



**Calhoun: The NPS Institutional Archive**  
**DSpace Repository**

---

NPS Scholarship

Theses

---

1980-03

A primer and checklist for the technology  
transfer/knowledge utilization process

Brink, Gale Dean

Monterey, California. Naval Postgraduate School

---

<https://hdl.handle.net/10945/19018>

---

*Downloaded from NPS Archive: Calhoun*



Calhoun is the Naval Postgraduate School's public access digital repository for research materials and institutional publications created by the NPS community. Calhoun is named for Professor of Mathematics Guy K. Calhoun, NPS's first appointed -- and published -- scholarly author.

**Dudley Knox Library / Naval Postgraduate School**  
**411 Dyer Road / 1 University Circle**  
**Monterey, California USA 93943**

<http://www.nps.edu/library>



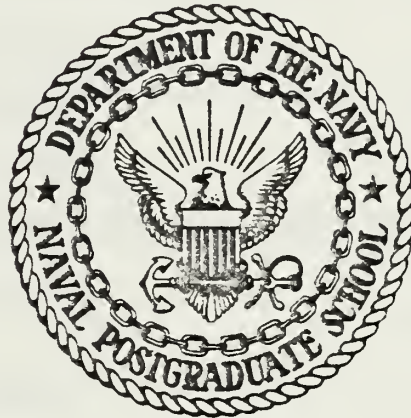
**DUDLEY KNOX LIBRARY  
NAVAL POSTGRADUATE SCHOOL  
MONTEREY, CALIF 93940**





# NAVAL POSTGRADUATE SCHOOL

## Monterey, California



# THESIS

A PRIMER AND CHECKLIST FOR THE TECHNOLOGY  
TRANSFER/KNOWLEDGE UTILIZATION PROCESS

by

Gale Dean Brink

March 1980

Thesis Advisor:

J. W. Creighton

Approved for public release; distribution unlimited.

T 195205



REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A Primer and Checklist for the Technology Transfer/Knowledge Utilization Process		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis; March 1980
7. AUTHOR(s) Gale Dean Brink		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Naval Postgraduate School Monterey, California 93940		12. REPORT DATE March 1980
		13. NUMBER OF PAGES 93
		15. SECURITY CLASS. (of this report) Unclassified
16. DISTRIBUTION STATEMENT (of this Report)  Approved for public release; distribution unlimited.		18. DECLASSIFICATION/DOWNGRADING SCHEDULE
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Knowledge Utilization Process Technology Transfer		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  This thesis details steps of the knowledge utilization process which are applicable to individuals and organizations and develops a model of an organization in which the process takes place. Elements of four categories (INPUT RESOURCES, ORGANIZATION, OUTPUTS and ENVIRONMENT) are analyzed to determine the characteristics that influence the use and transfer of knowledge. Models show the interrelationships between		





characteristics that describe each element and are combined into an integrated model of the organization to show the relationships between elements.

The author concludes that three resources, individuals, knowledge and time, are critical to the organization and the knowledge utilization process. "Used" in both planning and production, they result in organizational output that may satisfy a need in the organization's environment. Because time is the limiting resource, planning (assessing the inter-relationships, alternatives and consequences) is important in effectively managing the use of other resources and should precede individual and organizational activity.



Approved for public release; distribution unlimited

A Primer and Checklist for the Technology  
Transfer/Knowledge Utilization Process

by

Gale Dean Brink  
Lieutenant Commander, United States Navy  
B.S., United States Naval Academy, 1969

Submitted in partial fulfillment of the  
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL  
March 1980



ABSTRACT

DUDLEY KNOX LIBRARY  
NAVAL POSTGRADUATE SCHOOL  
MONTEREY, CALIF 93940

This thesis details steps of the knowledge utilization process which are applicable to individuals and organizations and develops a model of an organization in which the process takes place. Elements of four categories (INPUT RESOURCES, ORGANIZATION, OUTPUTS and ENVIRONMENT) are analyzed to determine the characteristics that influence the use and transfer of knowledge. Models show the interrelationships between characteristics that describe each element and are combined into an integrated model of the organization to show the relationships between elements.

The author concludes that three resources, individuals, knowledge and time, are critical to the organization and the knowledge utilization process. "Used" in both planning and production, they result in organizational output that may satisfy a need in the organization's environment. Because time is the limiting resource, planning (assessing the interrelationships, alternatives and consequences) is important in effectively managing the use of other resources and should precede individual and organizational activity.



## TABLE OF CONTENTS

I.	INTRODUCTION - - - - -	8
II.	PURPOSE- - - - -	10
III.	PROCEDURE- - - - -	12
IV.	KNOWLEDGE UTILIZATION PROCESS- - - - -	16
	A. PHASE 1 THEORY - - - - -	27
	B. PHASE 2 IMPLEMENTATION - - - - -	30
	C. PHASE 3 REVIEW/FEEDBACK- - - - -	30
	D. PHASE 4 TRANSFER - - - - -	30
	E. SUMMARY- - - - -	31
V.	AN ORGANIZATIONAL MODEL- - - - -	35
	A. INPUT RESOURCES- - - - -	35
	B. ORGANIZATION - - - - -	37
	1. Structure- - - - -	38
	a. Individuals- - - - -	40
	2. Goal Orientation/Motivation- - - - -	41
	3. Reward - - - - -	42
	4. Credibility- - - - -	43
	a. Management - - - - -	44
	b. Labor- - - - -	46
	5. Organization Climate - - - - -	48
	6. Production Process - - - - -	51
	a. Planning - - - - -	51
	b. Project- - - - -	58
	C. OUTPUTS- - - - -	61
	D. ENVIRONMENT- - - - -	62





E.	THE INTEGRATED MODEL - - - - -	67
VI.	KNOWLEDGE FLOW BETWEEN ORGANIZATIONS - - - - -	70
VII.	CONCLUSIONS/RECOMMENDATIONS- - - - -	73
APPENDIX A	- CHECKLISTS - - - - -	77
APPENDIX B	- TERMINOLOGY- - - - -	89
BIBLIOGRAPHY	- - - - -	91
INITIAL DISTRIBUTION LIST-	- - - - -	93



## LIST OF FIGURES

1.	The Interrelationship of Organizational Categories - - - - -	-13
2.	A Model of Organizational Elements - - - - -	-14
3.	Types of Knowledge - - - - -	-18
4.	Knowledge Flow - - - - -	-20
5.	Organizational Relationships - - - - -	-23
6.	Communication Flow - - - - -	-24
7.	Communication Flow (Detail - Links and Barriers)	-26
8.	Phases in the Knowledge Utilization Process- - -	-28
9.	Knowledge Utilization Cycle- - - - -	-33
10.	Structural Characteristics - - - - -	-39
11.	Management Characteristics - - - - -	-45
12.	Labor Characteristics- - - - -	-47
13.	Organizational Climate Characteristics - - - - -	-49
14.	Planning Characteristics - - - - -	-53
15.	Project Characteristics- - - - -	-59
16.	Project Work Flow Detail - - - - -	-60
17.	Environmental Characteristics (Individual) - - -	-64
18.	Environmental Characteristics (Organization) - -	-66
19.	An Integrated Model- - - - -	-68
20.	Knowledge Flow between Organizations - - - - -	-71



## I. INTRODUCTION

Philosophers and scholars throughout the ages have sought to understand the subtleties and truths which distinguish knowledge from opinion and the process by which knowledge is transferred or applied. Advances in knowledge and the accelerating rate of change in all disciplines have stimulated a renewed interest in managing the transfer and use of this important resource.

Recently this phenomenon has been referred to in various circles as knowledge utilization, knowledge transfer, information transfer or exchange, technology utilization, technology transfer, technology diffusion, public technology, etc. The phrase "knowledge utilization" will be used throughout this thesis to encompass the basic concepts in each descriptive phase. Knowledge utilization connotes all aspects of the process whereby a body of knowledge or research is transferred and applied to achieve useful processes, products or programs to meet the current or potential needs of an individual, organization or society. Knowledge is used in this context to include both information and technology.

Individuals, organizations, cities and states have come to the realization that, in order to effectively achieve their individual and common objectives and overcome common problems, they need to marshal as many resources as possible. Knowledge is seen as an intangible resource which, when



transferred and applied in a cooperative effort, can have a significant impact on tangible resources (personnel, capital, facilities and raw material), and on the organization and its outputs to solve the common problems within the organization's environment.

Recent interest in knowledge utilization focuses on the means to better link suppliers of knowledge with potential users and to understand the characteristics of the process which must be controlled or circumvented so as to increase the number of successful applications of the knowledge resource.





## II. PURPOSE

The purpose of this thesis is to develop a descriptive model of an organization which can be used by managers who wish to analyze the characteristics that influence the knowledge utilization process and use it to bring about improvements in their organizations.

The knowledge from various disciplines contributes to a total understanding of an organizational process (management theory, behavioral science, organization theory and communication theory). Of necessity, these knowledge bases have been selectively sampled and consolidated to demonstrate a procedure whereby any manager can develop a model that describes an organization or process.

An effort has been made to avoid ascribing to one theory or another in any of the disciplines, but to present basic concepts that can be used as is, or investigated further. Attention has been given to developing a framework for better understanding an organization or process that includes both verbal description and graphic models. The resulting integrated model of an organization demonstrates the analytic procedure and provides an appreciation of how the knowledge utilization process influences the organization.

An abundance of literature on the subjects addressed in this thesis was used to supplement conferences with individuals involved in technology transfer in the government sector,



personal experience, and education at the graduate and undergraduate level. This thesis represents the author's impressions and thoughts at this time and does not draw on any specific source. No references to the literature are made since this effort is a composite of knowledge and experience. A selected bibliography is included for the reader who is interested in constructing his or her model or expanding his or her knowledge base.



### III. PROCEDURE

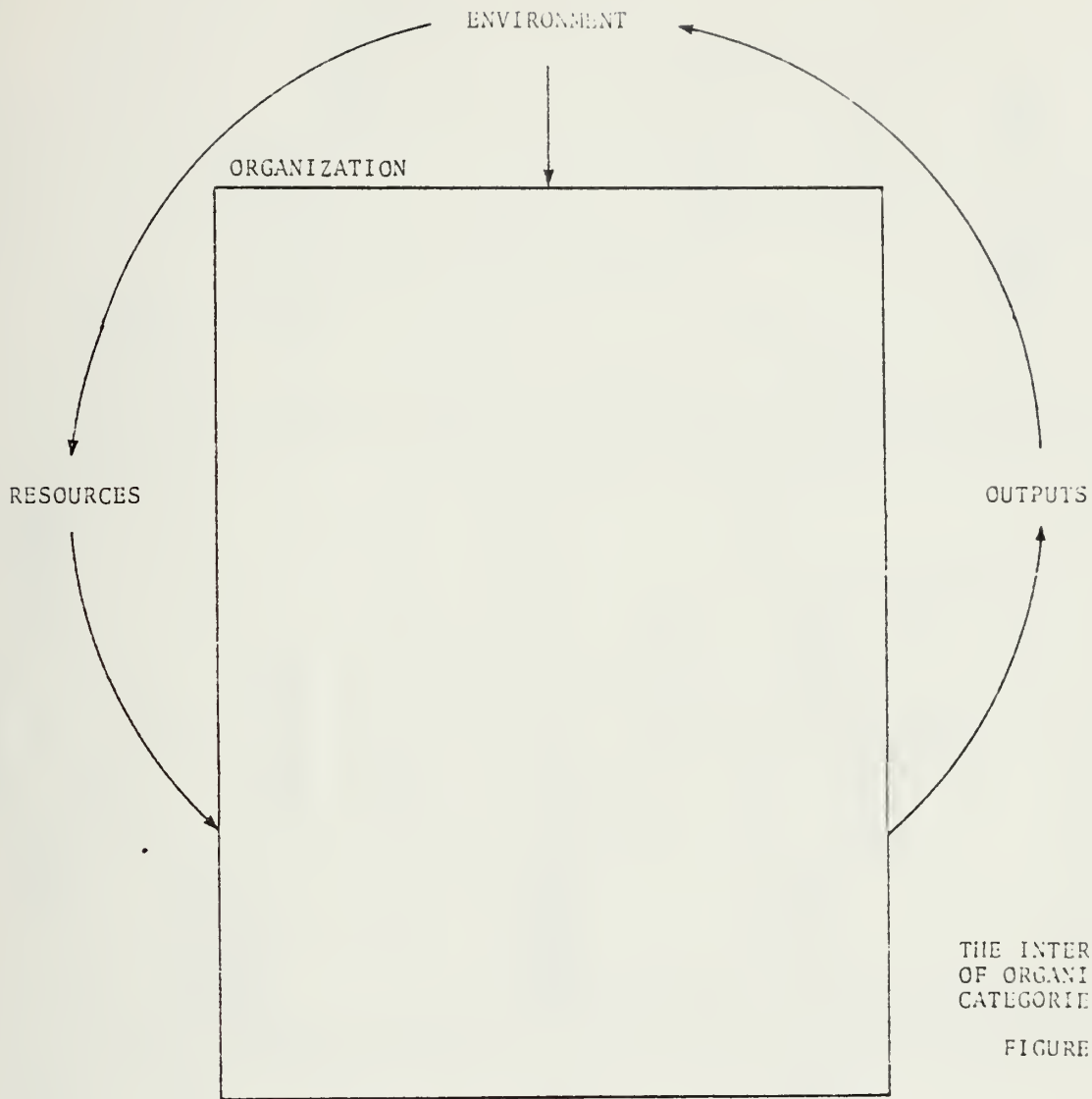
This thesis effort was divided into five sections:

- (1) A description of the knowledge utilization process.
- (2) A description and model of an organization in which the process takes place.
- (3) Extension of the model to include knowledge flow between organizations.
- (4) Development of a checklist to analyze the characteristics of the process.
- (5) Development of a list of terms with definitions which are commonly used in discussing the knowledge utilization process.

In developing the description and model of the organization, a production management orientation was used in which the following four categories and their interrelationships were explored: (1) the organization's resources (INPUTS), (2) the organization itself in which the inputs are transformed in a production process (ORGANIZATION), (3) organizational outputs (OUTPUTS), and (4) the external environment in which an organization functions (ENVIRONMENT) (Figure 1). This orientation closely resembles the open-system theory of organization development but was developed independently.

Elements within the categories which required description and between which relationships existed were then identified. Elements are factors that can be used to describe the category of which they are a part. Some elements within the ORGANIZATION category were further divided to facilitate analysis. The resulting diagram (Figure 2) provided the





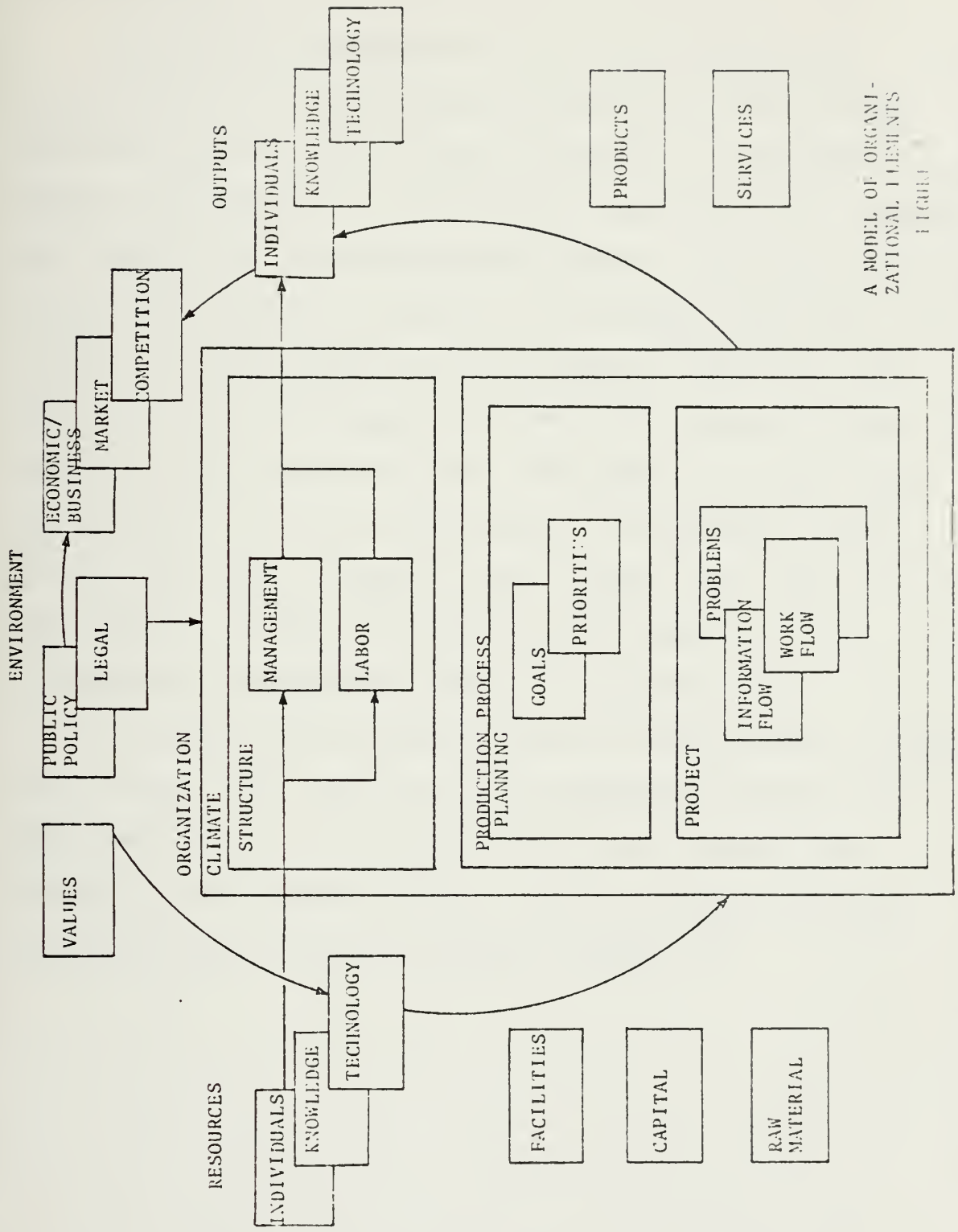
THE INTERRELATIONSHIPS  
OF ORGANIZATIONAL  
CATEGORIES.

