized by a grid structure which integrates project and functional elements. Proponents feel that the matrix approach creates a balance of power between project and functional managers while maximizing the utility of depth and breadth within the company.

Reeser² distinguishes a matrix from a project management organization primarily on the basis of the degree of autonomy afforded each. He identifies a project organization as having direct control over the bulk of its human and material resources, while a matrix organization must borrow the bulk of resources needed to accomplish its function. With this distinction, and in view of the earlier observations concerning the difference between theoretical and

actual project organizations, it is relatively safe to assume that the vast majority of project type organizations adhere to the restraints of matrix management. Thus, the writer concludes that although the theoretical constructs differ for project and matrix organizations, the operational construct of both follow matrix guidelines.

The moderate success of project management at the operational and functional levels of management does not guarantee success at the general (top) level. It is not enough for middle and first level managers to attempt to integrate the elements of the physical flow network (i.e., the flow of materials, manpower, money, and facilities) under their jurisdiction. Although beneficial, this represents a piecemeal approach to the solution of a problem which can only be effectively solved on a much larger scale. The ultimate test for the compatibility of project and systems philosophies is for management at the general level to plan, organize, control, and direct the physical flow network within the firm in a manner which will enable rapid adjustment and timely completion of mission oriented endeavors.

The impetus for eliminating the inherently conflicting objectives of traditional subsystems such as production control, quality control, inventory control, cost control, etc., must come from management at the general level.

Unification of the objectives of these diverse subsystems requires broad, overall guidance predicated on the attainment of goals for the total system. A philosophy on organization which supports systems concepts at the general level of management will have to be one which facilitates the integration of all subsystems into a total system which is self-regulating, self-learning, and partially closed.

Management Functions

Planning and Controlling

The requirement for integration of self-regulating, self-learning, and system closure concepts is really a statement of managements planning and controlling philosophy for a systems organization. Under a systems concept, planning will occur at three levels within the organization.³

The first level is master planning. This represents planning efforts at the highest levels, wherein broad policies, goals, and objectives are, by nature, rather unstructured and difficult to quantify.

The second level is resource-allocation planning. At this level of planning, emphasis should be placed on adapting resources for project and facilitating systems. Much of the information received from the master planning effort can be quantified for processing by computer oriented techniques.

The third and lowest level is operations planning. The day-to-day planning for each project system is normally of a repetitive nature, highly quantifiable, and easily programmed. Planning decisions at this level should be made by lower or middle management personnel with the aid of computers.

Through a systems approach, control of individual contributions to the cooperative system is achieved by means of what various management experts have called "consensus collaboration", or "internalized motivation". The objective of these concepts is to integrate personal and organization goals through the application of behavioral science concepts.

Communicating

Communication is the essential function of management regardless of the governing organization construct. Although the task of communicating is universal, the methods employed and the difficulties encountered are constantly changing. This dynamic aspect of communication results from alteration of technological and behavioral variables within the organizations environment.

The basic communications system model includes the source, the message, the transmitter, the receiver, and extraneous noise. In this context, noise refers to any

condition which interferes with the flow of information between source and receiver. Of course one objective of communication system design is to minimize noise consistent with operational and economic constraints. In organization terminology this means developing and transmitting information pertinent for decision making while screening out that which is unwanted or unnecessary.

An organization must be developed along lines which facilitate communications. It is a simple fact that formal complex organizations cannot function without formal communications. The relationship between informal organization channels and formal communication channels is not well defined or consistent in traditional organization structures. This situation exists, in part, because informal information tends to flow between "actual" decision centers in an organization whereas the traditional hierarchial structure allows only a vertical flow of formal information. This is a very serious restriction in complex, multi-disciplined organizations.

Ideally, the informal and formal organizations are one in the same. This requires that the communication system and the organizations structure be complementary. If this compatibility is realized then the potential for successfully planning and controlling an organizations activities is enhanced.

Application of systems concepts to communication and information processes requires consideration of at least three information subsystems.⁴ The "environmental subsystem" provides information on broad social, cultural, political, and economic parameters. This information is primarily used for long range planning. The "competitive subsystem" provides information on competitive and producer-consumer relationships. This information is primarily used for short range planning. The "internal subsystem" is the one most visible in traditional management practices. This subsystem provides information on the objectives, policies, and functional relationships within an organization. Information of this nature is primarily used for controlling. The accumulation, integration, and evaluation of information supplied by these information subsystems is essential to the implementation of the systems approach.

Implications

1. The rigidity and specialization of traditional industrial organizations renders them ineffective for dealing with rapid changes in technological or social constraints. This ineffectiveness can be significantly reduced by modifying planning, controlling, and communicating functions such that the organization strives to become self-regulating,

self-learning, and partially closed. These organizational attributes have always been desired by management, however, it is only through the integrative and coordinative aspects of systems concepts that these attributes approach a state of operationality (see H-4-B).

2. The functional modifications required by the systems approach are significant enough that they cannot be implemented without making structural changes to the organization. This is due primarily to the inherent conflicts within process oriented traditional organizations. One effective way to minimize these conflicts, without creating a situation that is incompatible with functional objectives, is to adopt project management philosophies (see H-4-B).

The material presented in this Appendix outlines the basic requirements for implementing systems concepts in traditional organizations and suggests a catalyst for implementation; i.e., project management. Once required modifications have been implemented, the structural attributes of the organization can be identified. A procedure for doing this is presented in Chapter IV.

FOOTNOTES

¹J. A. Stewart, "Why Does Project Management Fail?," Management Review, (January, 1970), pp. 54-68.

²C. Reeser, "Some Potential Human Problems of the Project Form of Organization," Academy of Management Journal, (December, 1969), pp. 459-467.

³R. A. Johnson, F. E. Kast, and J. E. Rosenzweig, The Theory and Management of Systems (New York, 1967), pp. 406-408.

⁴Ibid., p. 108.

APPENDIX B

GROUP DIMENSIONS QUESTIONNAIRE

GROUP DIMENSIONS QUESTIONNAIRE

The following questionnaire has been designed to measure certain organizational and behavioral characteristics. The statements in the questionnaire are not intended to imply whether the characteristics are desirable or undesirable. You should attempt to respond to each statement as you "perceive the actual situation" rather than as you "think it should be".

In each statement, an organizational unit has been denoted a "group". You should interpret your "group" as the largest organizational unit of which you are a member, and for which you have sufficient knowledge to answer all questions. It is important that you identify with the same "group" in answering all questions. If this is not possible please note exceptions on the questionnaire.

Record your response in the designated space at the end of each statement, according to the key provided at the top of each page. Please record only one response for each statement.

Neither your identity nor your organizations identity will be associated with specific results of this survey. However, in order to facilitate analysis and interpretation of survey data it would be appreciated if you would provide the following information:

Your title or position: _____

The "group" title or function: _____

The size of the "group" (No. employees): _____

Your organizations function or product: _____

YOUR COOPERATION WILL BE SINCERELY APPRECIATED!

KEY: (A) Definitely True (D) Mostly False
(B) Mostly True (E) Definitely False
(C) Both True and False

1. The group has well understood but unwritten rules concerning member conduct. ()
2. Members fear to express their real opinions. ()
3. The only way a member may leave the group is to be expelled. ()
4. No explanation need be given by a member wishing to be absent from the group. ()
5. An individual's membership can be dropped should he fail to live up to the standards of the group. ()
6. Members of the group work under close supervision. ()
7. Only certain kinds of ideas may be expressed freely within the group. ()
8. A member may leave the group by resigning at any time he wishes. ()
9. A request made by a member to leave the group can be refused. ()
10. A member has to think twice before speaking in the group's meetings. ()
11. Members are occasionally forced to resign. ()
12. The members of the group are subject to strict discipline. ()
13. The group is rapidly increasing in size. ()
14. Members are constantly leaving the group. ()
15. There is a large turn over of members within the group. ()
16. Members are constantly dropping out of the group but new members replace them. ()

KEY: (A) Definitely True (D) Mostly False
(B) Mostly True (E) Definitely False
(C) Both True and False

17. During the entire time of the group's existence no member has left. ()
18. The opinions of all members are considered as equal. ()
19. The group's officers hold a higher status in the group than other members. ()
20. The older members of the group are granted special privileges. ()
21. The group is controlled by the actions of a few members. ()
22. Every member of the group enjoys the same group privileges. ()
23. Experienced members are in charge of the group. ()
24. Certain problems are discussed only among the group's officers. ()
25. Certain members have more influence on the group than others. ()
26. Each member of the group has as much power as any other member. ()
27. An individual's standing in the group is determined only by how much he gets done. ()
28. Certain members of the group hold definite office in the group. ()
29. The original members of the group are given special privileges. ()
30. The group works independently of other groups. ()
31. The group has support from outside. ()

KEY: (A) Definitely True (D) Mostly False
(B) Mostly True (E) Definitely False
(C) Both True and False

32. The group is an active representative of a larger group. ()
33. The group's activities are influenced by a larger group of which it is a part. ()
34. People outside of the group decide on what work the group is to do. ()
35. The group follows the examples set by other groups. ()
36. The group is one of many similar groups which form one large organization. ()
37. The things the group does are approved by a group higher up in the organization. ()
38. The group joins other groups in carrying out its activities. ()
39. The group is a small part of a larger group. ()
40. The group is under outside pressure. ()
41. Members are disciplined by an outside group. ()
42. Plans of the group are made by other groups above it. ()
43. The members allow nothing to interfere with the progress of the group. ()
44. Members gain a feeling of being honored by being recognized as one of the group. ()
45. Membership in the group is a way of acquiring social status. ()
46. Failure of the group would mean little to individual members. ()