FIGURE 1

General relationships between four categories (RESOURCES, ORGANIZATION, OUTPUTS and ENVIRONMENT) are shown.







A MODEL OF ORGANIZATIONAL ELEMENTS  
FIGURE

The four categories (RESOURCES, ORGANIZATION, OUTPUTS and ENVIRONMENT) are divided into the factors (elements) that can be used to describe each category.



basis upon which to proceed with a description of the organization.

The detailed description of the organization was accomplished by identifying characteristics which, from experience and a review of the literature on management theory and organization development, appeared to be significant factors in describing each element. The characteristics which were selected to describe each element represent activities or traits that give that element a complexity and dimension that distinguish it from other elements in the same or similar organizations. Throughout this and subsequent phases of thesis development, the questions "what," "how," "how much," "where," "who," "when," and "what if," were asked to refine the questions that appear as the accompanying application checklist (Appendix A).

The primary relationships between characteristics within each element were described and diagrammed (Figures 10-18). Upon completion of this process for each element, the elements were combined to show the relationships between characteristics in other elements (Figure 19).



#### IV. KNOWLEDGE UTILIZATION PROCESS

Knowledge utilization is a descriptive phrase that can be used to characterize both a goal (the application of a body of knowledge) and a process (the activity and the factors involved).

The knowledge utilization process can be thought of as incorporating the concepts of organizational theory to examine the organizational factors, the concepts of behavioral science to examine the personal factors, and communications theory to examine the vehicle by which the knowledge (itself potentially a combination of disciplines) is transferred from individual to individual.

This individual orientation provides the basis for discussing the knowledge utilization process since the individual is the basic element. The discussion and conclusions that apply to the individual can be extrapolated to cover organizations.

Knowledge is defined as the range of information or understanding that leads to the fact or state of knowing. As used here, it describes the wide range of fact, theory, experience and opinion on various subjects that an individual has accepted, understands, and has ready for use in problem solving or otherwise dealing with his environment.

The knowledge utilization process begins with a body of knowledge that may be available in any number of forms. It



may be written documentation which is accessible to a wide range of potential users, or it may be an abstract concept or experience that is not readily identifiable except to the individual possessing it.

Of the knowledge that an individual is exposed to in his or her lifetime, only a portion is assimilated. Consequently, an individual's knowledge base is a unique combination of subjects. The type of knowledge that is available concerning any specific subject is graduated from the abstract or theoretical to the specific or practical (Figure 3) and is determined by the degree and adequacy of past exposure and present need.

Regardless of its original content or form, knowledge, in and of itself, is of little consequence until an individual or group of individuals (possibly an organization) is exposed to it. Consequently, whether it takes place on an individual or organizational basis, the knowledge utilization process requires that someone process the knowledge and make it personal. The fact that knowledge must be internalized before it can be applied is a significant limitation.

An individual's knowledge may be increased by broadening the knowledge to which he or she is exposed or by providing the individual with a better way of processing the knowledge.

Within some limits, an individual's processing activity can be influenced by external control attempts in the form of reward, but the degree to which control attempts are





THEORY



TECHNOLOGY  
SPECIFIC/PRACTICAL  
EXPERIENCE

OPINION

Types of knowledge, theory and opinion grade into each other with resulting technology and specific practical experience.

TYPES OF KNOWLEDGE  
FIGURE 3



successful is a function of the individual's orientation toward the knowledge, the reward and the situation.

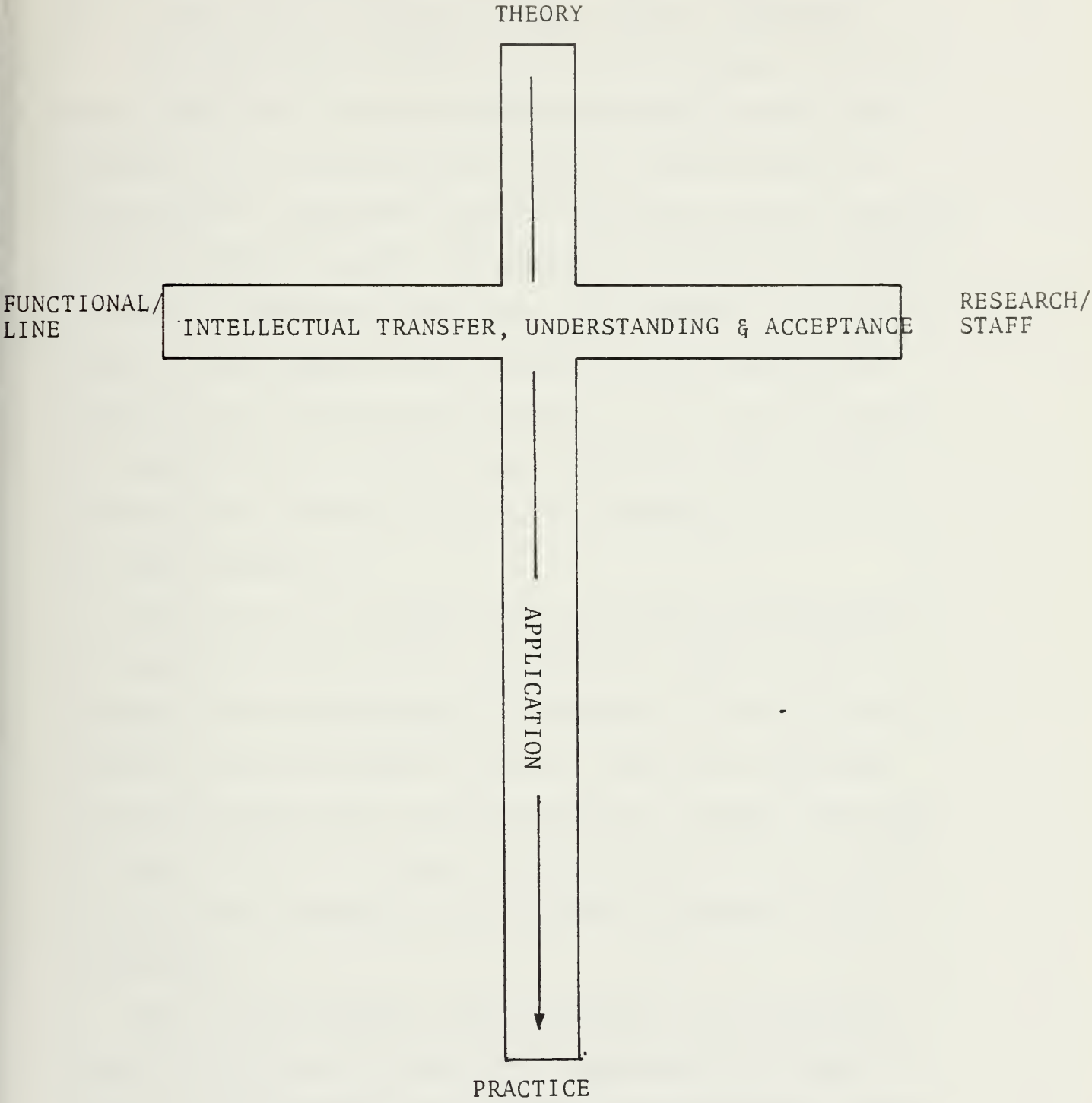
It should be remembered, however, that the individual's output is a function of both inputs and processing. The ability to draw conclusions and provide useful contributions from a store of knowledge may be limited by either factor.

The goal of knowledge utilization is the primary or secondary application of existing knowledge or of a new body of knowledge from research and development.

A distinction is made between the intellectual understanding or transfer and the application of knowledge to influence the individual's environment (Figure 4). The intellectual phase begins with the identification of an actual or potential use for a body of knowledge. Through planning and further investigation, the knowledge is refined to satisfy the need of the user. The second phase, the application, stems from the search for alternative solutions to a problem and suggests that the source(s) or supplier(s) and use(s) or user(s) have been identified. Where the parties and knowledge sought have not been identified beforehand, a link is needed to join a supplier and user; and the knowledge is an intellectual exercise (horizontal transfer) rather than application-oriented (vertical transfer).

Since the stated goal was application of knowledge, the transaction is not completed with horizontal transfer although it may be useful. The reward system should recognize





A distinction is made between the transfer, understanding and acceptance of knowledge from functional or research organizations and putting it into practice; the progressively more application-oriented knowledge is shown down the vertical axis.

KNOWLEDGE FLOW  
FIGURE 4



the difference between horizontal and vertical transfer. If it does not, the reward and goal are not congruent.

The application orientation is also important in that while the source may have perfect knowledge and may have extended this to the potential users, implementation is determined by the user's actual or perceived need, depending in part upon user goals, alternative solutions, priorities, resources, limitations and time. Consequently, the user comes to the supplier out of need, having exhausted his resources and alternative solutions, or out of faith that the supplier has a resource that either has been tested satisfactorily before or has been recommended, thus giving it some credibility.

The role of the supplier is to provide the knowledge, to facilitate its transfer to the user, and to provide feedback and help implement if requested. The supplier's role can range from one of control, where the knowledge and relationship with the individual are closely monitored at each step in the process, to one of facilitator, where knowledge and feedback are provided as required by the individual.

While it is feasible that a supplier could exercise control over both the theory and implementation phase of the knowledge utilization process, the individual's orientation toward external control will determine whether or not that knowledge source is used. The supplier's purpose in presenting the knowledge and orientation or identification





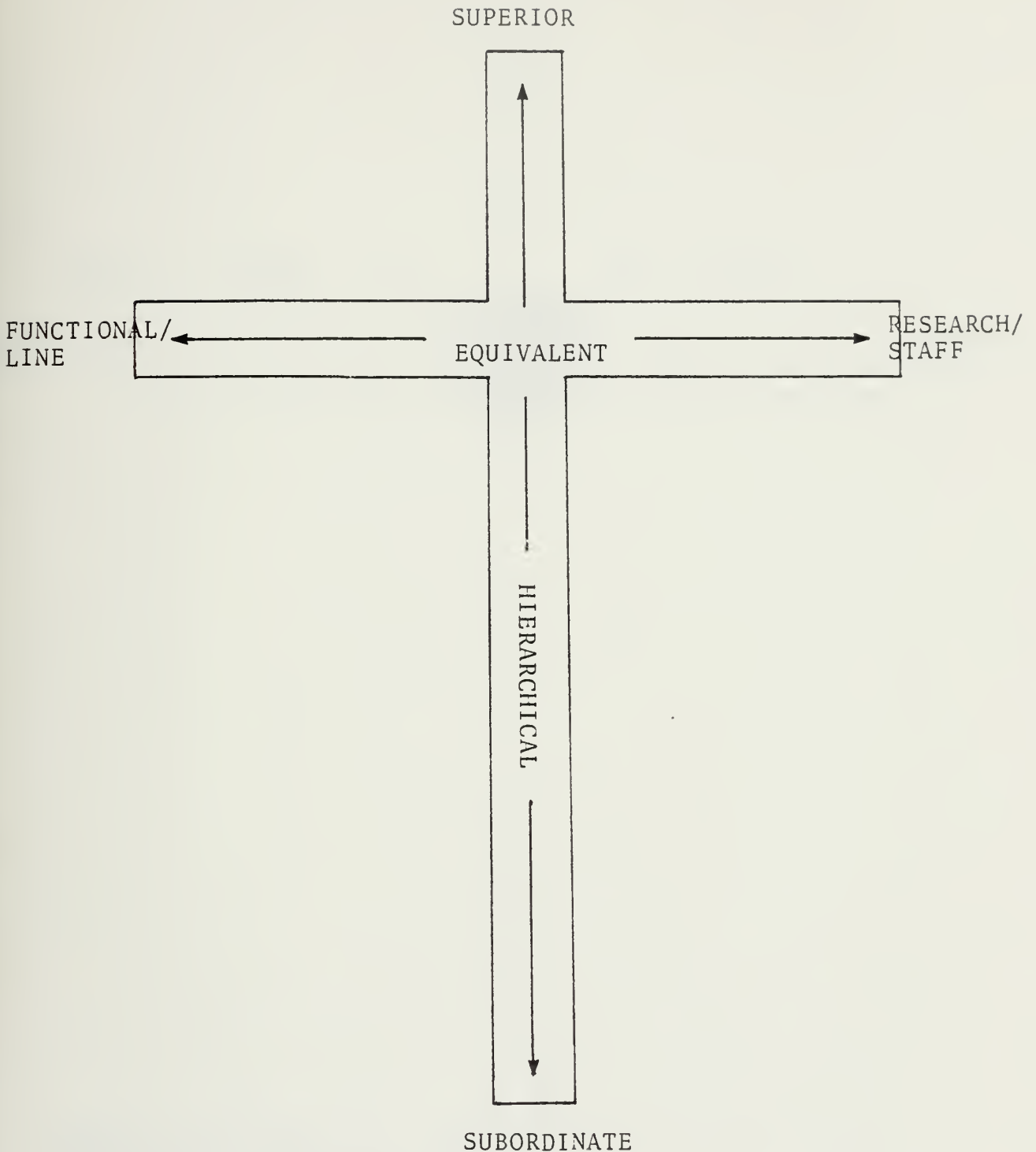
of his/her audience determines the method of presentation. The role of the user is to recognize that a problem exists, to seek additional knowledge to solve the problem, to accept or reject the knowledge that has been offered, and to implement the knowledge once it is understood.

The user's orientation toward the knowledge and the source determines whether the knowledge is applied. Regardless of the user's motivation, the application is a matter of degree and a function of the time that the user has (or perceives he has) available.

Once a supplier and user have been linked on a personal basis, the relationship is largely determined by the level of communication between participants. To elaborate, communications can be viewed as either formal (organizational correspondence, business meetings, conferences, etc.) or as informal (personal conversations or letters); however, regardless of the method of communication, its content and interpretation are influenced by the parties participating in the exchange.

Experience and communication theory suggest that the positional relationships (Figure 5) between the participants may have a significant influence on the content and form of the communication link (Figure 6). Suppliers and users should be aware of the potential distortion that can arise because of differences in individual perceptions as well as factual differences. The knowledge communicated then depends on the ability of the parties to understand and may



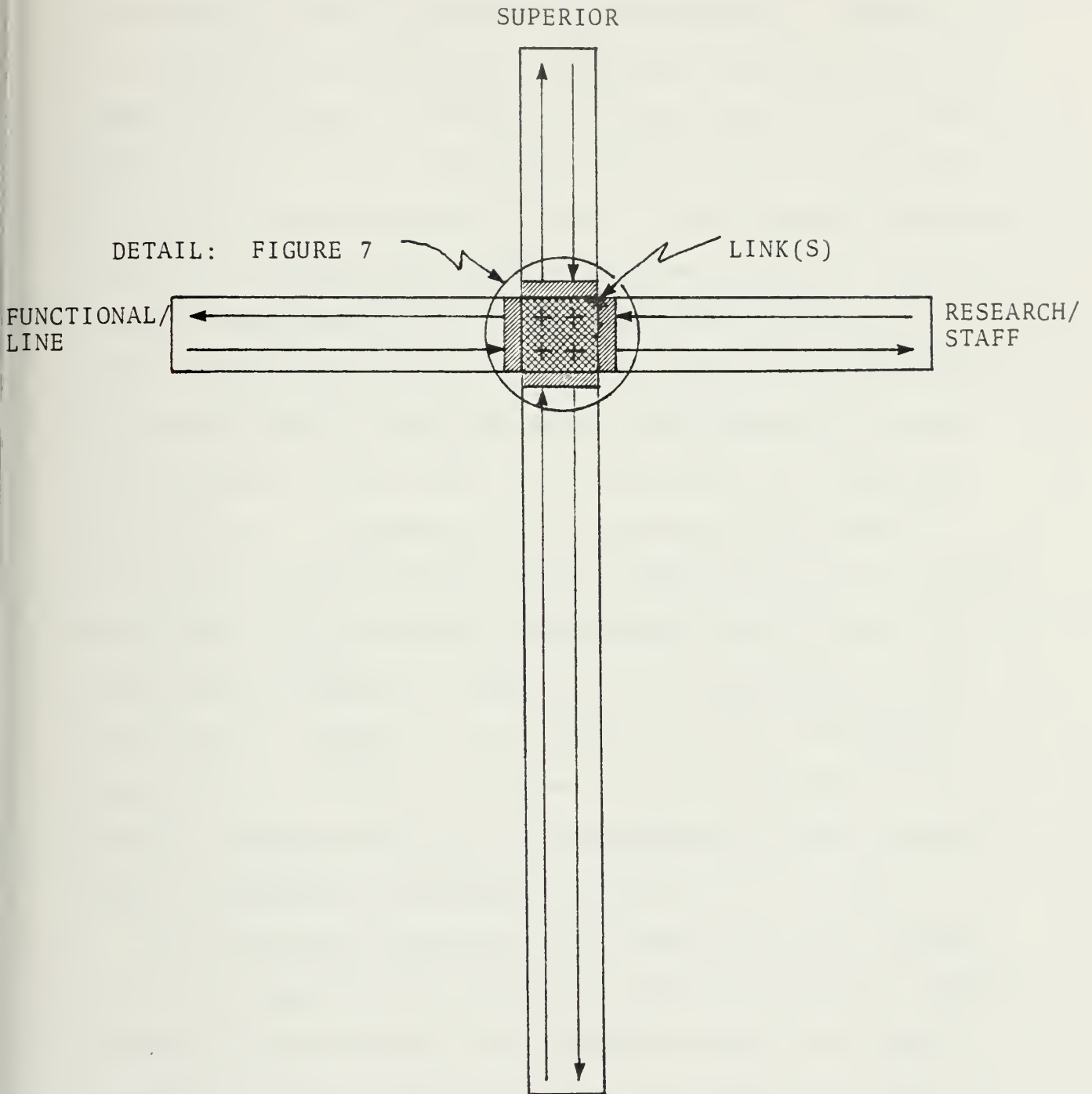


Relationships between individuals of similar level, status or function are shown as equivalent (horizontal); superior-subordinate relationships for a series of hierarchical layers are shown vertically.

ORGANIZATIONAL RELATIONSHIPS

FIGURE 5





Communication flow in or between divisions or organizations may be one- or two-way between superiors and subordinates (along the vertical axis), between peers (horizontal) or a combination of the two. Organizational characteristics and the communication method determine the individuals who possess and process knowledge and the type of flow.

COMMUNICATION FLOW  
FIGURE 6

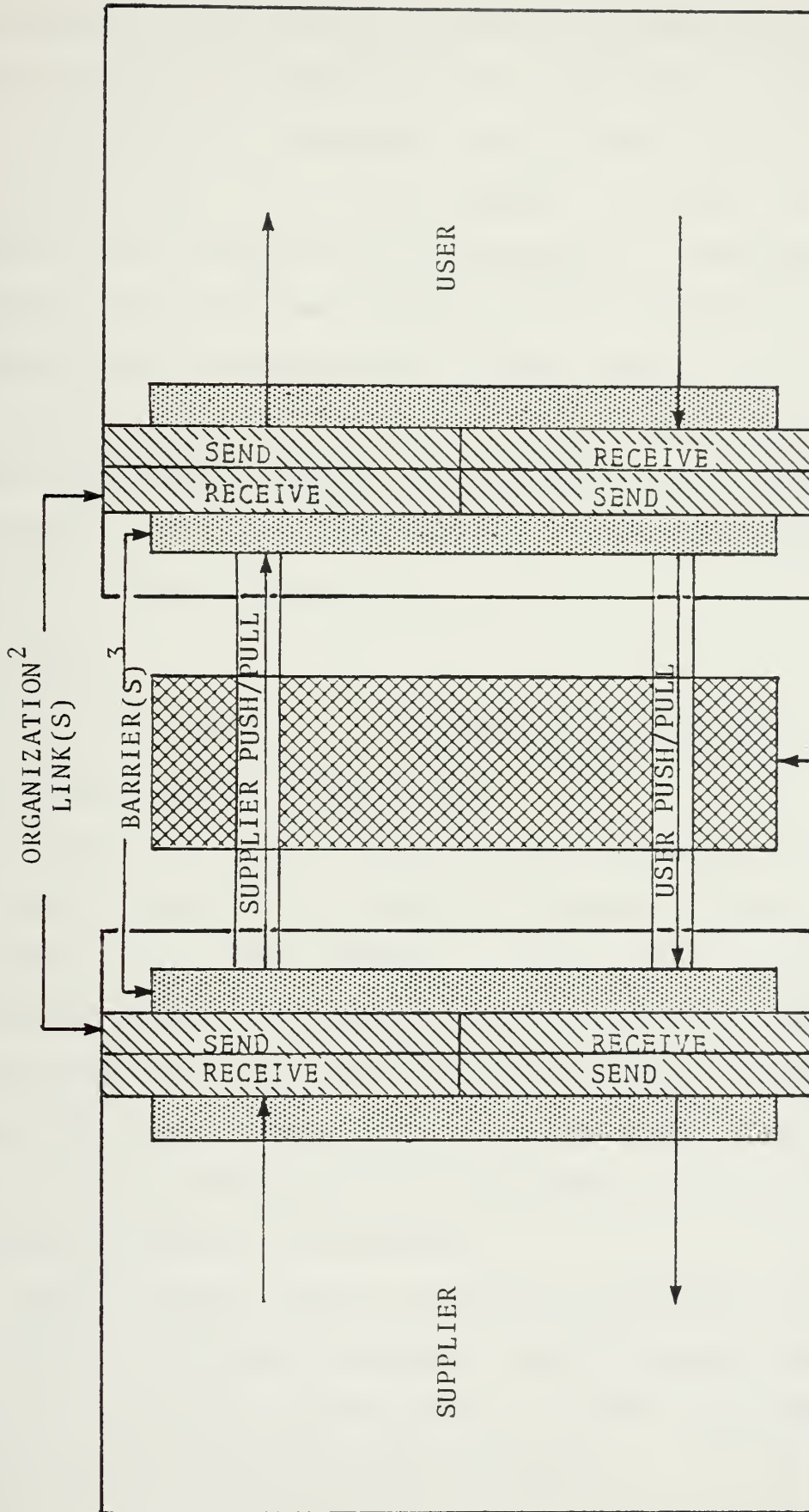


involve some degree of misunderstanding (which must be clarified) or conflict (which must be resolved). Inasmuch as the communication process, regardless of whether it is formal or informal, is affected by individuals, it is influenced not only by the individual's barrier(s) and reward(s) but also by organizations' barrier(s) and reward(s) and their ability to recognize and resolve miscommunications (Figure 7). When the communication is between two parties who do not speak the same "language," a link is necessary to facilitate the process until a self-sustaining relationship is established between them. Thus, it is apparent that a minimum of two links is necessary for an exchange of knowledge; additionally, communication can be either one-way or two-way. While there are undoubtedly circumstances where a one-way communication channel is appropriate, the opportunity for assessing the adequacy of the communication is sometimes incomplete or delayed and becomes a potential barrier to further communication (e.g., correspondence) when questions cannot be asked and conflicts resolved.

The expressions "supplier push" and "user pull" suggest a one-way communication and do not convey a balanced, complete exchange. Everyone has some knowledge and acts as either a supplier or user at different times throughout his lifetime. The degree to which an individual acts as one or the other appears dependent upon the individual's confidence in the amount of knowledge he possesses and the degree to which it has been personalized. However, an individual who is not







Notes: (1) Knowledge flow between links may be one- or two-way. Links may be obscure (diffusion) or may be highly visible and dominant (transfer). (2) There may be one or more links in each organization. Coordination/communication is complicated as links are added. (3) Barriers may be individual, organizational, or environmental and are present when sending and receiving knowledge.

COMMUNICATION FLOW (DETAIL)<sup>1</sup>  
LINKS & BARRIERS  
FIGURE 7



confident or possesses only "passing knowledge" may serve adequately as a link between other individuals.

An individual's knowledge does not have to be perfect to be useful and for it to be applied. However, the individual should recognize and be receptive to knowledge from outside sources that may provide useful additions to the knowledge base to which he or she has access.

The knowledge utilization process can be divided into four phases which will be discussed in the following order: (1) theory, (2) implementation, (3) review and feedback, and (4) transfer (Figure 8).

#### A. THEORY

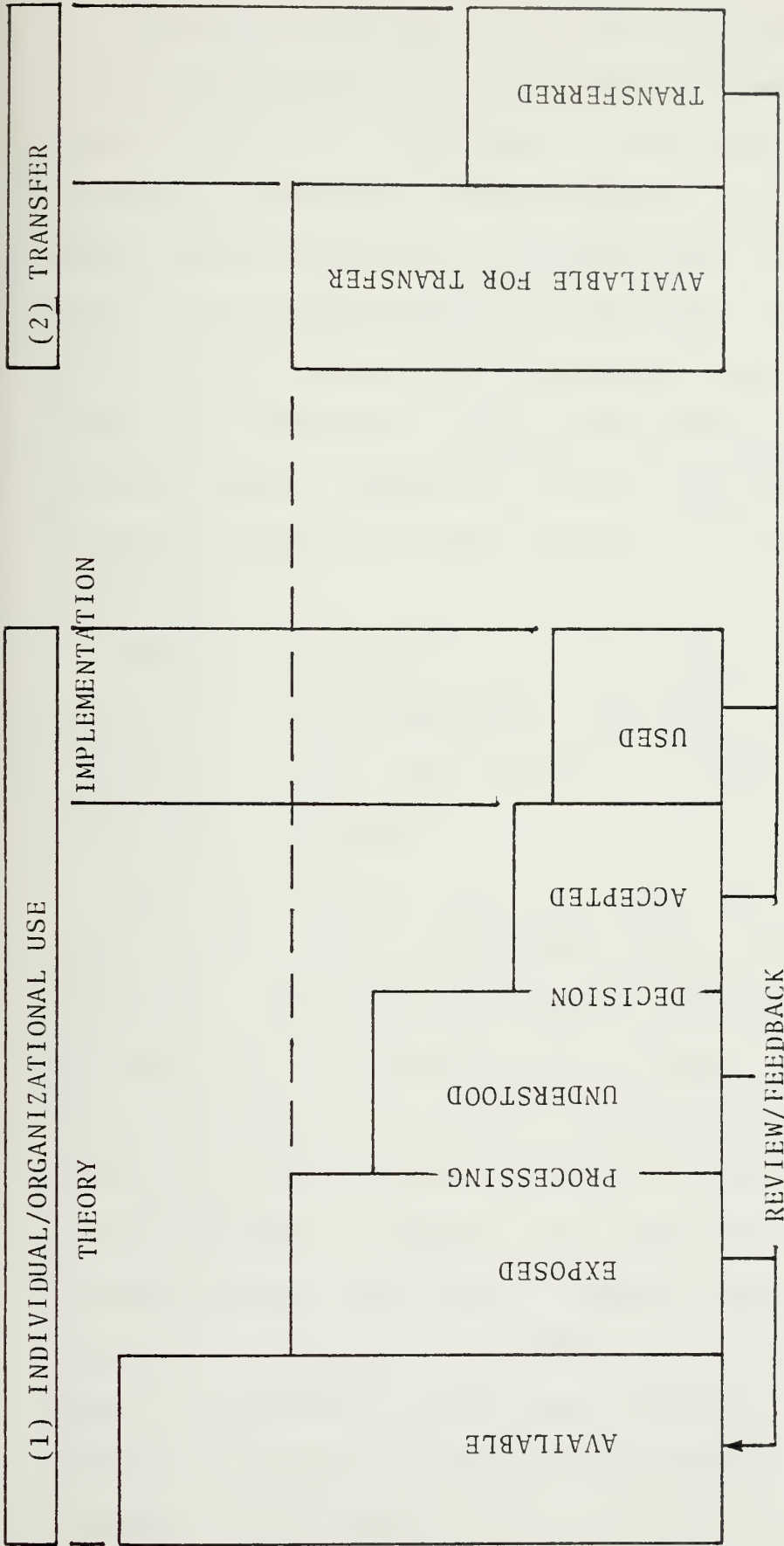
The theory phase includes three elements: (1) exposure, (2) processing, and (3) decision.

Of the wide range of information that exists in the world in various forms, an individual is exposed to only a portion throughout his or her lifetime. The exposure process occurs constantly during the waking hours and takes the form of a combination of audio, visual and tactile means within the individual's environment. When the knowledge is not available to or is overlooked by the individual, an intermediary link must complete the exposure.

Initial exposure may be planned or unplanned in a work or leisure environment; however, repeat exposure depends upon the individual's perception of whether the knowledge is or may be useful in problem solving.



NOTE: The process descends vertically with decreasing volume at each step.



Two activities are depicted -- (1) knowledge use and (2) transfer. An individual is exposed to only a portion of the available knowledge; this knowledge is personalized (processed for eventual use) or available for transfer. Only part of this knowledge is fully understood and accepted (theory) into the individual's personal knowledge base during the processing and decision phases of the knowledge utilization process. The amount of knowledge used or transferred represents only a portion of the available knowledge. Review and feedback are shown at each step in the process to determine the adequacy of the available knowledge and to stimulate expansion of the general knowledge base that is available for use.

PHASES IN THE KNOWLEDGE UTILIZATION PROCESS  
FIGURE 8



The amount of processing that is required for an individual to understand the information depends on a number of factors, including the method and length of exposure, the complexity of the subject, and the degree to which the knowledge was processed before exposure. If a high level of understanding is required, a means of feedback would be necessary at this point to determine whether re-exposure is needed. During the processing phase, the new knowledge is compared with the individual's current knowledge bank to determine whether it is useful and can be integrated.

The decision phase entails accepting or rejecting all or part of the new knowledge. Since the decision phase requires no action, the outcome of the decision is known only to the individual.

The theory phase of the knowledge utilization process begins with a body of knowledge that is supplied to an individual. The method of exposure determines how actively the supplier participates in the process. The method of presentation and the degree to which the knowledge is processed may influence the individual's level of understanding of the knowledge presented. The supplier's credibility with and control over the individual, along with the orientation of the individual, determine the outcome of the theory phase. Completion of this phase allows for a diversity of supplier and user involvement but requires the individual's positive participation.





## B. IMPLEMENTATION

Implementation is the second phase of the process and involves application of the individual's knowledge. Because it represents composite knowledge, it may or may not reflect any specific knowledge to which the individual was exposed in the theory phase. Application is the activity phase of the process in which the knowledge resource is "used" in solving individual or organizational problems or producing a product.

## C. REVIEW/FEEDBACK

The individual's conscious or unconscious review of the effect that the knowledge had on the problem occurs constantly throughout the process. This review is important because it determines whether the knowledge and its source gain or lose credibility. It also determines whether the knowledge base is adequate for the circumstances (is useful) or needs modification. Without user review, the process stagnates and the knowledge may become obsolete. Similarly, without feedback, the supplier will not know whether the output adequately meets the market demand.

## D. TRANSFER

Knowledge transfer appears to be a separate activity which is independent of implementation. Unlike the theory and implementation phases which are oriented toward the individual, transfer activities involve at least two individuals who have separate and shared responsibilities



for the success or failure of the transfer. Because knowledge can be stored by various methods, time differences between production and use can occur that may limit the interaction between supplier and user and may reduce the effectiveness of the transfer/utilization effort.

#### E. SUMMARY

An individual's or organization's effectiveness is determined and measured by the ability to influence the resources at their disposal to produce useful outputs. They draw on and integrate internal and external resources within their environment to produce outputs which in turn influence their environment. While not all individuals or organizations operate in exactly the same environment or have access to the same resources, their definition of goals and assessment of resources have a significant influence on the output and the means of achieving it. The loop, from resources that are drawn from the environment to outputs that influence the environment, provides continuous feedback to the organization and is necessary to provide the means for internal (self) and external performance evaluation.

Organizations require knowledgeable individuals to manage and transform resources into outputs that have a market in their environment. It is important to note that a business is oriented toward providing an output that is perceived to be useful by some segment of the market. Feedback is in the form of user acceptance. However, acceptance may be an



inadequate and misleading measure of a product's usefulness, depending on the number of alternative suppliers or the degree of control over the user.

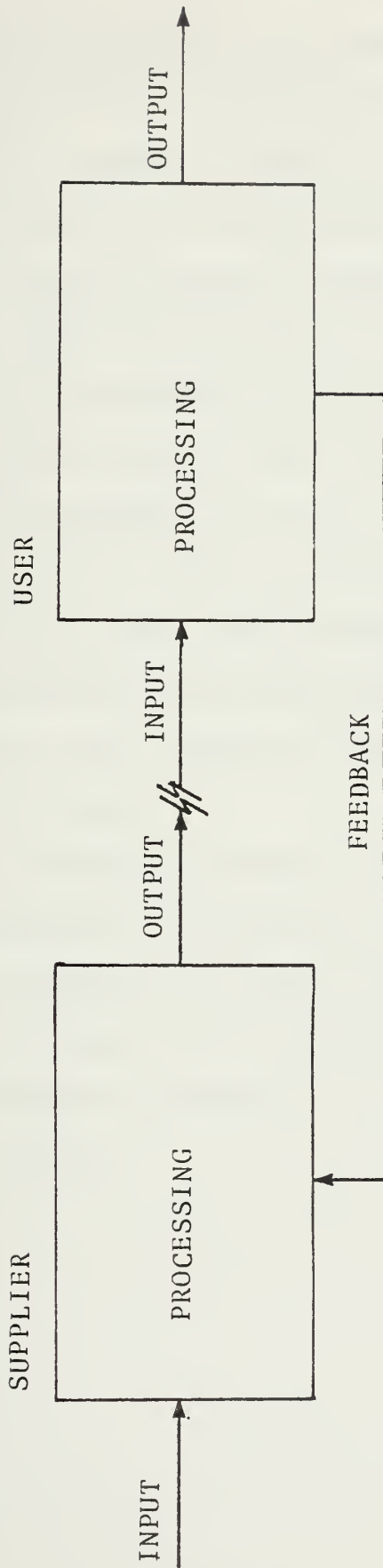
Usefulness is measured by the degree to which the product is applied -- something is done with it after it is accepted. Application is almost entirely a responsibility of the user and is a function of his perception of the supplier's output.

The significance of this in the knowledge utilization process is that, while the transfer is relatively easy to identify, user application is more difficult to gauge.