KEY: (A) Definitely True (D) Mostly False
(B) Mostly True (E) Definitely False
(C) Both True and False

47. The activities of the group take less than ten percent of each member's waking time. ()
48. Members gain in prestige among outsiders by joining the group. ()
49. A mistake by one member of the group might result in hardship for all. ()
50. The activities of the group take up over ninety percent of each member's waking time. ()
51. Membership in the group serves as an aid to vocational advancement. ()
52. Failure of the group would mean nothing to most members. ()
53. Each member would lose his self-respect if the group should fail. ()
54. Membership in the group gives members a feeling of superiority. ()
55. The activities of the group take up over half the time each member is awake. ()
56. Failure of the group would lead to embarrassment for members. ()
57. Members are not rewarded for effort put out for the group. ()
58. There is a high degree of participation on the part of members. ()
59. If a member of the group is not productive he is not encouraged to remain. ()
60. Work of the group is left to those who are considered most capable for the job. ()

KEY: (A) Definitely True (D) Mostly False
(B) Mostly True (E) Definitely False
(C) Both True and False

61. The group has a reputation for not getting much done. ()
62. Each member of the group is on one or more active committees. ()
63. Members are interested in the group but not all of them want to work. ()
64. The work of the group is well divided among members. ()
65. Every member of the group does not have a job to do. ()
66. The work of the group is frequently interrupted by not having anything to do. ()
67. There are long periods during which the group does nothing. ()
68. The group is directed toward one particular goal. ()
69. The group divides its efforts among several purposes. ()
70. The group operates with sets of conflicting plans. ()
71. The group has only one main purpose. ()
72. The group knows exactly what is to be done. ()
73. The group is working toward many different goals. ()
74. The group does many things that are not directly related to its main purpose. ()
75. Each member of the group has a clear idea of the group's goals. ()

KEY: (A) Definitely True (D) Mostly False
(B) Mostly True (E) Definitely False
(C) Both True and False

76. The objective of the group is specific. ()
77. Certain members meet for one thing and others for a different thing. ()
78. The group has major purposes which to some degree are in conflict. ()
79. The objectives of the group have never been clearly recognized. ()
80. The group is very informal. ()
81. A list of rules and regulations is given to each member. ()
82. The group has meetings at regularly scheduled times. ()
83. The group is organized along semi-military lines. ()
84. The group's meetings are not planned or organized. ()
85. The group has an organization chart. ()
86. The group has rules to guide its activities. ()
87. The group is staffed according to a table of organization. ()
88. The group keeps a list of names of members. ()
89. Group meetings are conducted according to Robert's Rules of Order. ()
90. There is a recognized right and wrong way of going about activities. ()
91. Most matters that come up before the group are voted upon. ()

KEY: (A) Definitely True (D) Mostly False
(B) Mostly True (E) Definitely False
(C) Both True and False

92. The group meets any place that happens to be handy. ()
93. Members of the group are from the same social class. ()
94. The members of the group vary in amount of ambition. ()
95. Some members are interested in altogether different things than other members. ()
96. The group contains members with widely varying backgrounds. ()
97. The group contains whites and negroes. ()
98. Members of the group are all about the same ages. ()
99. A few members of the group have greater ability than others. ()
100. A number of religious beliefs are represented by members of the group. ()
101. Members of the group vary greatly in social background. ()
102. All members of the group are of the same sex. ()
103. The ages of members range over a period of at least 20 years. ()
104. Members come into the group with quite different family backgrounds. ()
105. Members of the group vary widely in amount of experience. ()
106. Members vary in the number of years they have been in the group. ()

KEY: (A) Definitely True (D) Mostly False
 (B) Mostly True (E) Definitely False
 (C) Both True and False

107. The group includes members of different races. ()
108. Members of the group have more than one immediate supervisor. ()
109. The group has a well defined function. ()
110. The group is responsible for a specific project. ()
111. Control of computer facilities is centralized within the groups environment. ()
112. Use of computer facilities is decentralized within the groups environment. ()
113. Responsibility for assigning personnel work assignments is retained within the group. ()
114. The group supervisor or manager has overall responsibility for maintaining work schedules for group efforts. ()
115. The group supervisor or manager has overall responsibility for controlling expenditures of money and environmental resources. ()
116. Timely and accurate management planning and control information is provided to the group. ()
117. Information needed to fulfill the groups operating, legal, governmental, and financial requirements is provided to the group. ()
118. Various elements or systems within the organization environment of which the group is a member are interlocked to attain a total system. ()
119. Integrated data processing techniques are employed throughout the organizational environment of which the group is a member. ()
120. The organizational environment of which the group is a member is viewed as an integrated entity. ()

APPENDIX C

ORGANIZATIONAL DIMENSIONS QUESTIONNAIRE

ORGANIZATIONAL DIMENSIONS QUESTIONNAIRE

The following questionnaire has been designed to measure certain characteristics of organizations. The statements in the questionnaire are not intended to imply whether the characteristics are desirable or undesirable. You should attempt to respond to each statement as you perceive the "actual", rather than the "ideal", situation.

The organization referred to in each statement should be interpreted as the largest organizational unit of which you are a member, and for which you have sufficient knowledge to respond to all statements in the questionnaire. It is important that you identify with the same organizational unit when responding to all statements. If this is not possible, please note exceptions on the questionnaire.

Record your response in the designated space at the right of each statement according to the key provided at the top of each page. Please record only one response for each statement.

Neither your identity nor your organizations identity will be disclosed in conjunction with the results of this survey without your prior written consent. In order to facilitate the analysis and interpretation of survey results it would be appreciated if you would provide the information requested on the following page.

BACKGROUND INFORMATION

NOTE: Before providing any information requested below,
please read all statements in the questionnaire.

The organizations title or function: _____

Number of people in organization: _____

Age of organization (years, months): _____

Name of parent organization: _____

Your title or position in the organization: _____

Time in present position (years, months): _____

Total work experience (years, months): _____

Work experience in present organization (years, months):

KEY: (A) Definitely True (D) Mostly False
(B) Mostly True (E) Definitely False
(C) Both True and False

1. The organization is functionally dependent upon a larger organization. ()
2. The organization's activities are directly influenced by another organization. ()
3. The organization joins with other organizations to carry out its primary activities. ()
4. Members of the organization are disciplined by external organizations. ()
5. Detailed methods of operation for the organization are determined by its members. ()
6. Primary technical and administrative support is provided to the organization from an external source. ()
7. The organization is completely responsible for the formulation and implementation of its activities. ()
8. Members of the organization perform their tasks according to operating procedures established by another organization. ()
9. The organization contains members with widely varying social backgrounds. ()
10. Members of the organization vary widely in amount of experience. ()
11. The amount of time spent in the organization varies widely between members. ()
12. Certain members of the organization have greater professional ability than others. ()
13. Members of the organization are recognized for their unique abilities. ()

KEY: (A) Definitely True (D) Mostly False
(B) Mostly True (E) Definitely False
(C) Both True and False

14. Members of the organization have common interests regarding technical matters. ()
15. Uniformity with respect to socio-economic standards are considered important for membership in the organization. ()
16. Conformance to a common technical ideology is the primary means by which members gain recognition within the organization. ()
17. If a member of the organization is not productive he is looked upon with disfavor by his peers. ()
18. Certain members of the organization continually carry a larger work load than other members. ()
19. There are long periods of time during which the organization does nothing. ()
20. Members of the organization are selected on the basis of their proven technical ability in a relatively narrow discipline. ()
21. The organization requires a high degree of participation from all members if it is to succeed. ()
22. Members of the organization are achievement motivated. ()
23. The amount of time that a member devotes to activities of the organization is primarily determined by his allegiance to other organizations. ()
24. The organization has a reputation for not getting much done. ()
25. The organization is directed toward one particular goal. ()

KEY: (A) Definitely True (D) Mostly False
(B) Mostly True (E) Definitely False
(C) Both True and False

26. The organization operates within sets of conflicting constraints. ()
27. Each member knows what the organization is trying to accomplish. ()
28. The organization performs many activities that are not directly related to its main purpose. ()
29. Members feel that the immediate objectives of the organization will be attained during the period of their membership. ()
30. Specific goals of the members of the organization differ. ()
31. Each member of the organization performs tasks for which he has received special training. ()
32. Members do not fully understand how their individual contributions affect organizational goals. ()
33. Timely and accurate management planning and controlling information is available to the organization. ()
34. Information needed to fulfill the organizations operating, legal, governmental, and financial requirements is available. ()
35. Various elements or systems within the environment in which the organization must function are interlocked to attain a total system. ()
36. Integrated data processing techniques are stressed throughout the environment in which the organization must function. ()
37. The environment in which the organization must function is viewed as an integrated entity. ()

APPENDIX D

Q-SORT STATEMENTS

Code
Number*

Q-Sort
Statement

Achievement

12 Incomplete work assignment
89 Professional development
54 Individual contribution to group effort
97 Marginal performance record
74 Pride in accomplishment

Responsibility

37 Freedom to plan own work
94 Close supervision on the job
51 Autonomous work environment
17 Assignment of important work
10 Subordinate role in work assignment

Advancement

69 Maintain present position
42 Promotion within technical ranks
71 Accept demotion to remain employed
66 Higher social standing
34 Promotion within administrative ranks

Recognition

04 Publication of work
85 Participate in technical symposium
19 Lack of recognition by co-workers
53 Public service leadership
63 Not considered an expert in field

Work Itself

80 Challenging work assignment
67 Repetitive task assignment
22 Purpose of assigned task not clear
92 State-of-the-art work activity
16 Self-satisfying work

Wage Level

52 Increase in salary (6% of base wage)
44 Maintain higher wage than members of peer group
77 Shift premium for night work
27 Loss of premium pay due to reduced overtime
93 Across-the-board wage freeze

<u>Code Number</u>	<u>Q-Sort Statement</u>
<u>Leisure</u>	
60	Moonlighting sanctioned by employer
78	Provision for time off without pay
70	Increased vacation time (one week more)
33	Four-ten hour days per week (same pay)
15	Thirty two hour work week with a 20% reduction in pay
<u>Working Conditions</u>	
91	Clean, comfortable working conditions
14	Modern office furnishings
59	Noisy work environment
25	Inadequate temperature control
20	Flexible daily schedule
<u>Supervisory Relationships</u>	
47	Friendliness of supervision
75	Technical competence of supervision
64	Administrative competence of supervision
72	Reduced delegation of authority
95	Partiality exhibited by supervision
<u>Company Policy</u>	
50	Equitable salary administration program
45	Communications from top management
08	Liberal educational benefits
55	Marginal fringe benefits
79	Detailed operating procedures

* Code numbers were selected from a random number table. These numbers appear with the proper statement on each card in the Q-sort deck.