If the market analogy is used in the knowledge utilization process, the implications are clear. Some measure of market acceptance of the "product" is necessary for an organization that "sells" knowledge as an output. In the business environment, the consequences of an inflexible attitude toward the user's need or a nonexistent or misinterpreted signal from the market may be bankruptcy. The analogy appears no less true for the knowledge utilization process in which there is an opportunity for constant give and take. The question then becomes what is the quality, quantity, and timeliness of the supplier's output compared to the quality, quantity, timeliness of the user's input requirement. A complete knowledge cycle can then be depicted (Figure 9).

In actuality, input may be from a variety of sources, each of which will provide some type of feedback.





A knowledge cycle is shown to include a supplier and a user. The supplier receives input, processes it into some form of output that in turn becomes the user's input. The user organization is shown providing feedback to the supplier and its own output.

KNOWLEDGE CYCLE  
FIGURE 9





Like other resources, the amount of knowledge that is available and can be assimilated decreases as the time is reduced. In a normal diffusion process, the time constraint is not a significant consideration; however, when knowledge becomes a managed resource, diffusion may not be acceptable and a more rapid dissemination method may be desirable. The length of time available to complete the knowledge utilization process directly affects the link (both the individual and communication method) selection.

Insofar as the goal of the knowledge utilization process is dependent on human intervention, personal interactions are extremely important and become more so as time constraints are imposed on the transfer or the implementation either by choice or necessity.

Two-way communication and direct feedback are possible but not guaranteed. Successful completion of the knowledge utilization process may require a great deal of time and effort since losses are probable at each step in the process and whenever knowledge is transferred from one individual to another.



## V. AN ORGANIZATIONAL MODEL

Knowledge utilization in an organizational context, planning, prediction, transfer or marketing, review/feedback from sales, follows the same basic cycle as does the individual level. The relationships between four categories, INPUTS, ORGANIZATION, OUTPUTS and ENVIRONMENT, were analyzed in an attempt to clarify the factors that affected the knowledge utilization process. Characteristics that describe elements within each category provide the framework for developing a model of an organization and the role that individuals play in applying their knowledge to active organizational objectives.

### A. INPUT RESOURCES

Knowledge is a resource, just as significant as capital, labor, facilities and raw material. As such, its effective use depends upon the ability to collect it, organize it, and apply it to organizational or individual problems. Knowledge is applied in the prevailing environment external to the organization and within the organization's climate. Its use depends upon the time within which utilization is measured. Like the other resources, its availability is subordinate to its utilization. Consequently, a plan to maximize the potential benefit to the organization and individuals involved in the knowledge utilization process is desirable.



Unlike the tangible resources, knowledge is more difficult to measure. The measure of efficiency, comparing knowledge input to output, is often obscured in combination with other resources which are used in providing organizational outputs and problem solving. Likewise, effectiveness, the comparison of actual output to planned output, cannot be accurately measured except against subjective measures of quality or quantity and, perhaps a more objective measure, timeliness. Regardless of the orientation or measurement technique, knowledge utilization has become an increasingly important issue as individuals and organizations have tried to mobilize as many resources as possible in attaining their goals within the physical, social, and time limits which are imposed.

In assessing input resources, it is useful to remember that, whether one uses quantitative or qualitative measures, there are several comparisons which may be useful. A comparison of the amount of the resource that is available may be different from the amount that is needed or desired and provides the first point of potential efficiency loss in the process. In general, the amount of resources used varies from the amount that is available, usually because the resource did not fully meet the needs of the user. In the case of knowledge, this loss could be caused by any number of reasons including redundancy; the quality was above or below the level needed by the user, or the quantity may have either been too little or too great for the intended use. For whatever reasons, the amount of resource available for



use seldom matches exactly the resource needs. An analysis of each case may indicate the reasons for the variance. Subsequent changes which eliminate the barriers or time constraints may bring a closer match between the supply and demand for a given resource. In the case of knowledge, this match may be somewhat more difficult because the resource itself is difficult to quantify. Consequently, frequent communication between the supplier and user may be needed to more closely match the two.

One frequently heard complaint is that either the potential user had not applied the knowledge or that the supplier had not provided the knowledge requested. The implication is that the knowledge utilization process had broken down but neither party knew why. Further communication (investigation) may clarify whether it broke down at the source, in the transfer, or in the implementation. The process requires frequent assessment against the goals to reduce the losses which are inherent in the knowledge utilization process. Where there is no feedback or infrequent feedback, the gaps between what is needed and what is available or provided may widen, and the process will have to revert to the point of divergence where an agreement or understanding between the parties is again possible.

## B. ORGANIZATION

The organizational category of the model has been depicted as being comprised of two elements: (1) the structure, the





relationships between labor and management and (2) the process, the method by which resources are converted into organizational outputs. These elements are cast within the environment of that particular organization (as differentiated from the external environment).

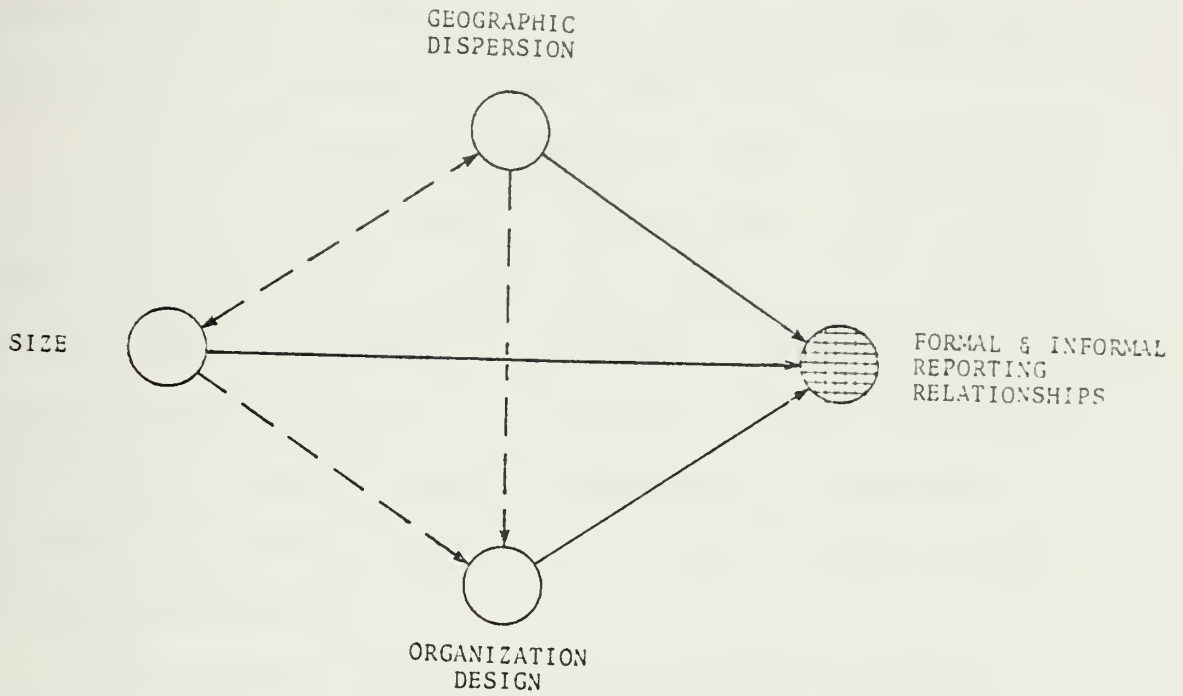
### 1. Structure

The structure of an organization has been the subject of a great deal of study by organization development theorists and practitioners. Various types of organizations, ranging from strict pyramid or hierarchical, arranged by functional divisions, to matrix organizations are treated in the literature. Each type of organizational design has different effects on the formal and informal relationships between individuals which establish the environment in which they work and on other process variables. The structural sub-elements influence the interpersonal relationships within the organization as well as its external relationships with its environment (market and competition). The term structure as used here means the organization's design including the formal and informal relationships between the individuals in the organization.

The model (Figure 10) focuses on the factors that influence reporting relationships between individuals. Four factors were selected: size, geographic dispersion, organization design and the reporting relationships themselves.

Reporting relationships are most often thought of as the formal organization chart. Size, geographic dispersion





STRUCTURAL CHARACTERISTICS  
FIGURE 10

- KEY
- CHARACTERISTICS
  - ⊕ ELEMENT OUTCOME
  - DIRECT RELATIONSHIP
  - (-) INVERSE RELATIONSHIP
  - ⊗ KEY CHARACTERISTIC
  - ⊙ ORGANIZATIONAL OUTPUT
  - - - - - POTENTIAL RELATIONSHIP

The diagram indicates the organization's structural characteristics that influence formal and informal reporting relationships.



and organization design all appear to influence the formal relationships between individuals and departments. The structure defines boundaries within which the individual works and the production process takes place.

The relationships between the other variables are not as clear and are shown as dotted lines. Size, the number of individuals in the organization, may or may not have an effect on organization design. Additionally, size may influence or be influenced by the decision to disperse the organization geographically. Geographic location may have an impact on the type of design chosen for the organization.

The formal and informal relationships between individuals appear to play an important role in the knowledge utilization process. Consequently, it should be recognized that knowledge production and use can be facilitated or hindered by any of the four formal factors.

a. Individuals

The heart of the model includes the individuals involved in the knowledge utilization process since they are the repository for the knowledge and are the motivating force for transfer and implementation. This is not to say that the other factors are not important; however, the interaction between the individuals within the organization, or between organizations, significantly influences the utilization of other resources, the production process and output and, to a lesser degree, influences the environment.



Three characteristics, goal orientation or motivation, reward, and credibility, play important parts in influencing individual and organizational output.

## 2. Goal Orientation/Motivation

One of the most important factors is the definition of goals. It should be recognized that organizational and individual goals may not be coincident. Where they are not, the potential for conflict is present. Where the potential for conflict exists, the manager has several choices: either to confront and resolve the conflict, to defer it to a later time, or reject/ignore the problem. The difference in orientation may reduce organizational effectiveness unless one element or the other subordinates or changes its goals.

The reward system plays a significant role in reinforcing or destroying the emphasis on specific goals. Where the organizational goal is for vertical knowledge transfers that result in applications (i.e., user orientation) and the individual goal and reward system is oriented to horizontal transfers (i.e., peer orientation), at least one of the following must be changed to reach a satisfactory outcome: (1) the organization's goal; (2) the individual's goal; (3) the individual.

Changes in any or all of the categories can be effected by positive or coercive means. It is important to attempt to project the consequences of each alternative and then select the most desirable alternative in terms of individual and organizational benefit/cost.





### 3. Reward

The reward system can be an important mechanism of motivation and control. The degree to which the organization's reward system fulfills an individual's need for reward is dependent on what he or she perceives as an adequate reward. Because individuals are a mobile resource, organizational reward is only one factor in meeting the individual's need for reward, the other elements being self-appraisal, reward from peers and reward from non-organizationally related activities (e.g., family and friends).

An organization's reward is realized after the output is produced and accepted; however, individual reward may be realized before or regardless of whether organizational output results in reward or not. When the individual who is responsible for supplying knowledge has little or no personal contact with the user, his or her reward must be derived from within the supplier organization. The problem then becomes one of distinguishing how or whether individual output contributes to organizational output since the responsibility for determining whether it is useful or not has shifted from the user, where it normally belongs, to the supplying organization. A distinction needs to be drawn between horizontal transfer or intellectual activity and vertical application or practical output. In the case of knowledge, the distinction between the two could be confused if the reward system reinforces individual effort that does not contribute to organizational output but still results in reward to the individual.



#### 4. Credibility

Credibility influences the knowledge utilization process at the transition point between the intellectual understanding and implementation. Its influence is dependent upon the user's perception of the combination of supplier characteristics: knowledge (expert/referent power), position (authority/positional power) and the potential usefulness of the output which may be influenced by previous experience with that supplier. This should not be construed to mean that the supplier does not have an opinion of his or her credibility with the user, only that the two may not have the same opinion and that the user's opinion will have an impact on whether to accept or reject the supplier's output. The positional relationship between the two determines the degree of control that may be exercised by the supplier.

Credibility is shown as being a management trait; however, it can be equally appropriate to labor. Assignment to one or the other or both depends upon the situation. In the knowledge utilization process, credibility is determined by the user's perception of who is supplying the output and may be determined by his previous experience and personal contacts within the supplier organization.

The effect of informal relationships has also been noted. Its significance is in the fact that the informal, personal, non-structural relationships are not as easily monitored or controlled as those which take place within the formal structure of the organization. The question



then becomes one of understanding where the formal and informal relationships differ and whether changes in the existing relationships will have favorable or unfavorable implications for accomplishing the organizational goals. The consequences of attempts to control the informal organization are often difficult to predict; such attempts should be approached with care.

a. Management

The interrelationships within the management element of an organization's structure are complex. The fields of psychology, general management and management development suggest many factors that influence an individual manager's contribution (output) to the organization. Figure 11 depicts the primary relationships among ten factors which were selected to describe a manager's style and contribution to the organization.

This element of the model focuses on two management characteristics, the willingness to contribute and the ability to contribute. The manager's willingness to contribute is shown as being influenced by eight factors (personal goals; knowledge; position; the orientation toward people, reward, decision making and planning; and the individual's output). His willingness to contribute is in turn influenced by seven of the same factors (the exception is position which is not usually affected immediately by the individual's output) in a continuous feedback and comparison process as the manager attempts to resolve the differences between his



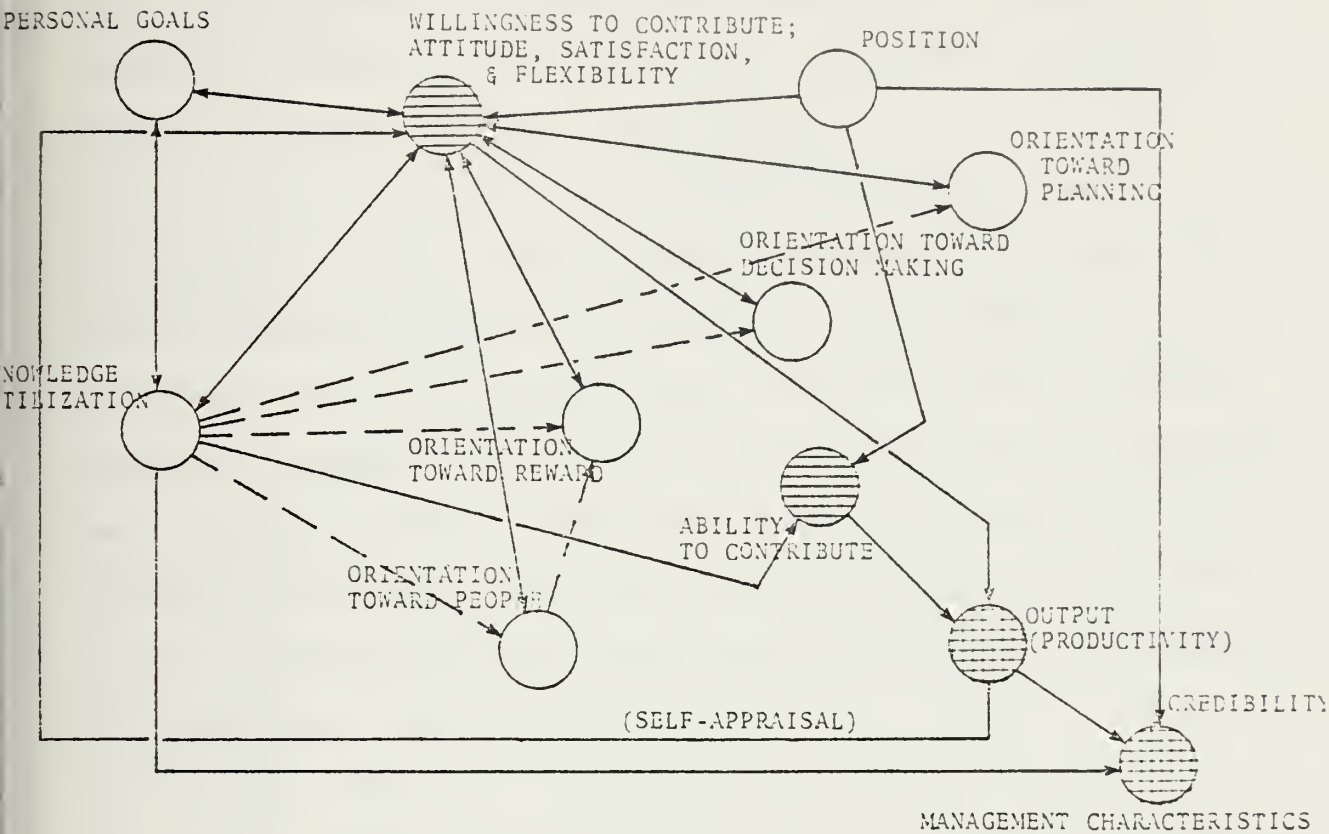


FIGURE 11

KEY

- |                          |                                  |
|--------------------------|----------------------------------|
| ○ CHARACTERISTICS        | ⊖ KEY CHARACTERISTIC             |
| ⊕ ELEMENT OUTCOME        | ⊙ ORGANIZATIONAL OUTPUT          |
| → DIRECT RELATIONSHIP    | - - - - - POTENTIAL RELATIONSHIP |
| (-) INVERSE RELATIONSHIP |                                  |

This diagram focuses on the characteristics that influence management's output and credibility. Willingness and ability to contribute are shown as key characteristics.





expectations and actual outcomes. As a result of this process, the manager's attitude and level of satisfaction together with his or her flexibility determine the willingness to contribute to the organization.

The ability to contribute appears to be a combination of two factors, knowledge and/or position. The exact combination of the two factors is not important in and of itself but does influence the credibility and the impact that the manager's output has on the organization. Knowledge may change the orientation characteristics (indicated by a dotted line) with a resulting change in the attitude factors (i.e., satisfaction with the organization or job, willingness to contribute, etc.).