APPENDIX E

Q-SORT INSTRUCTIONS AND DATA SHEETS

NATURE AND PURPOSE OF STUDY

The attitude that an individual has toward his job results from many conditions occurring both on and off the job. In general, this attitude or feeling toward a job varies between individuals and varies with time for each individual.

This test instrument has been designed to measure the extent of satisfaction that individuals derive from their job when confronted with specified job-related conditions that are time dependent. The extent of satisfaction is expressed in terms of varying degrees of desirability associated with each condition.

A great many of the conditions associated with the work environment can be controlled or significantly influenced by management. This influence is realized through the controlled distribution of incentives to employees. The results of this study will tend to indicate the nature and magnitude of those incentives which promote conditions on the job perceived by employees to offer the greatest amount of satisfaction for the longest period of time.

BACKGROUND INFORMATION

Neither your identity nor your organizations identity will be disclosed in conjunction with the results of this study. However, in order to facilitate the analysis and interpretation of study results, it would be appreciated if you would provide the information requested below:

Name: _____ Phone No: _____

Address: _____

Name of organization (if employed): _____

Your title or position (if employed): _____

Experience in present position (years, months): _____

Total work experience (years, months): _____

Student classification (Grad., Sr., etc.): _____

Major area of study: _____

PROCEDURE

The information that you will need in order to participate in this experiment is provided on a deck of 59 small cards (50 white, 9 orange). A brief statement of a job-related condition or situation is printed on each white card. The two digit number appearing in the upper right hand corner of each white card is a randomized code which has no relation to the printed statement. A number between one and nine, together with a descriptive phrase, is printed on each orange card. These numbers and descriptions constitute nine categories of desirability.

The general procedure is to sort the 50 statements (cards) into 9 categories in a manner which reflects your relative desirability for the statements. You are asked to complete this sorting procedure three times according to the instructions provided under Sort 1, Sort 2, and Sort 3.

Begin by placing each orange card in a row on a flat surface with card number one at the left and card number nine on the right. These nine cards constitute the headings for the nine categories of desirability.

The procedure for actually sorting the 50 cards is optional; however, it is suggested that you begin by reading all statements and separating the corresponding cards into a "desirable" and an "undesirable" group. From each group select the two cards which go in categories one and nine. Proceed in this manner, working from the ends of the distribution toward the center. It is best not to cover one card with another once sorting has begun. When all 50 cards have been sorted make any changes that you desire as long as you maintain the specified number of cards in each category.

When you are satisfied that the cards have been sorted to the best of your ability, record the number on each white card in the appropriate space on the data sheet. The relative position of cards under each category heading is not important; however, you must be careful to assure that the number on each white card is recorded under it's proper category and on the proper data sheet. When you have completed one sort and have recorded the results on the data sheet, pick up the white cards, shuffle them, and complete another sort in accordance with the appropriate directions.

Sort 1

If you are currently employed or have actual work experience and are presently in school, complete this first sort for your appropriate work environment. That is, the first sort should reflect the work environment of which you are familiar.

If you are a student who has no practical work experience, assume that you are now on your first job. Project yourself into that work environment as you perceive it to be after approximately one year of experience. Assume that the total work environment is satisfactory, that is, you are reasonably happy with your job and have no immediate desire to seek work elsewhere.

Sort 2

Assume that those conditions which you selected as extremely desirable on Sort 1 have been realized. Three years have passed since Sort 1 was completed. Assume that you are still reasonably happy with your job and have no immediate plans to seek work elsewhere. Complete Sort 2 under these simulated work conditions.

Sort 3

Assume that those conditions which you selected as extremely desirable on Sort 2 have been realized. Two years have passed since Sort 2 was completed, thus, five years have passed since Sort 1 was completed. As before, assume that you are reasonably happy with your job and have no immediate desire to seek work elsewhere. Complete Sort 3 under these simulated conditions.

SORT 1

(Time frame 0 years)

1 2 3 4 5 6 7 8 9
Extremely Highly Moderately Fairly Neutral Fairly Moderately Highly Extremely
← Undesirable → ← Desirable →

_____	_____	_____	_____	_____	_____	_____	_____	_____
(2)	_____	_____	_____	_____	_____	_____	_____	(2)
	(3)	_____	_____	_____	_____	_____	(3)	
		_____	_____	_____	_____	_____		
		_____	_____	_____	_____	_____		
		(6)	_____	_____	_____	(6)		
			_____	_____	_____			
			_____	_____	_____			
			(9)	_____	_____	(9)		
				(10)	_____			

SORT 2

(Time frame 3 years)

1	2	3	4	5	6	7	8	9
Extremely	Highly	Moderately	Fairly	Neutral	Fairly	Moderately	Highly	Extremely
← Undesirable →					← Desirable →			
_____	_____	_____	_____	_____	_____	_____	_____	_____
(2)								(2)
	(3)						(3)	
		(6)				(6)		
			(9)		(9)			
				(10)				

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APPENDIX F

TABULATION OF Q-SORT DATA

TABLE VIII
 AVERAGE Q-SCORES FOR STUDENT SAMPLE

Q-Statement Categories	Average Q-Scores		
	Time Now	Three Years From Now	Five Years From Now
Achievement	32.2	29.5	29.8
Advancement	30.7	32.2	33.4
Company Policy	15.5	18.7	19.9
Leisure	20.9	21.3	21.1
Recognition	27.8	28.3	28.7
Responsibility	25.6	27.3	30.3
Supervisory Relationships	29.3	29.8	28.1
Wage Level	26.3	26.5	26.1
Working Conditions	30.5	29.9	29.4
Work Itself	32.8	32.9	32.5

TABLE IX

Q-SCORE PROFILE FOR STUDENT SAMPLE ON FIRST SORT

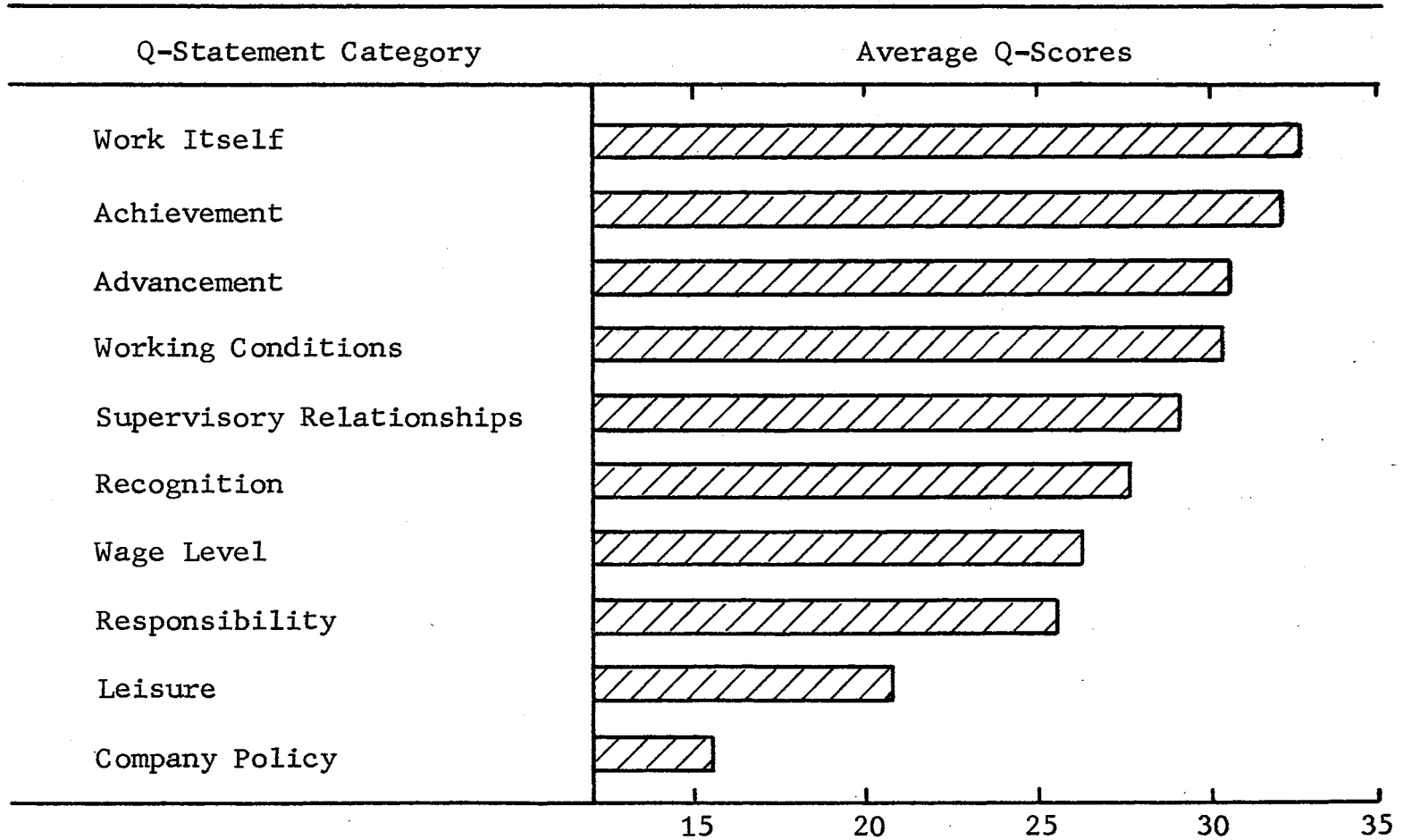


TABLE X

Q-SCORE PROFILE FOR STUDENT SAMPLE ON SECOND SORT

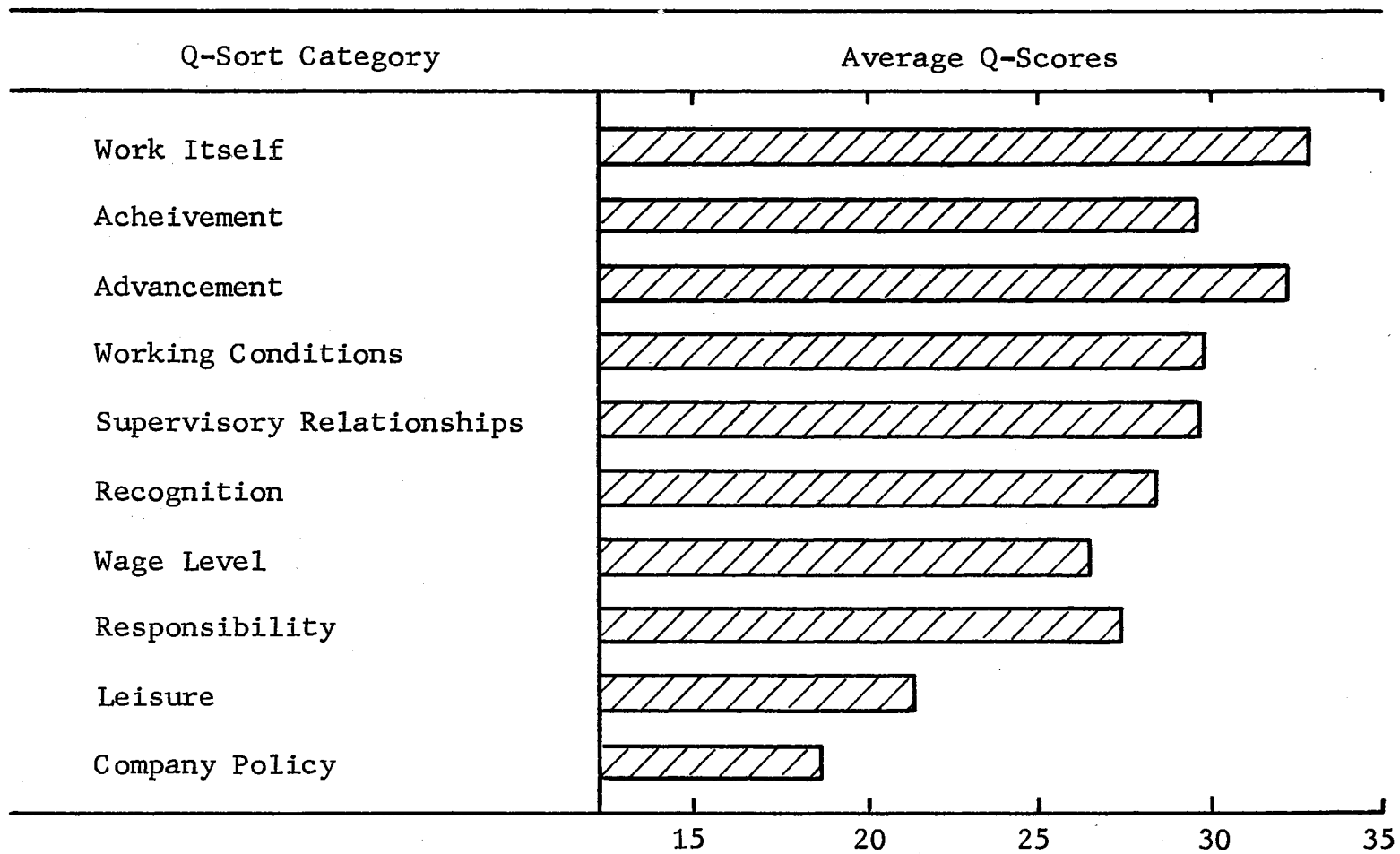


TABLE XI

Q-SCORE PROFILE FOR STUDENT SAMPLE ON THIRD SORT

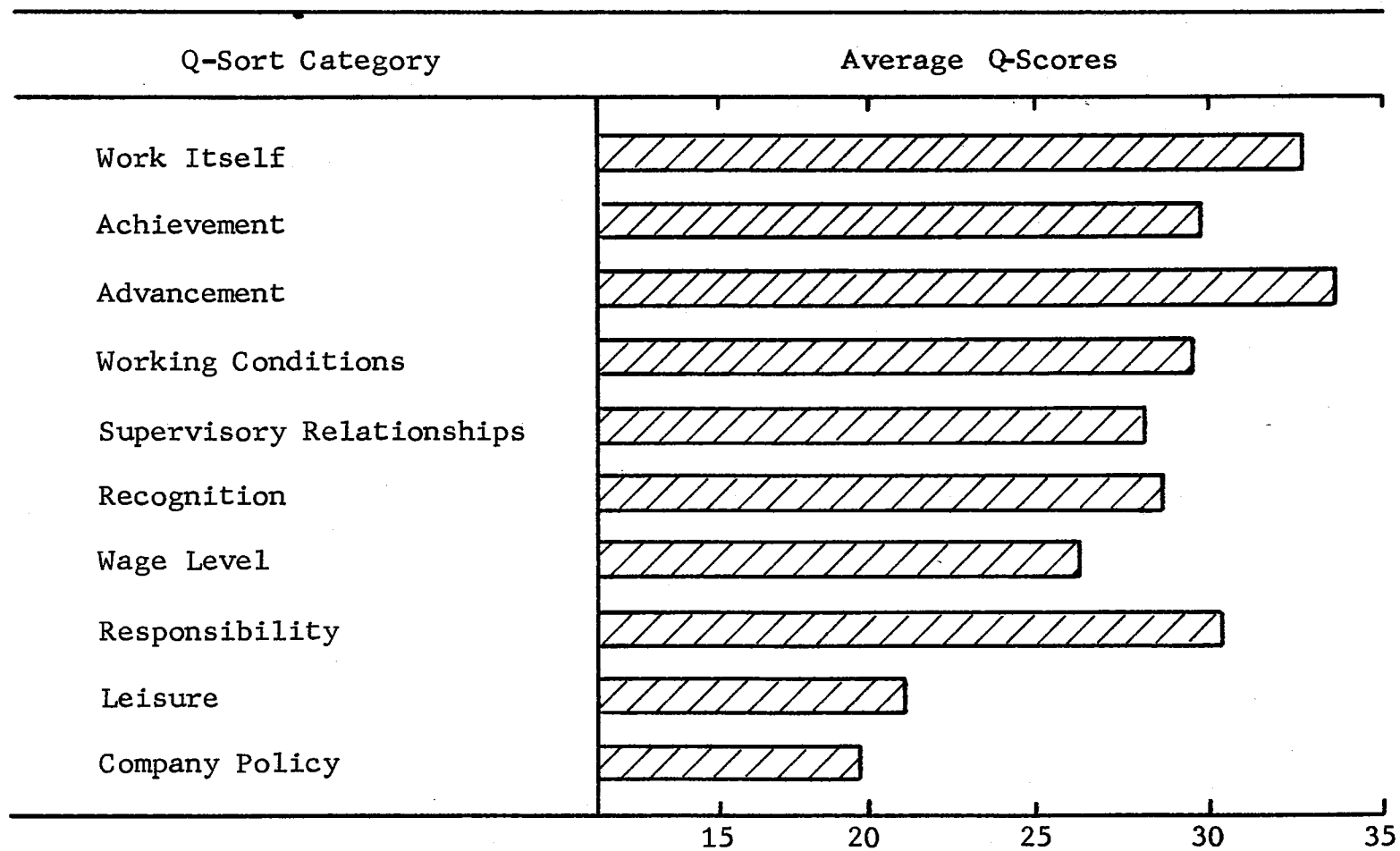


TABLE XII
 AVERAGE Q-SCORES FOR INDUSTRIAL SAMPLE

Q-Statement Categories	Average Q-Scores		
	Time Now	Three Years From Now	Five Years From Now
Achievement	35.8	34.5	34.2
Advancement	31.4	30.9	31.8
Company Policy	29.1	29.2	29.5
Leisure	21.5	21.5	20.6
Recognition	29.0	31.0	31.9
Responsibility	30.7	30.7	32.8
Supervisory Relationships	31.7	31.4	31.2
Wage Level	26.4	23.2	23.5
Working Conditions	31.5	30.8	29.2
Work Itself	35.2	35.3	34.5