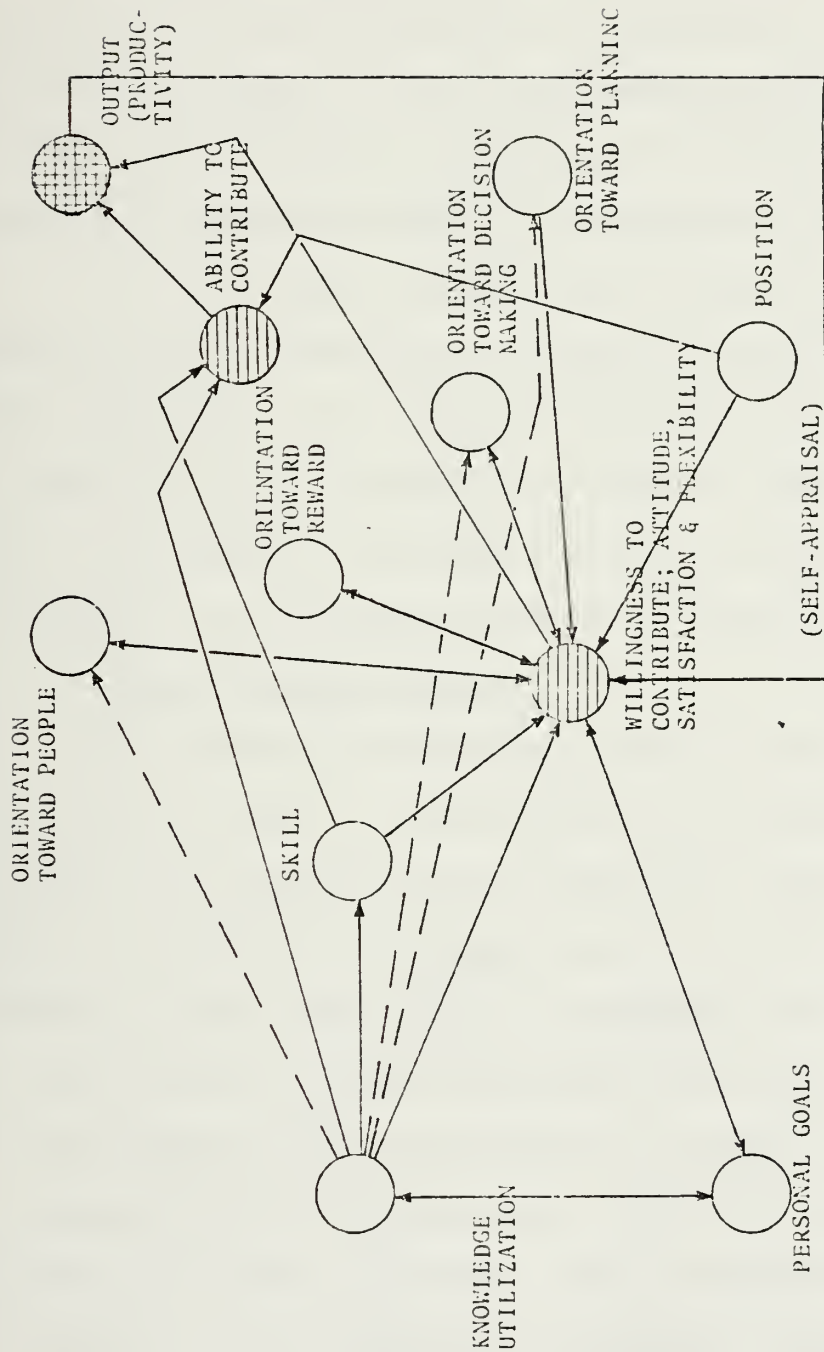
b. Labor

Like management, the interrelationships within the labor element of the organization's structure are complex since the individuals themselves are unique and complex.

The model (Figure 12) again focuses on two characteristics important to describing labor, the willingness and the ability to contribute to the organization. Eight characteristics were selected which appear to influence labor's output.

The willingness to contribute is shown as being influenced by nine factors (personal goals; knowledge utilization; position; skill; orientation toward people; reward; decision making; planning; and the individual's output), which determine labor's satisfaction and attitude toward the





LABOR CHARACTERISTICS

FIGURE 12

KEY

- CHARACTERISTICS
- ⊖ KEY CHARACTERISTIC
- ⊕ ELEMENT OUTCOME
- DIRECT RELATIONSHIP
- (-) INVERSE RELATIONSHIP

This diagram focuses on the characteristics that influence labor's output. Willingness and ability to contribute are shown as key characteristics.



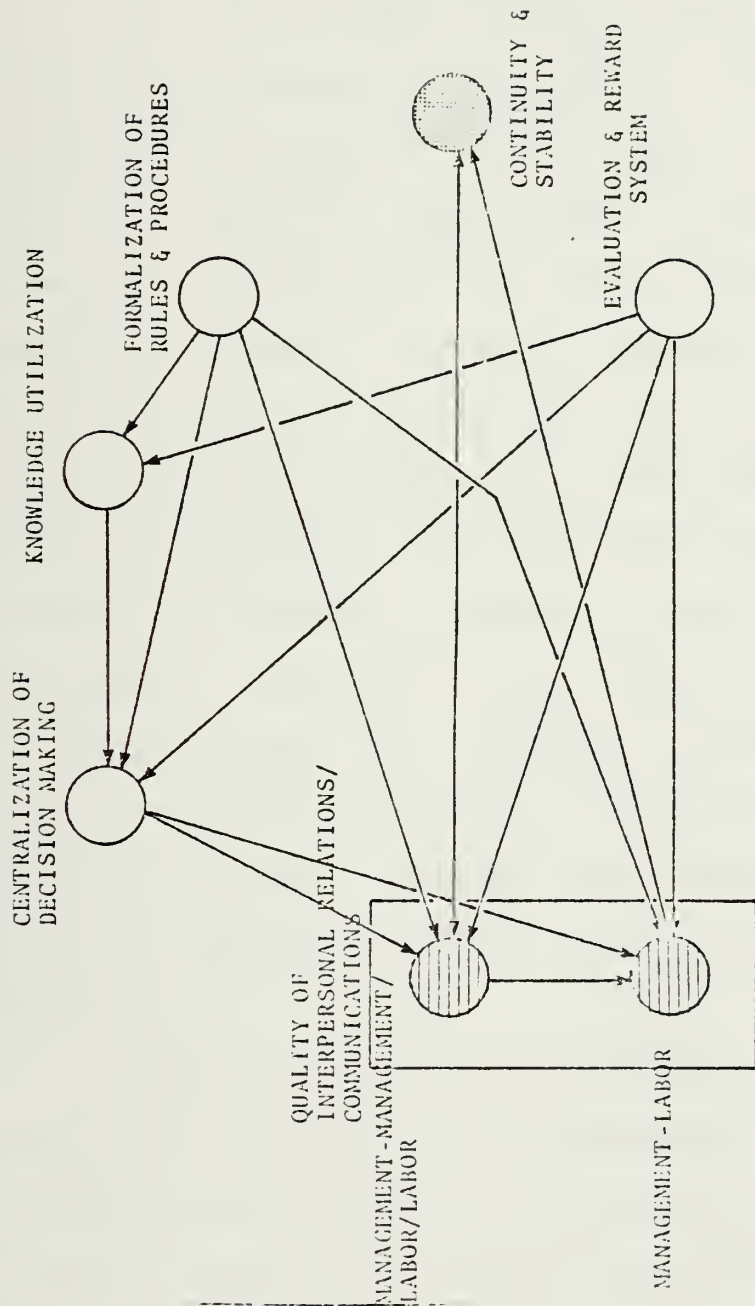
organization. Their satisfaction and attitude, in turn, influence their orientation toward people, reward, decision making and planning and culminate in labor's willingness to contribute to the organization. The process is one of continuous feedback in which the expected and actual outcomes of other organizational elements and characteristics are compared to determine labor's willingness to contribute.

The second factor, the ability to contribute, appears to be a combination of three factors (knowledge, skill, position). The combination of the resultant willingness and ability determine the output of this element of the model. Knowledge is indicated as having a direct or potential effect on all characteristics of this element.

##### 5. Organization Climate

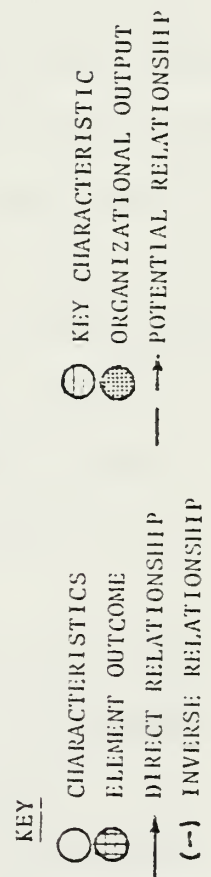
The internal environment, known as the climate, is seen by this author as the quality of the interpersonal relations and communications (Figure 13) within the organization. It is shown as being made up of two elements, the relations between peers at the management and labor levels and the relations between management and labor. The importance of investigating the organization's climate is in determining the consequences of interactions within the organization's management and labor elements. The consequences, continuity and stability, are measured by personnel turnover and morale. The quality of the relations, measured by individual satisfaction with the interaction, is determined by the method, degree and timeliness of the individual outputs. The





ORGANIZATION CLIMATE CHARACTERISTICS

FIGURE 13



This diagram indicates the characteristics that influence the organization's climate; the key characteristics are shown as being the quality of interpersonal relations and communications between management and labor. The outcomes of this element, continuity and stability, are reflected in turnover and morale. The outcome of this element is one of two organizational outputs in the integrated model.





selection of this communication link has a significant bearing on the organization climate. Two forms of control, rules/procedures and evaluation/reward, are used by organizations to direct individual output toward organizational purposes.

The formalization of rules and procedures is shown as being the most pervasive characteristic in influencing the organization's climate. It will have some degree of direct effect on almost all of the factors. Of particular importance is how the organization's rules and procedures affect the structure and method of personal interaction. Also of importance is the degree to which they determine the extent and level of knowledge utilization in decision making and planning (discussed separately) since the decisions which are reached influence who interacts with whom, how, where, when and for what purpose. The evaluation and reward system, like rules and procedures, may have a profound influence on the individuals and their contribution to the organization's output. The selection of rules and reward should be dependent on how well they accomplish the objectives of control and productivity.

Stability refers to the degree to which the climate characteristics result in an environment that is conducive to a predictable pattern of interaction and outputs. It is reflected in morale (attitudes) that influence productivity (outputs) at any point in time. Continuity is an extended measure of stability and is used to measure changes over time (i.e., personnel turnover). Both attitude and turnover are



consequences of the organization's climate and have significant impact on individual and organizational output.

## 6. Production Process

The production process, like the knowledge utilization process, is composed of four phases: planning (intellectual understanding), project (application), marketing (transfer), and sale (feedback). The planning and project phases are singled out for analysis since they are largely controlled by one organization, the supplier. The market demand for production is reflected in the planning phase by the demand forecast and in the project phase by the design of the supplier organization's output.

### a. Planning

In an engineering, business or scientific environment, most successful entities devote a great deal of time to systematically planning and analyzing the relationships between the input resources (personnel, capital, facilities, material) and the output product or service and then comparing the actual output with the expected output over a given time period.

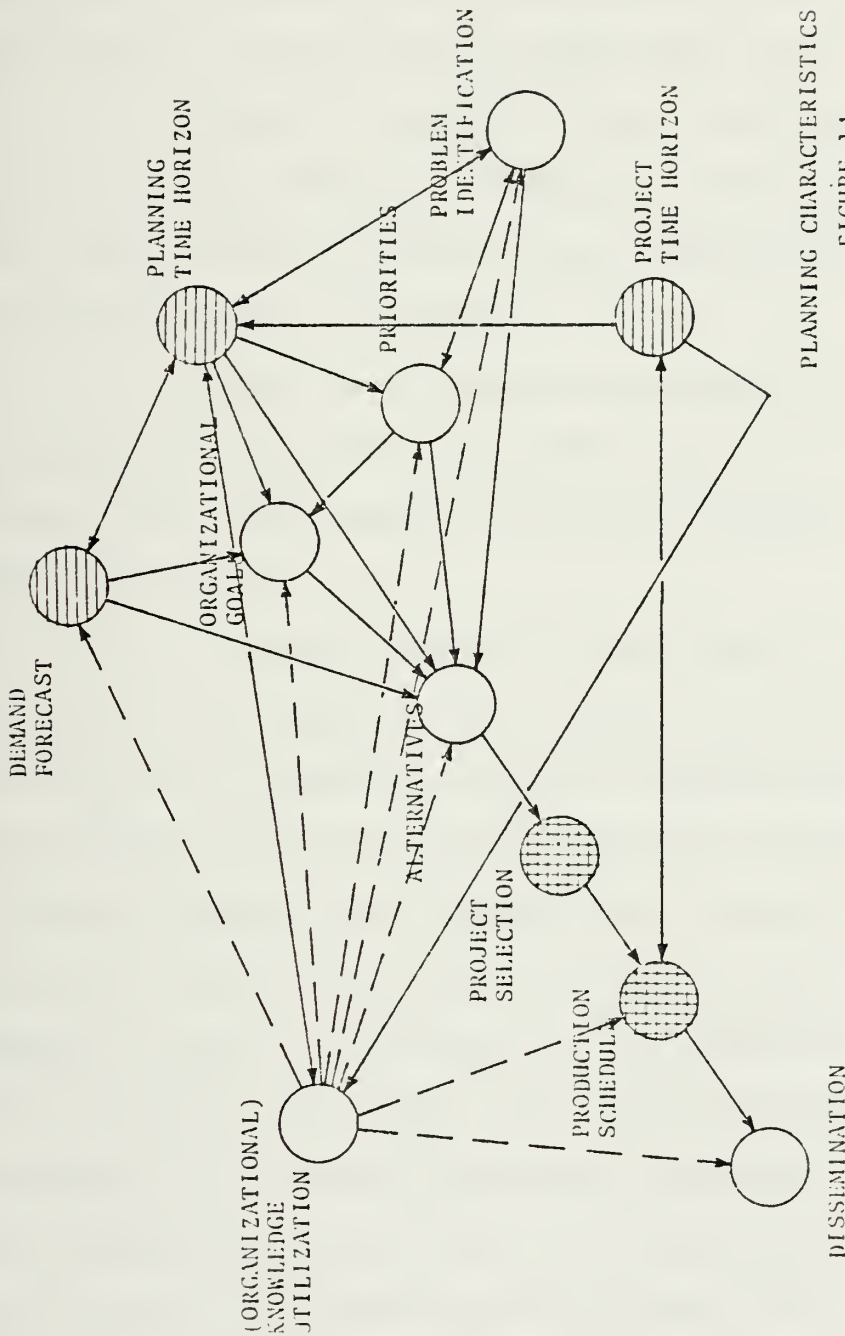
While the inputs and outputs are sometimes more difficult to quantify, the "soft sciences" (management theory, organizational development, psychology and communication theory) have attempted to systematically analyze the elements of the problem-solving process. The results of the problem-solving process are then used to formulate plans which



would resolve the difference (or variance) between the actual and predicted inputs or outputs. Regardless of the discipline, the analytic technique is basically the same and evolves from the attempt to improve or explain performance. Insofar as there are inherent capabilities and limitations in any individual, organization or process, there will be shortfalls in actual and potential performance. Characteristics of the planning process are shown in Figure 14.

Problem solving begins with an observation of a condition which deviates from the expected (the goal). Through a systematic investigation, the facts, causes, effects, information and assumptions are collected concerning the observation. The problem-solving technique presupposes that the real problem or problems have been identified, rather than the causes, effects, or symptoms. Distinguishing one from the other is often one of the most difficult steps. Once the problem is identified, deductive or inductive reasoning and investigation are used to identify potential alternatives along with their inherent strengths and weaknesses. The extent to which an alternative solves the problem then depends not only on how well the problem was identified but also on how completely the potential alternatives (or fields of knowledge) were enumerated. The selection of an alternative implies the element of choice. It is based on recognized need to employ an individual's or organization's resources effectively.





PLANNING CHARACTERISTICS  
FIGURE 14

This diagram indicates the relationships between the characteristics that influence the organization's planning activity. Key characteristics in determining project selection and the production schedule are the demand forecast, the time needed to plan and the time needed to complete the project.





The manager's goal is to determine the depth and mix of the resources (including knowledge) that will accomplish the organizational objectives most effectively and then to formulate or facilitate the plan which takes into account the time factor that makes the process dynamic.

Time is a resource that, unlike other resources, cannot be controlled, only managed. For this reason, it is most often viewed as the limiting resource for individual or organizational activities.

Since time can only be managed, planning represents a potentially important factor in any production process and should receive explicit treatment in evaluating the organization.

Planning generally starts with a forecast of demand for the organization's output over the planning time horizon and is translated into an organization's long-range, intermediate and short-range production goals. It implies (1) that a set of goals (objectives) has been established, (2) that a set of priorities exists by which the goals are ranked in order of importance to the individual or organization, and (3) that some time reference/limitation has been superimposed by which to complete the actual attainment with the feasible or desired goal. The planning process involves three steps: (1) assessing the present, (2) projecting a goal and (3) comparing the present with the goal to determine if differences exist and then if plan or goal revision is necessary, desirable or feasible.



Because input resources (personnel, capital, facilities, raw material, technology, knowledge and time) are limited, planning must account for the differences between feasible and desired goals and provide for the best use of available resources. The resources and factors which may prove to be problems or limitations (including resource limitations) in attaining the goal should be identified during the planning process. Where limitations are encountered, priorities and the effective allocation of resources play a particularly important role in realizing the (feasible) goals. The assessment of resources, problems and alternatives is important for planning and can influence subsequent performance.