TABLE XIII

Q-SCORE PROFILE FOR INDUSTRIAL SAMPLE ON FIRST SORT

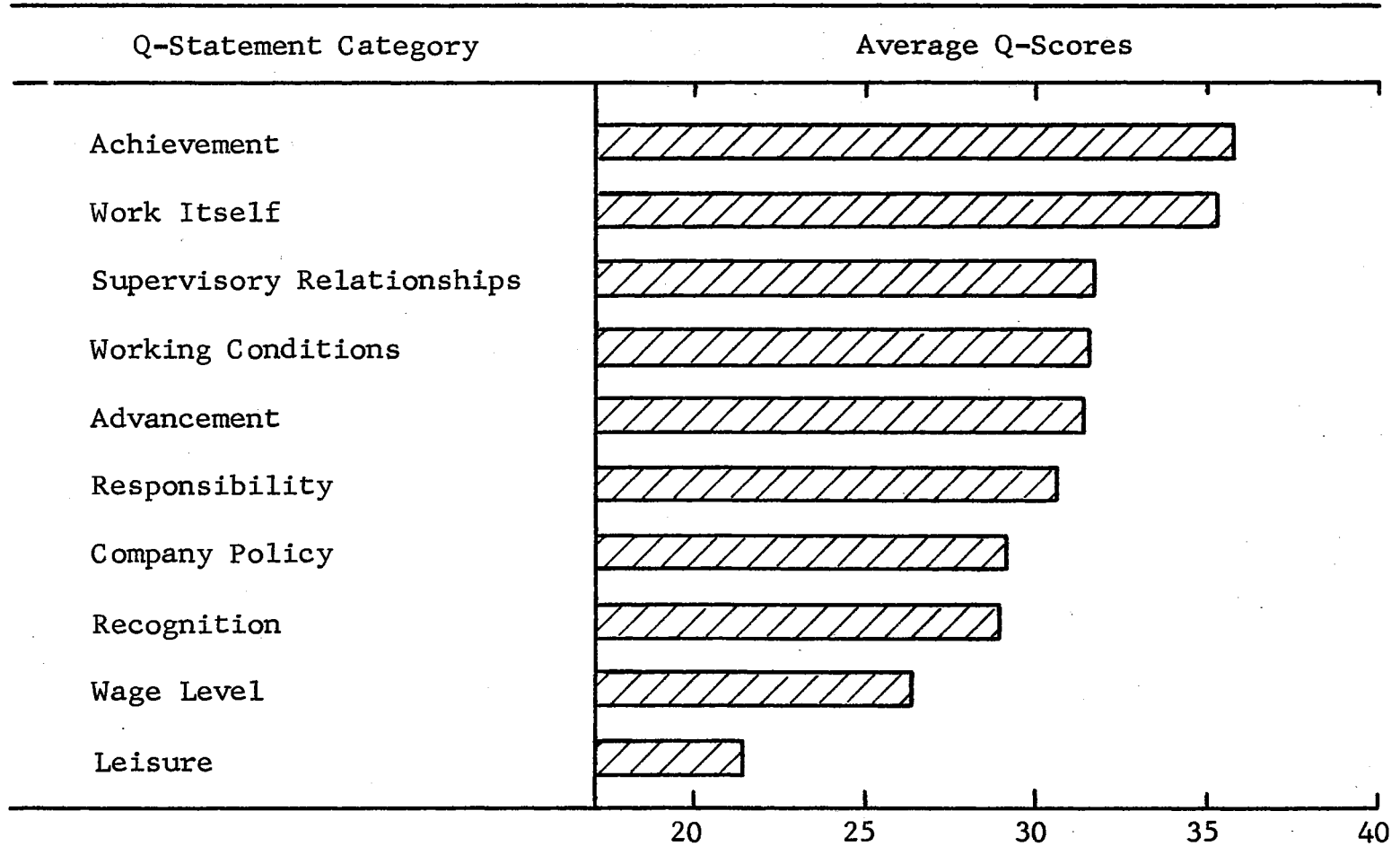


TABLE XIV

Q-SCORE PROFILE FOR INDUSTRIAL SAMPLE ON SECOND SORT

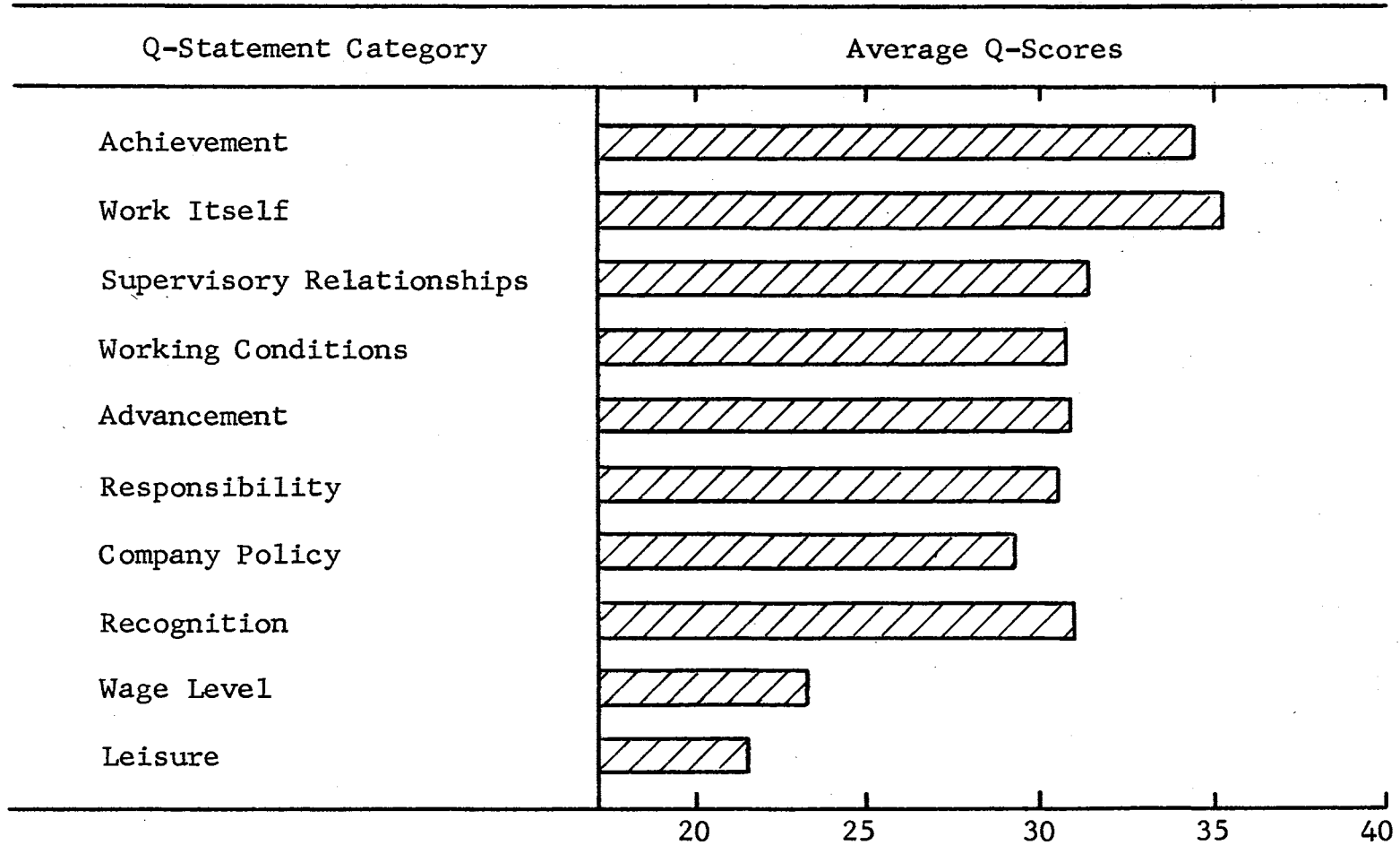
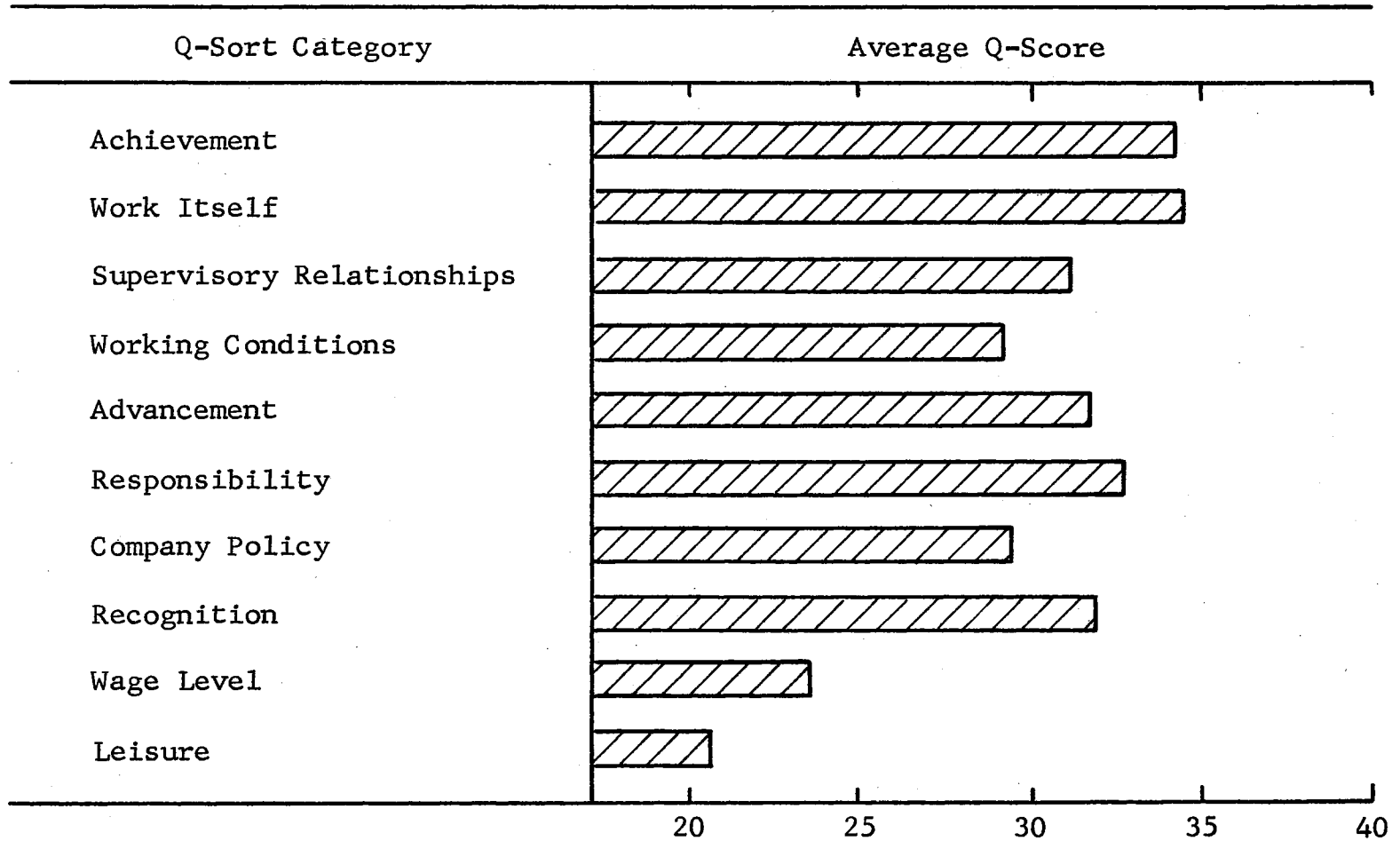


TABLE XV

Q-SCORE PROFILE FOR INDUSTRIAL SAMPLE ON THIRD SORT



APPENDIX G

GRAPHICAL PRESENTATION OF Q-SORT DATA

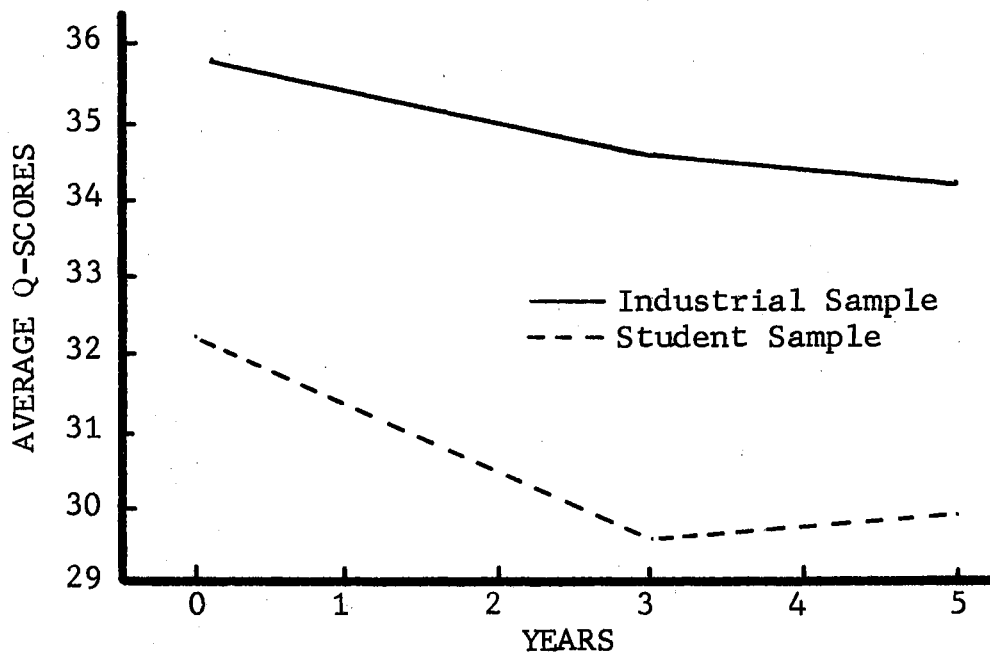


Figure 4. Composite Desirability for Achievement

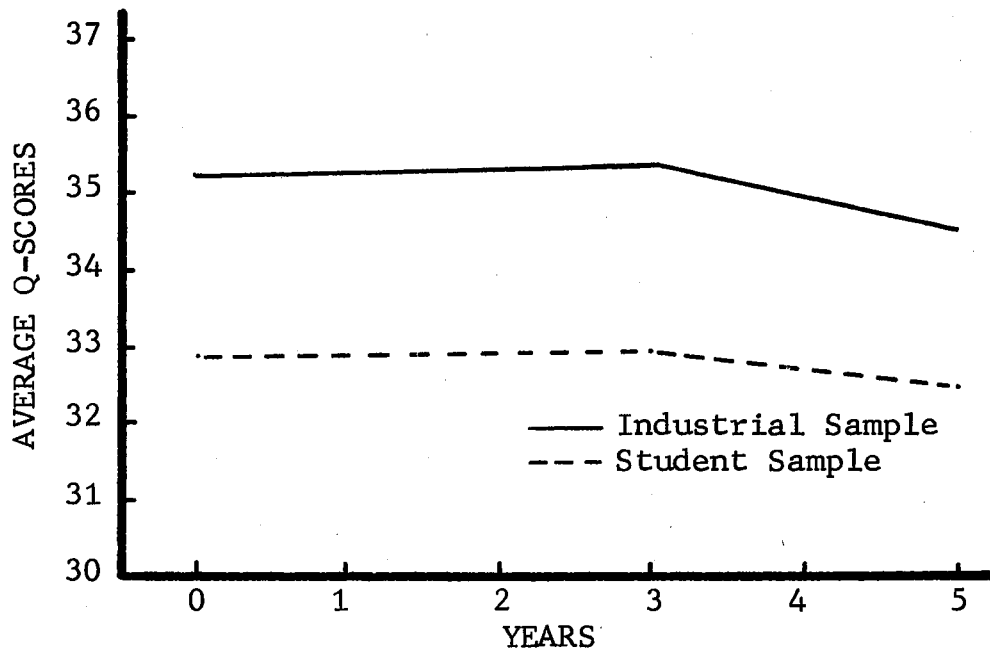


Figure 5. Composite Desirability for Work Itself

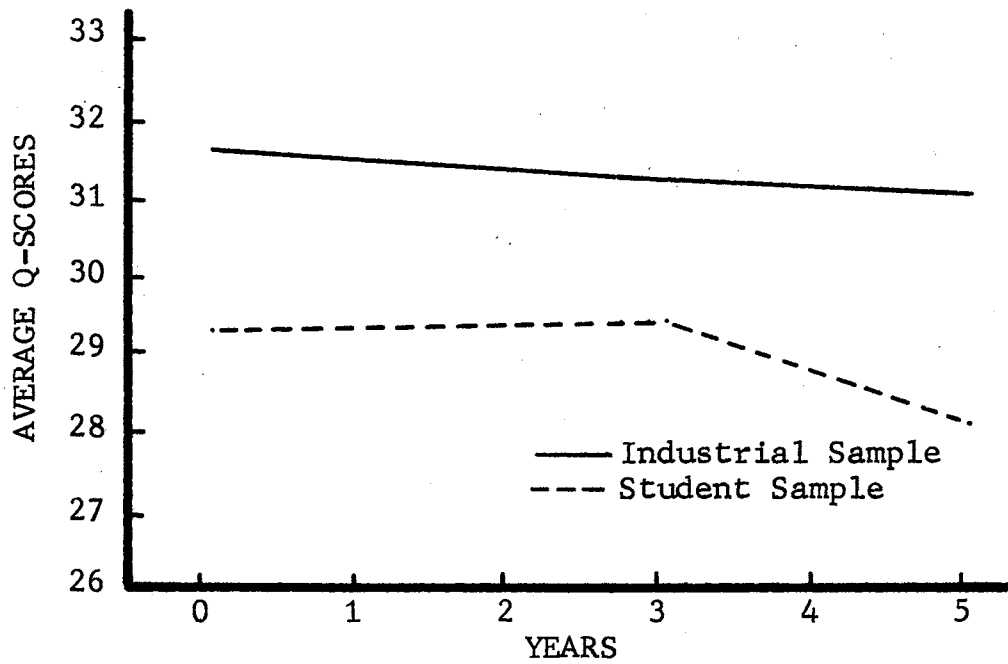


Figure 6. Composite Desirability for Supervisory Relationships