The level of planning and goal setting gives some degree of structure and purpose to the production process. Where the purpose is absent, production can still occur; but the potential for contributing to the organization's goals is significantly reduced.

Production without purpose appears to be a particularly important problem when considering how or whether an individual's knowledge production (research, technical publications, etc.) contributes to the organizational output. Where significant differences exist between the two, the plan or purpose should be reviewed to determine whether the output satisfied individual or organizational goals.

One factor that is often neglected is the review and communication of results at selected intermediate points.



The point at which review and communication are accomplished can be measured either in time or goal attainment. These activities facilitate revision of the plan before the final time or goal is attained if they are accomplished early enough to make changes in the planning or implementation process.

Review is necessary as a basis for measuring goal attainment and performance evaluation. Used in conjunction with the control system, review provides the means to coordinate individual or organizational efforts. Having the mechanisms in place, however, does not imply that favorable or adverse observations are understood, communicated, or acted on.

As appears true with any process that involves knowledge, comparison and planning should precede action. The planning and review process provides a basis of predictability, stability and continuity on which to build credibility and control. Credibility and control represent a continuum. No particular level of control is implied; that is a function of the manager's orientation and of the reward system. The consequences of specific control and reward systems must be understood in the light of the individuals and circumstances prevailing at the time.

Any one factor may retard or stop the knowledge utilization process. The planning function should be designed to take into account the interrelationships of as many variables as possible, providing alternative courses of action



and predicting possible consequences, to facilitate the resource usage.

Considering the alternatives and consequences provides for better understanding of what factors can be controlled, can be modified or influenced, and which factors cannot be controlled. The direct and indirect consequences of the course of action that is selected for implementation has a substantial impact on the individuals, the means, and the output, the end.

Where two (or more) individuals or organizations are involved in planning or project selection, as in the knowledge utilization process, there is a potential that the planning system (goal orientation, priorities, commitment to the project and time horizon) of the parties may not be matched or coincident. The differences can only be recognized, understood and resolved through frequent and thorough communication.

The defined time horizon in which the planning and knowledge utilization process are affected obviously has significant consequences and represents a continuum of possibilities from the short-time, "now" orientation of daily routine to the futuristic, long-planning horizon attendant with innovation. The longer the horizon, the greater the degree of uncertainty in planning and utilization, the greater the possibility that resources will become available and that old problems will be solved and new ones will arise. As old problems are solved and new problems arise, the use of





individuals and their knowledge can be modified through the planning and problem-solving processes. It is important to note that planning, the intellectual phase, precedes and facilitates production, the utilization or activity phase. Any orientation that distorts this emphasis on output appears to have confused the means with the end.

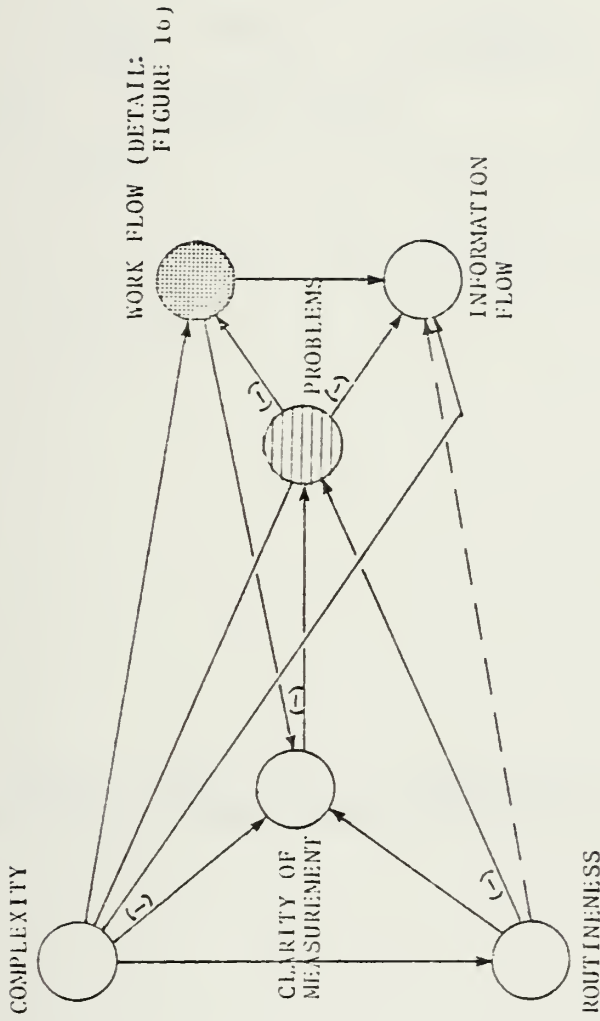
b. Project

The project element is the second phase of the production process. It is the implementation or activity phase in which various organizational resources are combined to produce the organization's output. The project phase consists of a pattern of receipt, inspection and processing that is unique to that organization.

The type of output and process determine the work flow and, to some extent, the information flow required to monitor progress. Where knowledge is an output, the process follows the pattern described earlier. The project may involve a series of receipts, transfers, inspections and processing at one or more places in the organization before the knowledge reaches the final processing stage. The resultant output which is inspected to determine whether or not it satisfies the organization's project requirements is accepted and either used directly or stored for later transfer and use, reprocessed or rejected.

While output is the objective of the project phase, the focus of this element is on the problems encountered in achieving it (Figure 15). The complexity of the project





**KEY**

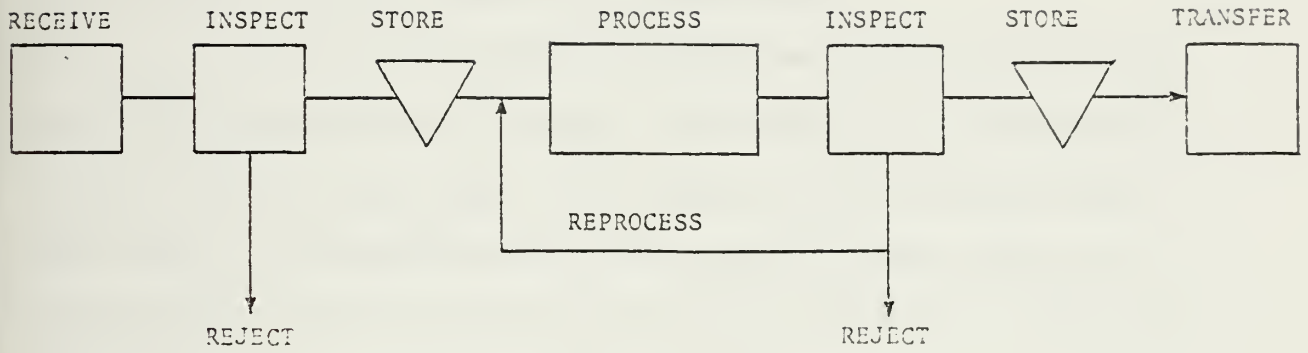
- CHARACTERISTICS
- ⊙ ELEMENT OUTCOME
- DIRECT RELATIONSHIP
- (-) INVERSE RELATIONSHIP
- ⊙ KEY CHARACTERISTIC
- ⊙ ORGANIZATIONAL OUTPUT
- - - POTENTIAL RELATIONSHIP

**PROJECT CHARACTERISTICS**

**FIGURE 15**

This diagram focuses on the characteristics that describe organizational projects. Problems represent a key characteristic that influences the organization's output. The outcome of this element is one of two organizational outputs in the integrated model.





PROJECT WORK FLOW DETAIL  
FIGURE 16

Project work flow is shown as a series of receipt, inspection, storage and processing that leads to transfer.



and how frequently it is accomplished have a significant impact on the problems associated with the work flow.

Problems are shown as being the direct result of a complex project whose inputs, outputs and steps are not routine and clearly defined or measurable.

The project phase culminates in an output that is potentially useful to other individuals or organizations. In the case of knowledge, the method of the documentation and means of dissemination between individuals within the organization and between organizations should be sensitive to the needs and time constraints of the user.

### C. OUTPUTS

An organization's outputs, the consequences of organizational activity, may take many forms. To the traditional goods and services are added individuals who may leave the organization as products of the process and from personnel turnover or who may contribute to the organization's output in the form of knowledge, information or technology.

It is sometimes difficult to standardize or quantify an individual's contribution to the organization since it can take many forms and is spread over time. Typical measures of output include quantity, quality and timeliness. Measures of the production or knowledge utilization process may use comparison of actual and expected output to determine whether the output meets the organizational objective of effectiveness or may compare input to output to determine efficiency.





unlike some products which can be measured objectively, knowledge and its utilization are subjective and may be difficult to quantify.

Organizational outcomes are measured in terms of human results (i.e., attitudes and turnover that affect productivity) as well as the economic results of production activity. While one cannot lose track of the fact that the organization is output-oriented, it is important to remember that the individual is the means of achieving the output. Achieving a balance between the means and the ends has become a serious organizational problem.

#### D. ENVIRONMENT

Individuals or organizations operate within and are influenced by their environment. On an individual basis, the environment is composed of personal relationships with individuals, family and groups and work/organizational relationships with individuals and groups. The combination of social, religious, educational, and work relationships shapes the individual's values and orientation toward various facets of his or her environment. The same type of relationships exists on an organizational basis but these relationships are known as organizational rather than personal. Cooperative interaction with the organization's suppliers and clients corresponds to the individual's personal relationships; and competition with other organizations for a share of the market or with government and



regulatory agencies equates to the individual's work relationships.

The organization, like the individual, needs to understand the environment within which it operates. In the process of achieving this understanding, the organization uses both investigative research and practical interaction to identify the factors that advance or impede its cooperative or competitive position. Understanding is the first phase of the knowledge utilization process; it precedes the activity phase in which the organization or individual applies the knowledge to change or exploit the factors that can be controlled and to find alternative solutions to the problems which cannot be controlled. Problem identification and control are largely a matter of timing; some problems may be anticipated by planning while others occur during production despite planning efforts. While planning may not eliminate all problems, it does give some degree of control to the organization's response to them.

Individual and organizational responses or outputs influence the environment. The degree to which outputs affect the environment is dependent not only upon the size of the output but also on the receptivity and predictability of the individual or organizational response to the output. The environment is a complex combination of regulatory and legal policy which, in conjunction with the prevailing economic conditions of market (user) and competition, influences the supplier organization's demand forecast for its output. Where



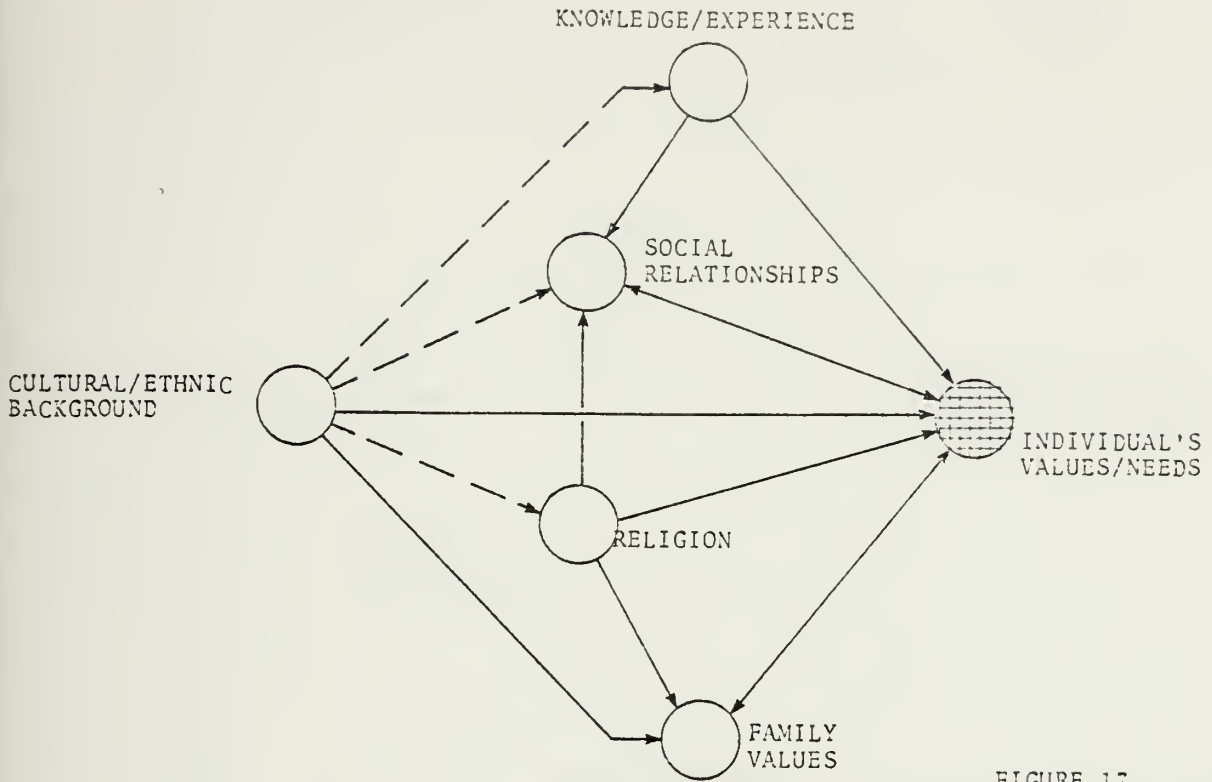


FIGURE 17  
ENVIRONMENTAL CHARACTERISTICS  
(INDIVIDUAL - MANAGEMENT)

- KEY
- CHARACTERISTICS
  - ⊗ ELEMENT OUTCOME
  - DIRECT RELATIONSHIP
  - (-) INVERSE RELATIONSHIP
  - ⊖ KEY CHARACTERISTIC
  - ⊘ ORGANIZATIONAL OUTPUT
  - - - - - POTENTIAL RELATIONSHIP

(Individual) This diagram indicates the relationships between environmental characteristics that influence an individual's values and needs.



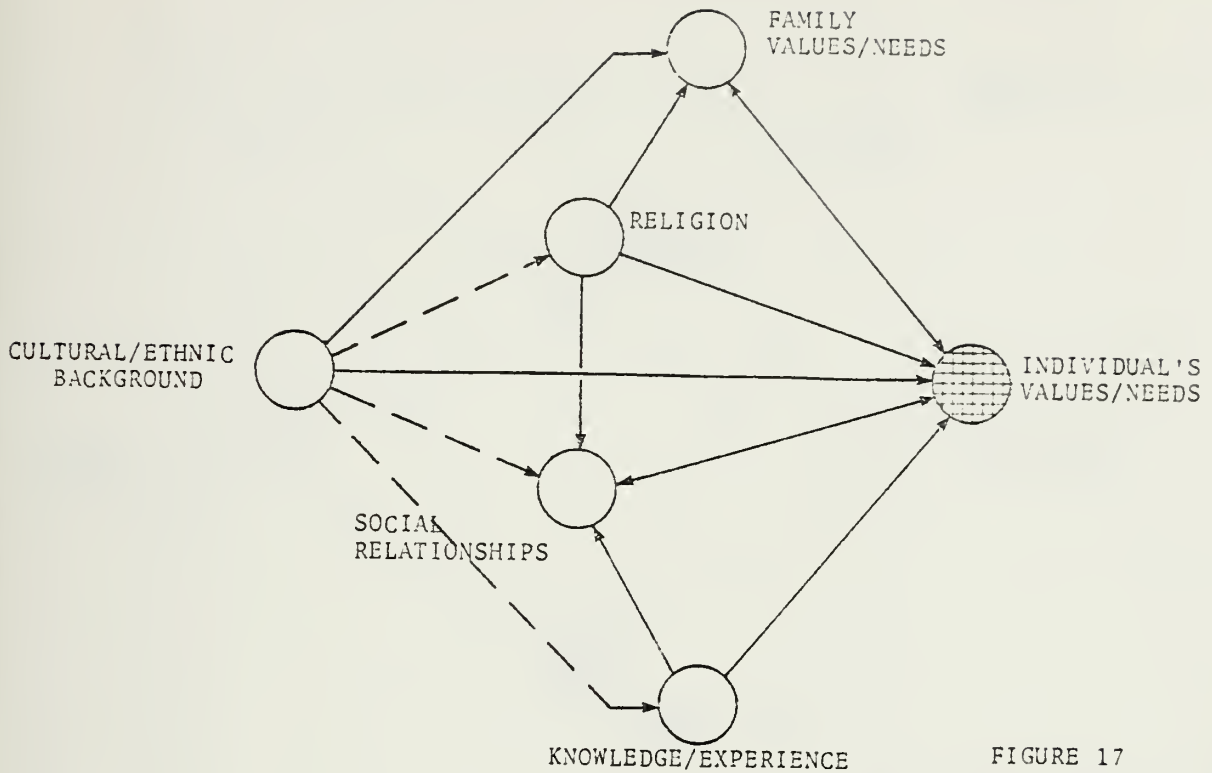


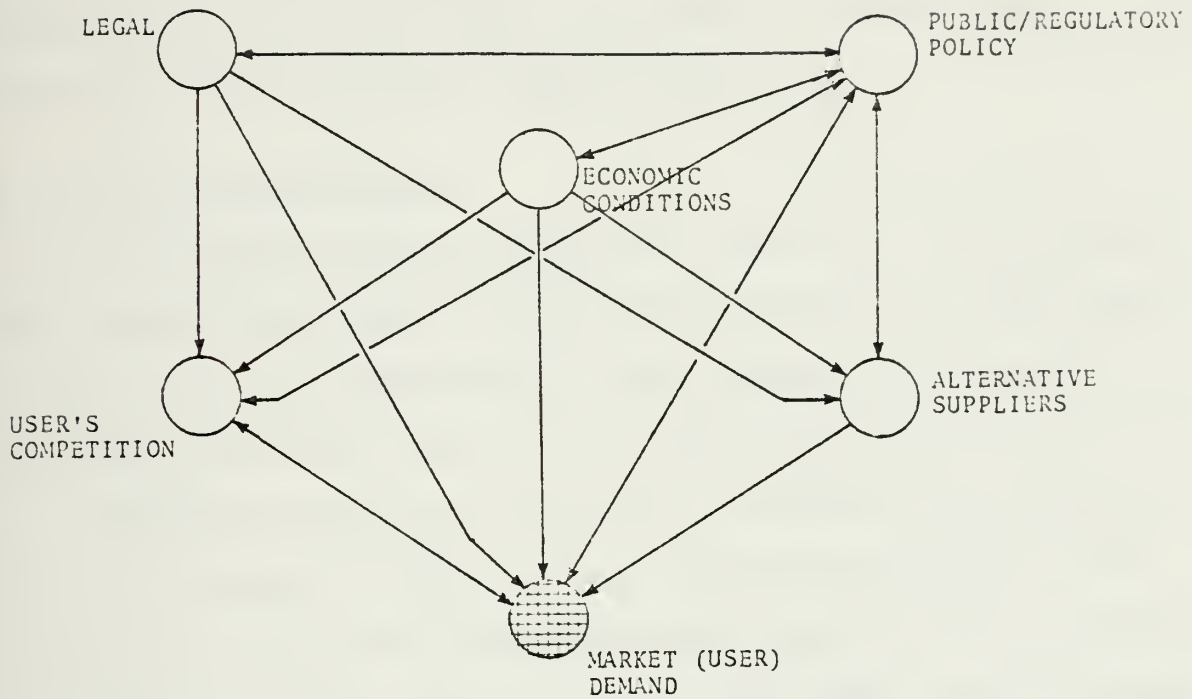
FIGURE 17  
ENVIRONMENTAL CHARACTERISTICS  
(INDIVIDUAL - LABOR)

- KEY
- CHARACTERISTICS
  - ⊕ ELEMENT OUTCOME
  - DIRECT RELATIONSHIP
  - (-) INVERSE RELATIONSHIP
  - ⊖ KEY CHARACTERISTIC
  - ⊘ ORGANIZATIONAL OUTPUT
  - - - - - POTENTIAL RELATIONSHIP

(Individual) This diagram indicates the relationships between environmental characteristics that influence an individual's values and needs.