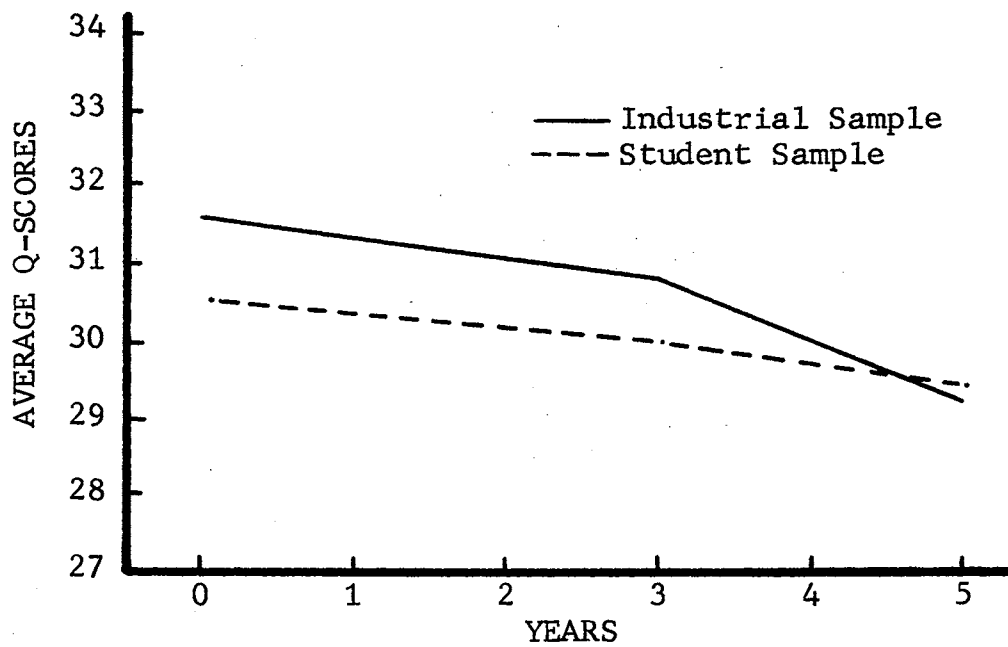


Figure 7. Composite Desirability for Working Conditions

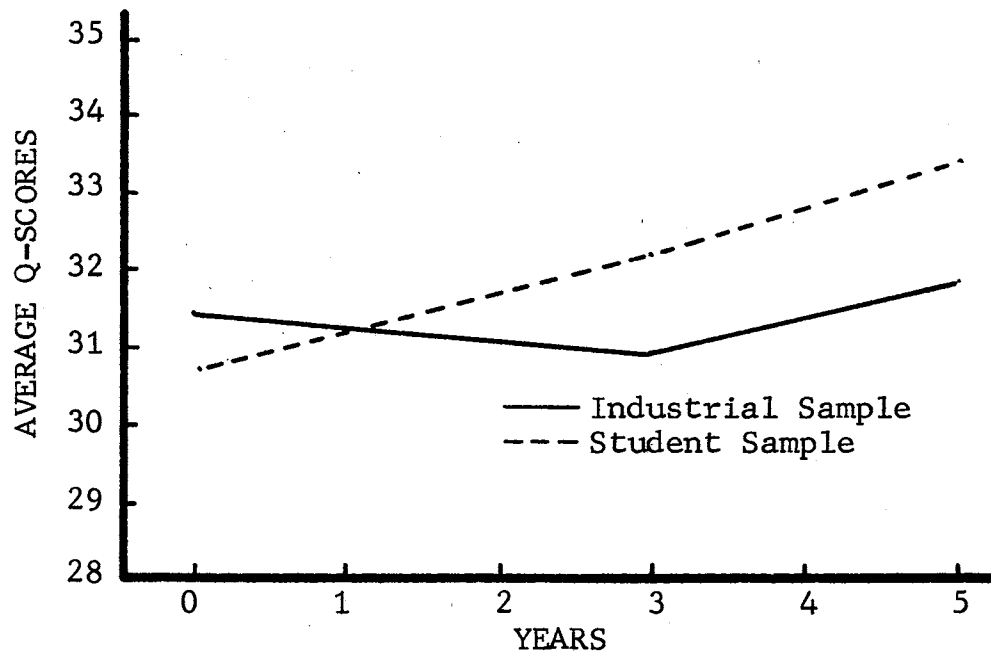


Figure 8. Composite Desirability for Advancement

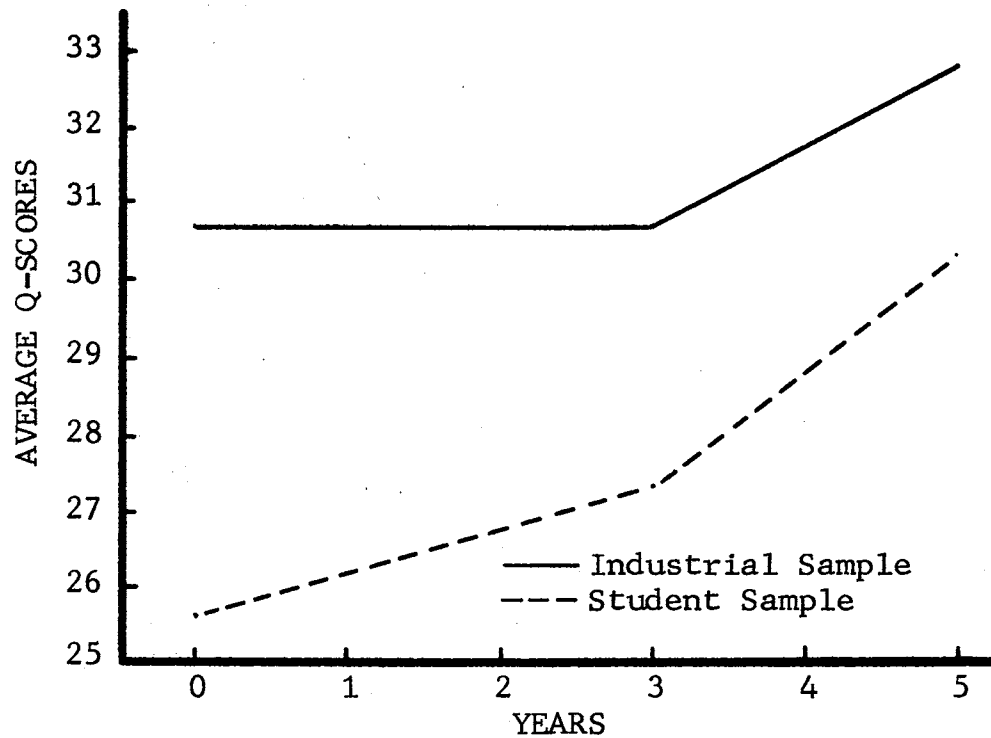


Figure 9. Composite Desirability for Responsibility

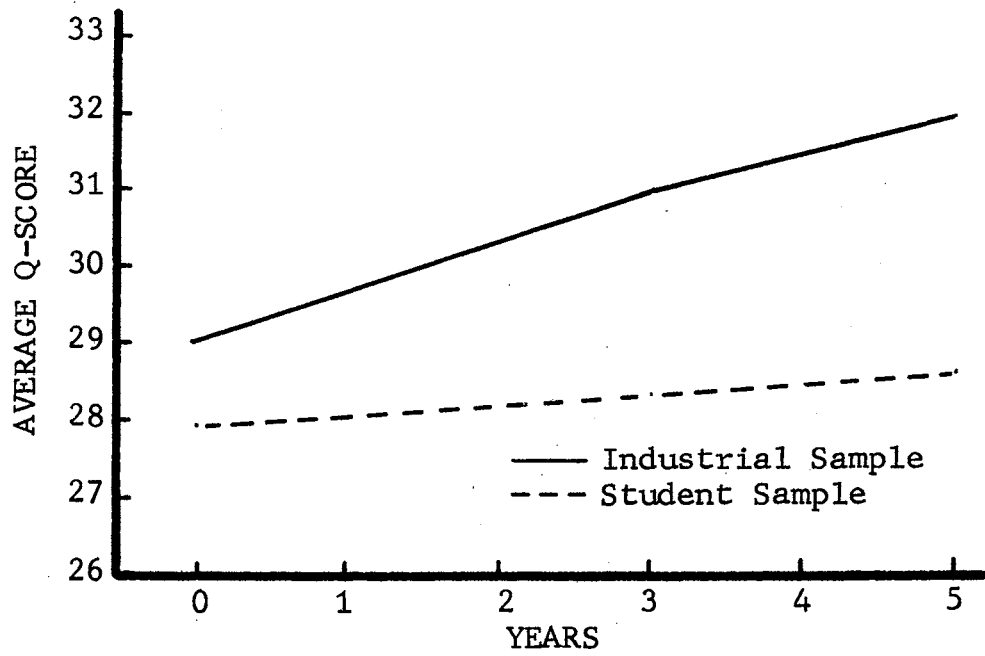


Figure 10. Composite Desirability for Recognition

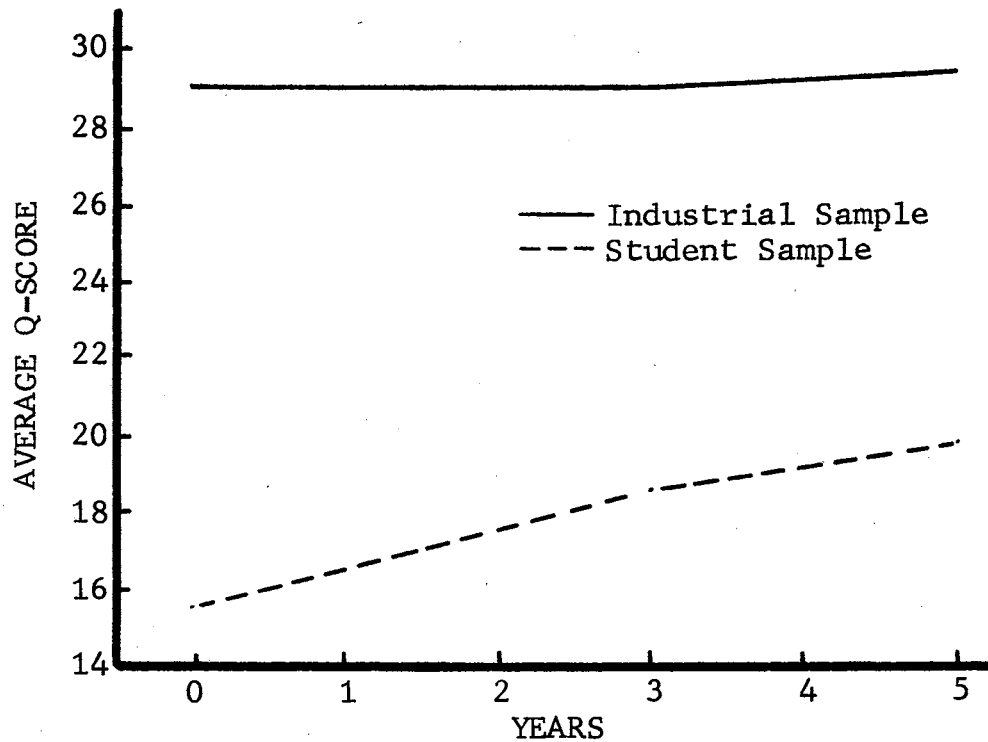