ENVIRONMENTAL CHARACTERISTICS  
((RGANIZATION)

FIGURE 18

KEY

- |                          |                                  |
|--------------------------|----------------------------------|
| ○ CHARACTERISTICS        | ⊖ KEY CHARACTERISTIC             |
| ⊕ ELEMENT OUTCOME        | ▨ ORGANIZATIONAL OUTPUT          |
| → DIRECT RELATIONSHIP    | - - - - - POTENTIAL RELATIONSHIP |
| (-) INVERSE RELATIONSHIP |                                  |

(Organization) This diagram indicates the relationships between environmental characteristics that influence the market (user's) demand for an organization's output.



significant barriers exist to distort or obstruct the knowledge that is necessary to develop the demand forecast, distortions in product output are likely to occur which adversely affect both the supplier and user.

#### E. THE INTEGRATED MODEL

The integrated model (Figure 19) shows the interrelationship between the elements and characteristics that were used to describe the organization. Three factors, individuals, knowledge and time, appear to be particularly important.

Interaction between individuals in planning and production is important in determining organization output. The interaction during the planning phase generally occurs either by direct, personal contact between management and the user or indirectly through sale of the organization's output. Management is shown as being the dominant element of the planning process; the degree to which labor contributes to planning may vary widely and is shown as occurring in the project selection phase although it may also occur elsewhere. During the production phase, interaction between management and labor is important. The dominant element becomes labor, whose individual or collective output completes the production process. Management involvement during production takes the form of facilitation, inspection and control. It is feasible that the user may have some direct contact with labor, depending on the project, management's orientation toward control, and the relationship between supplier and user organizations.