Figure 11. Composite Desirability for Company Policy

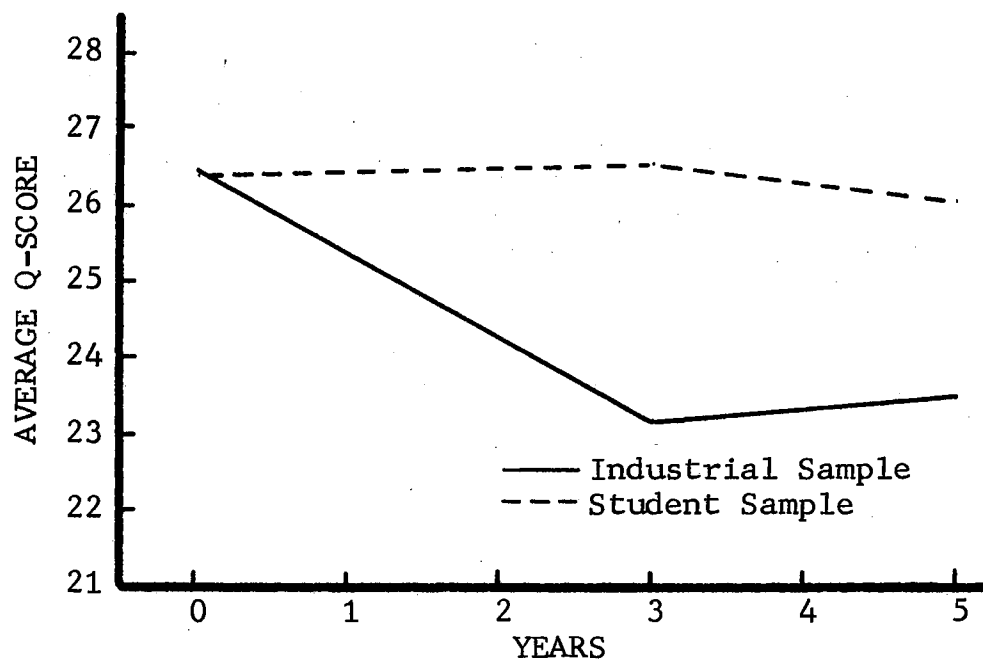


Figure 12. Composite Desirability for Wage Level

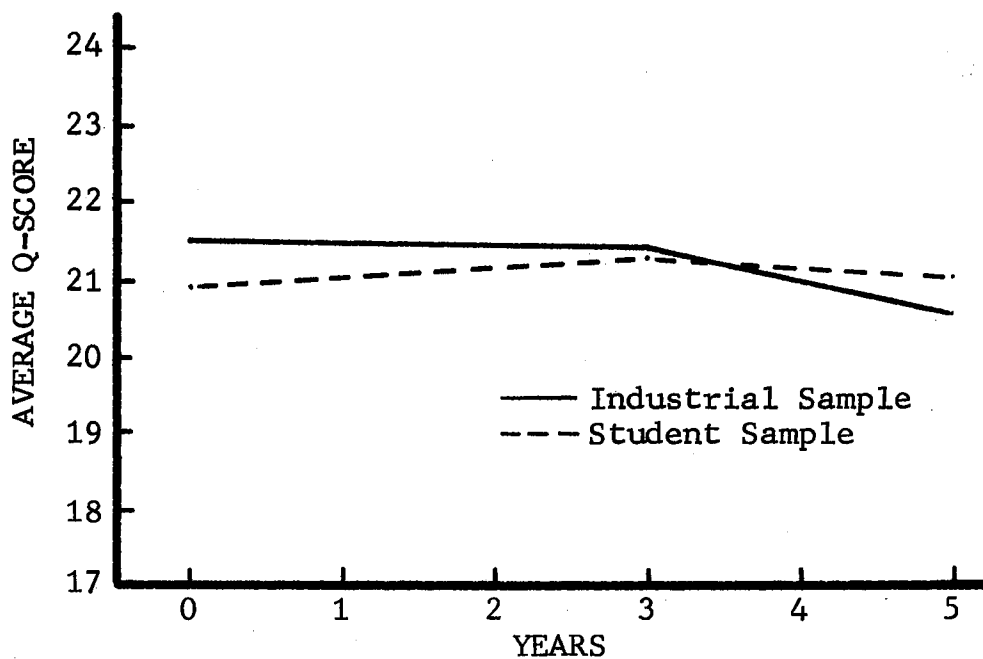


Figure 13. Composite Desirability for Leisure

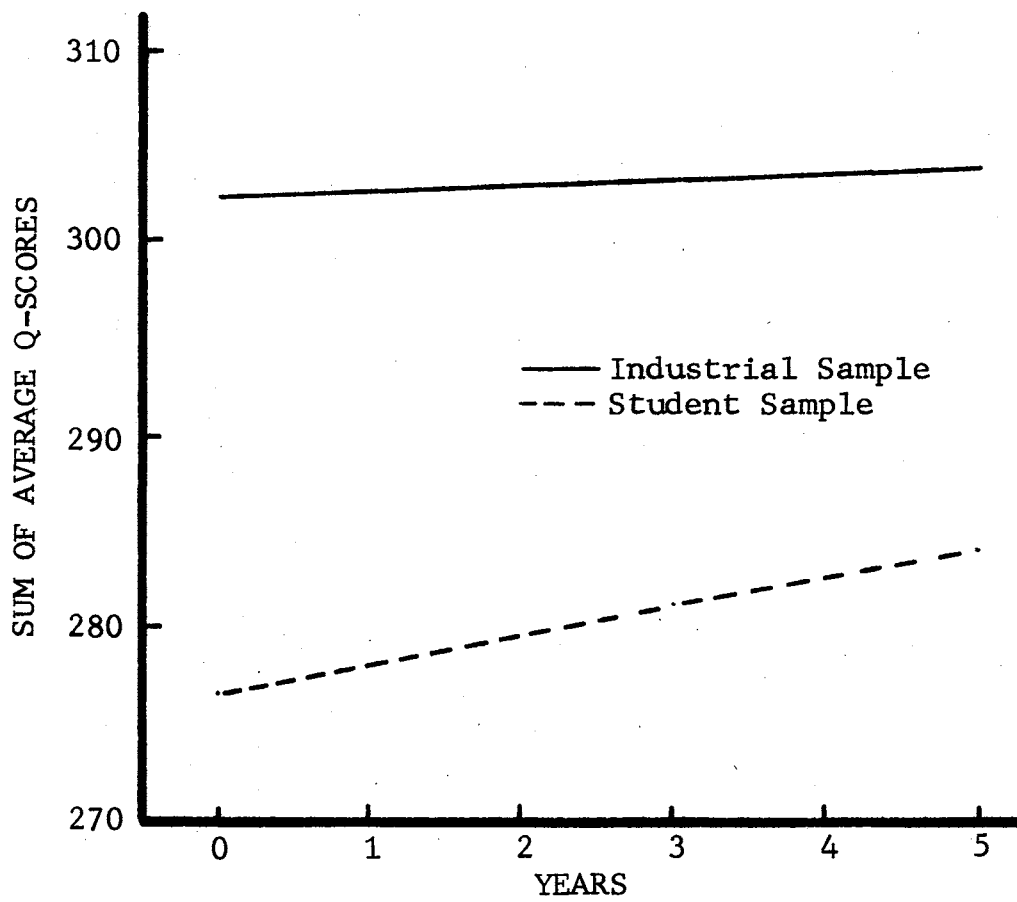


Figure 14. Composite Desirability for Ten Intrinsic Inducements

VITA

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