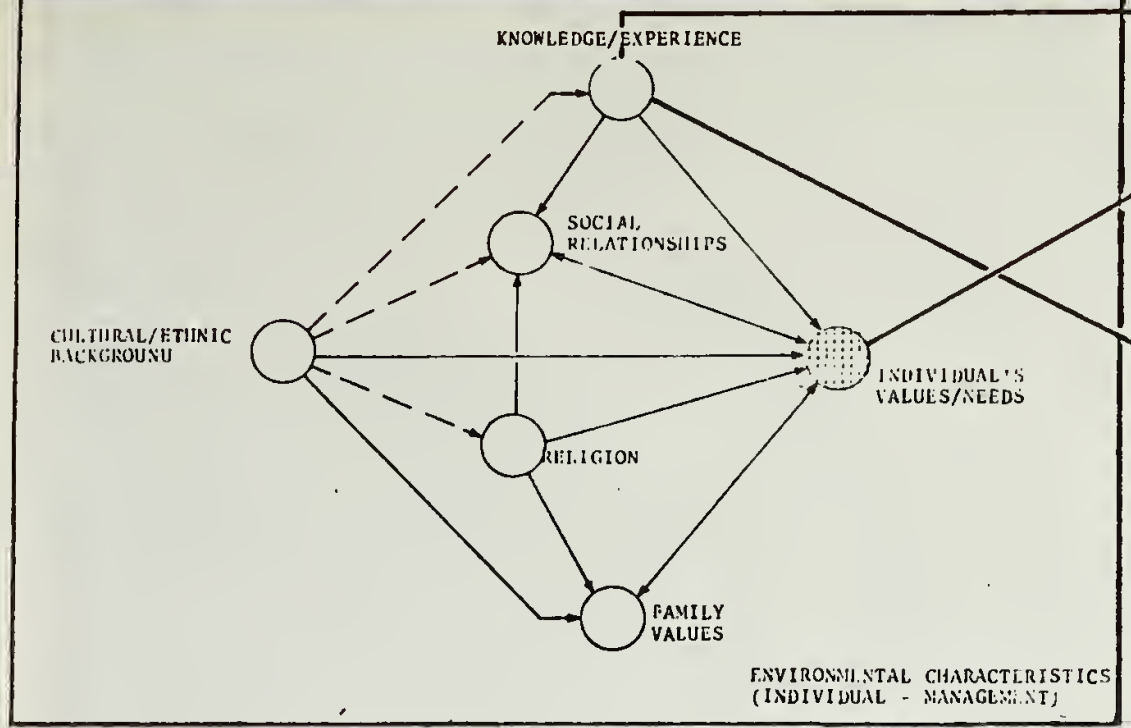


FIGURE 17

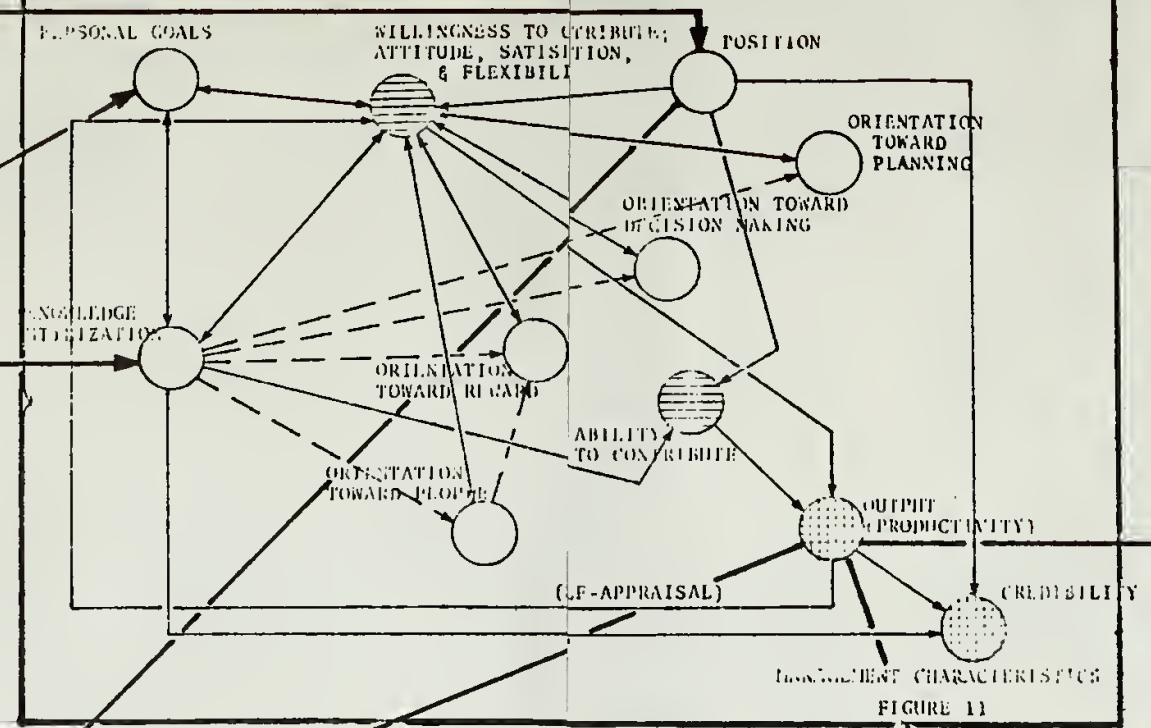


FIGURE 11

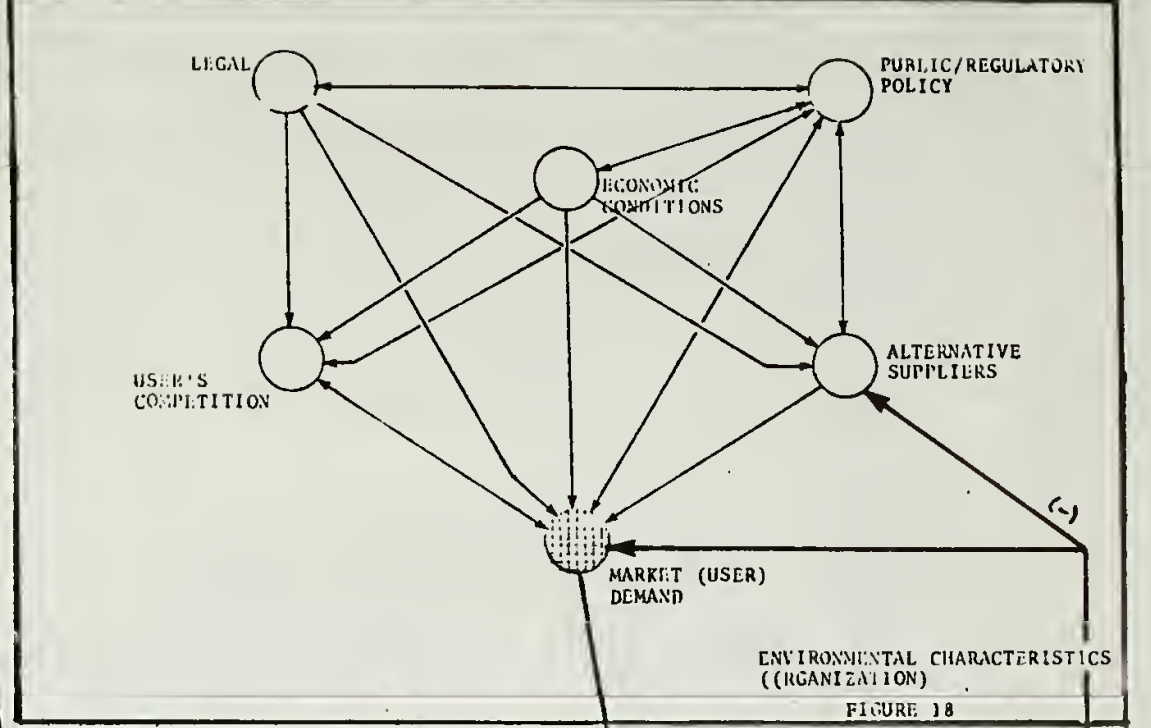


FIGURE 18

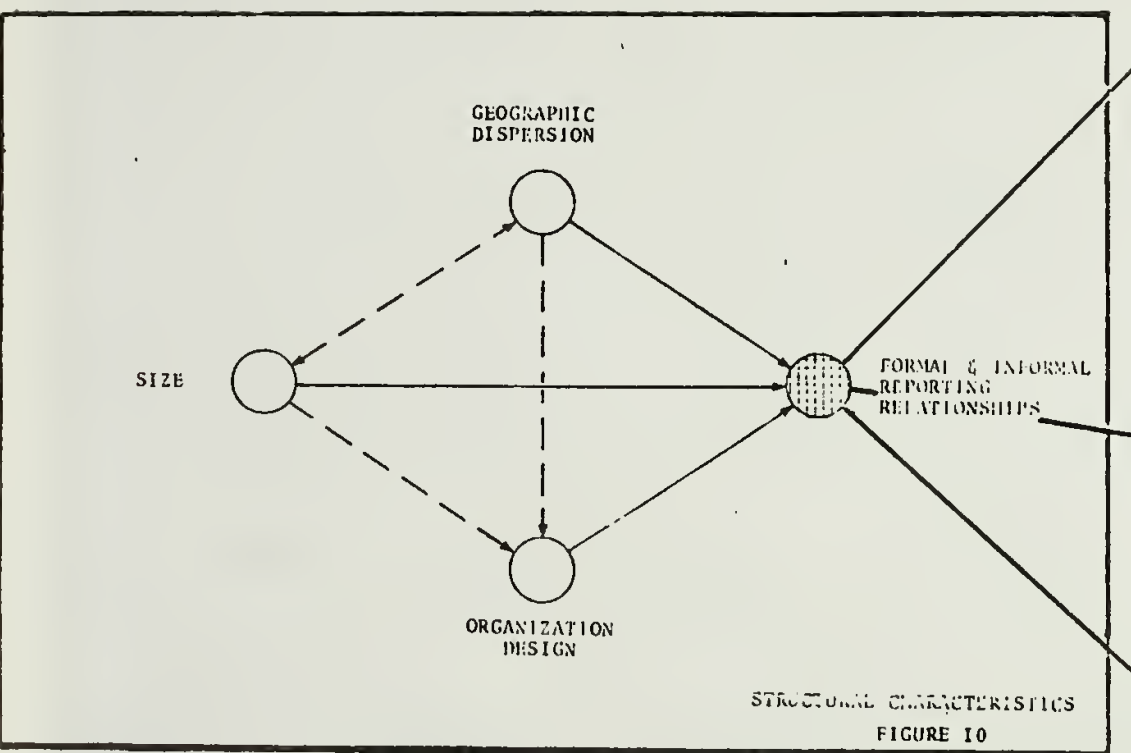


FIGURE 10

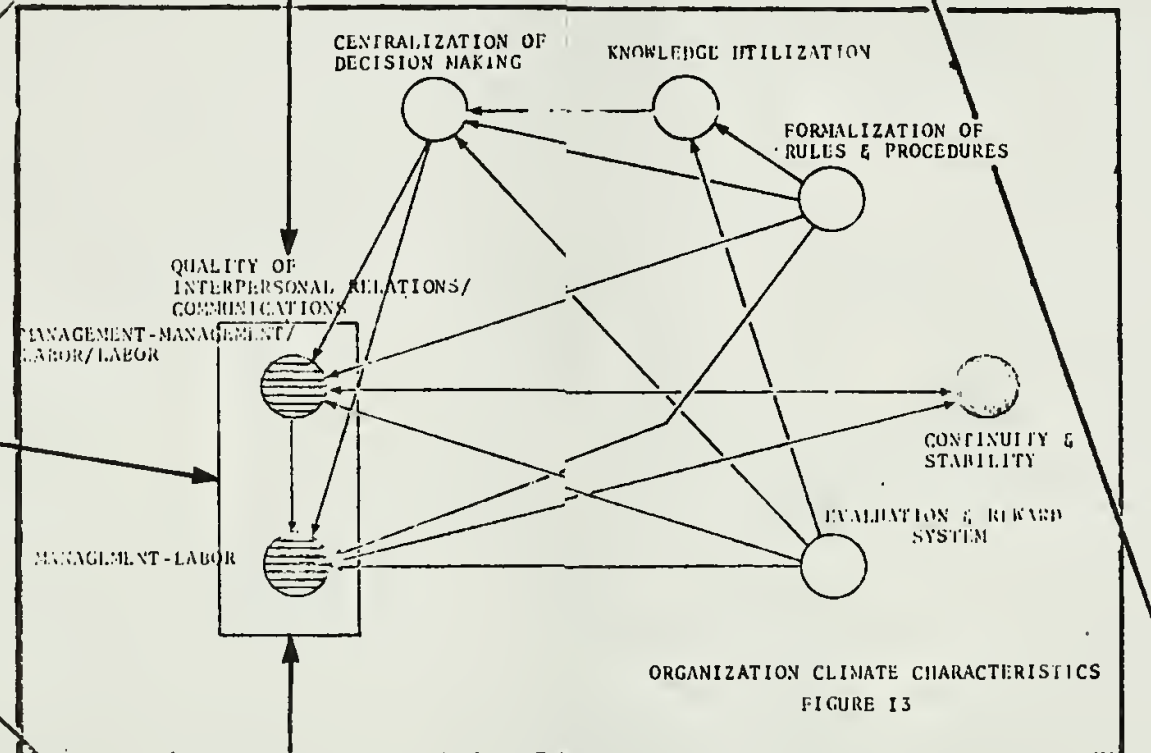


FIGURE 13

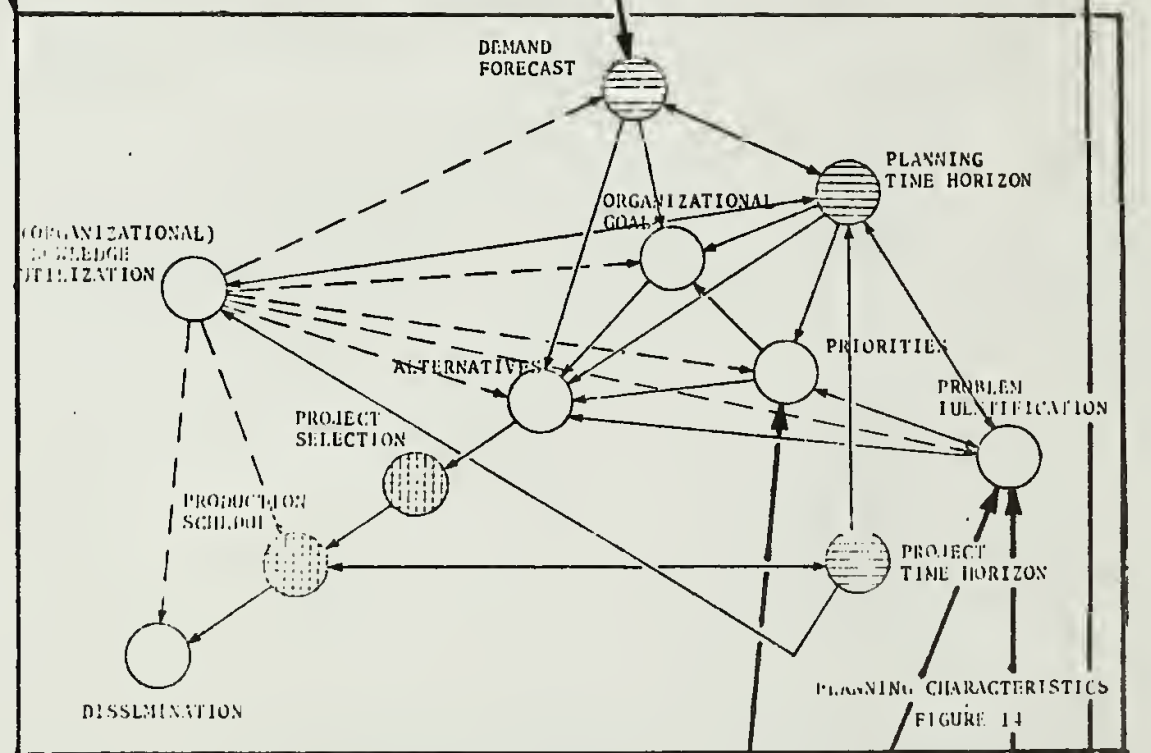


FIGURE 14

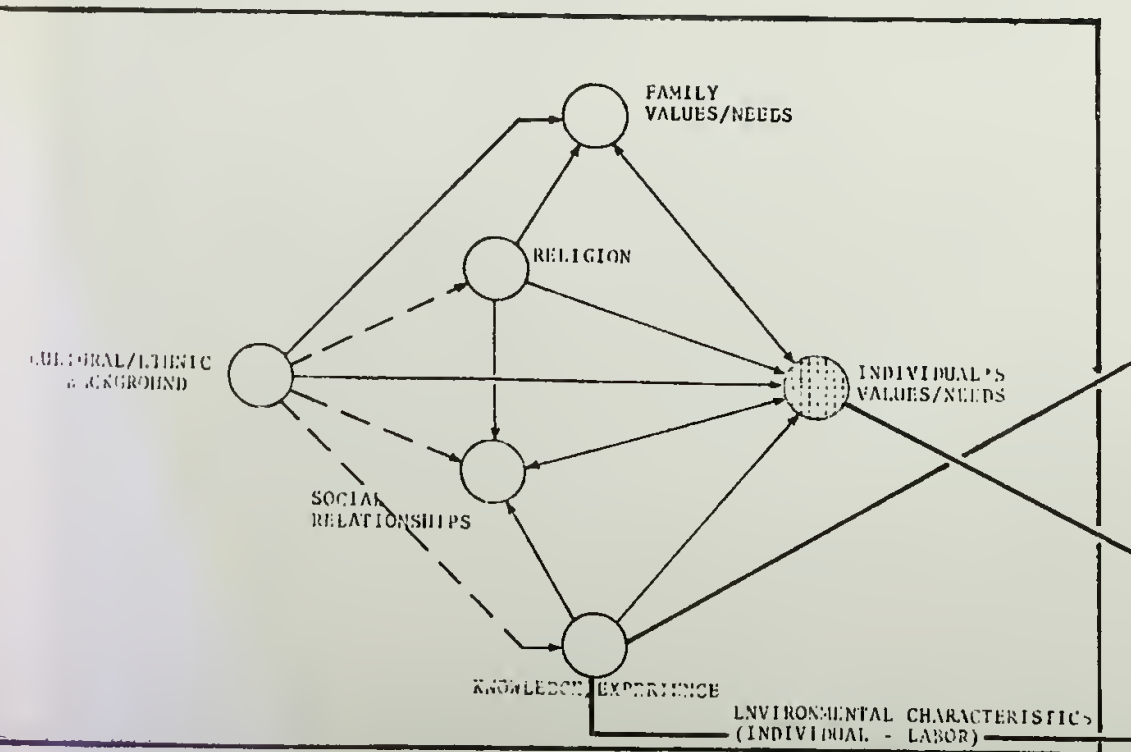


FIGURE 17

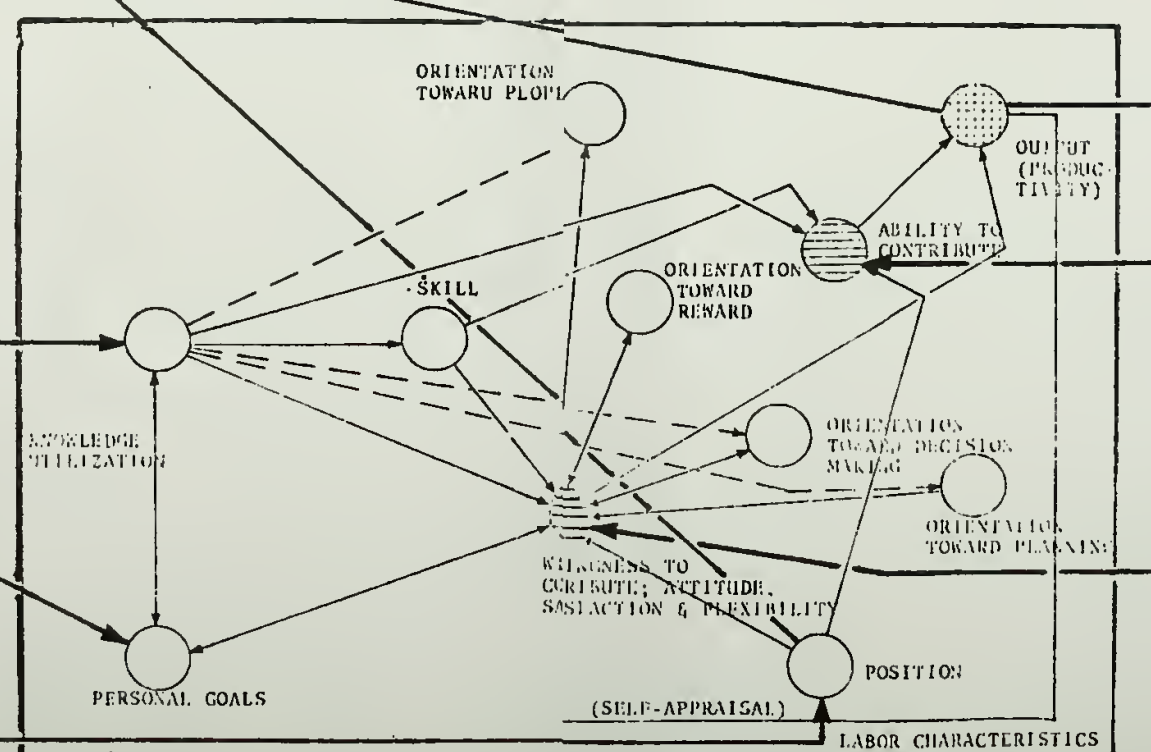


FIGURE 12

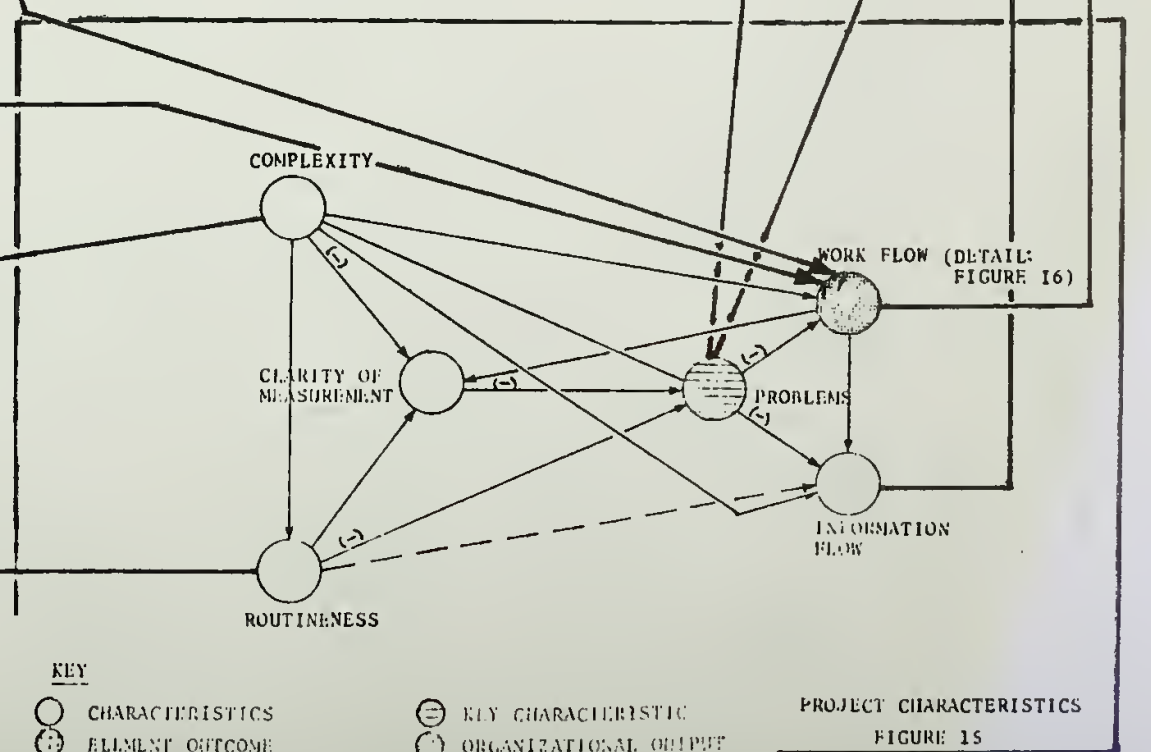


FIGURE 15

KEY  
 ○ CHARACTERISTICS  
 ⊙ KEY CHARACTERISTIC  
 ⊕ ELEMENT OUTCOME  
 ⊖ ORGANIZATIONAL OUTPUT  
 → DIRECT RELATIONSHIP  
 - - - POTENTIAL RELATIONSHIP  
 (-) INVERSE RELATIONSHIP

Figure 19. This diagram integrates the models that were developed previously (Figures 10-18) to indicate the relationships between elements.

The potential for knowledge utilization exists in both planning and production. Drawing on knowledge appears to be a function of the orientation of the individuals involved and the time available for planning and/or production. The trade-offs between using knowledge for one or the other are too complex to be discussed briefly or displayed graphically.

The importance of time is seen in both planning and production as limiting individual and organizational output. Time makes the process dynamic through changes in productivity (output) and through changes in the input resources (individuals, knowledge, technology, facilities, capital and raw materials).





## VI. KNOWLEDGE FLOW BETWEEN ORGANIZATIONS

The interactions between organizations, whether it be in terms of goods, services, or knowledge, are dependent upon the interaction between people; the interface is communication (Figure 20). Consequently, if the communication between the sender and receiver is relatively complete and accurate, there is a greater likelihood that some of the environmental characteristics will be understood and that supplier outputs will more closely match user need. Links, which may either be people or the communications between people, are important because they originate, transmit, receive, interpret, accept or reject, process, store, transmit, and apply knowledge. Some individuals are more adept at some link functions than others; attention should be given to selecting the individuals and communication (documentation and distribution) links that best accomplish the knowledge utilization and transfer process.

When considering the transfer between two or more organizations, it is important to note that the general factors which have been discussed are operative at some time and to some degree in both organizations. The implication for the knowledge transfer and utilization process is that control and coordination become somewhat more difficult and may necessitate more frequent (though not necessarily formal) interaction to identify and resolve differences. Individuals



ENVIRONMENT

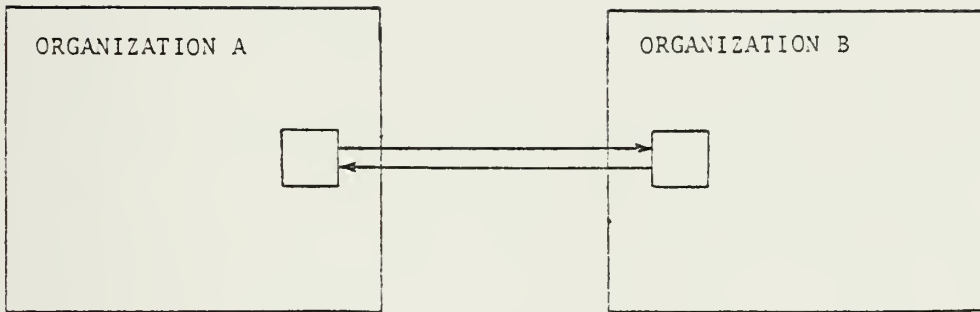


FIGURE 20  
KNOWLEDGE FLOW BETWEEN  
ORGANIZATIONS

Knowledge flow results from the interaction and communication between individuals.



in both organizations who can communicate well and know their respective organizations well enough to facilitate all phases of the transfer and subsequent implementation should be selected as links.



## VII. CONCLUSIONS/RECOMMENDATIONS

This thesis has described the knowledge utilization process and developed a descriptive model of an organization in which the process takes place. The model integrates elements from four categories: (1) RESOURCES, of which individuals and the knowledge they possess are critical, (2) the ORGANIZATION, within which the planning (theory) and project (implementation) phases of the knowledge utilization process are conducted, (3) the OUTPUTS, individuals and knowledge, and (4) the organization's external ENVIRONMENT. In developing the model, a procedure was demonstrated that can be used by managers to analyze the interrelationships between characteristics that influence the knowledge utilization process. A series of questions serve as checklists that parallel the development of the model and could be used by managers and consultants to provide a better understanding of an organization and its knowledge utilization process. Two elements appear to be critical to both; they are individuals and time.

Individuals and the link(s) between individuals, within or between organizations, are essential since they influence the planning and project phases of the knowledge utilization process and consequently determine organizational output. The planning phase involves expansion and structuring of the knowledge resource in preparation for the project phase.





Individuals frequently rely on a resource base that they control (self-reliance) or on one which is on their level (horizontal/peer relationships). Given the rate of change and interdependency between individuals and organizations, reaching beyond strictly vertical or horizontal relationships and seeking outside resources is important to organizational survival. Calling on additional resources is dependent on awareness which can be achieved by individual research or an intercessory link. Once exposure has been achieved, acceptance is based on the user's perceived need and the perceived usefulness of the resource, on the credibility of the source, and on the implicit and explicit cost of obtaining it.

During the production phase, the organization's resources are integrated to produce outputs that are intended to satisfy a need in its environment. Since there are at least two participants, a supplier and a user, in the process, at least two perspectives should be compared in analyzing the process and adequacy of the output or input. Given the inherent limitations in the knowledge transfer/utilization process, planning is extremely important in resolving the differences between the current and the desired or future resource base, organization, process, output or environment and should precede production.

Time is usually a limiting resource and adds a dynamic dimension to the process that reinforces the importance of planning and the effective use of knowledge in managing organizational outcomes (i.e., personnel turnover, individual



output, organizational output, and change). Where differences exist, the characteristics and elements that can be controlled need to be identified in order to expand the number of possible alternatives from which to choose a project and implementation strategy. A review of the ensuing consequences further accounts for the effects of time and is important to complete the process.

It is obvious from looking at any book or library section dealing with management that there is no one answer -- only a variety of choices of knowledge and intervention strategies. The selection of one or the other and its eventual success or failure depend on the situation, the organization, the individuals and their ability to use the knowledge resource and time.

It is important to recognize that every organization operates in a different environment, has different resources, and has unique processes and outputs. It is also important to understand the interrelationships and the limitations imposed on the knowledge utilization process by the various elements.

Because time is a critical and uncontrolled resource, it is imperative that it be well managed. Planning should precede activity and draw upon expanded knowledge and alternatives to better utilize and integrate input resources during the production process. It is recommended that further study be given to describing the interrelationships between these elements and characteristics. Use in analyzing actual



organizational processes may clarify the areas where additional study or priority of effort should be concentrated.

It is recommended that each potential user develop an organizational model so as to put the various organizational factors into perspective and to visualize their interrelationships more clearly.



## APPENDIX A

### CHECKLISTS

This section represents the application phase of this thesis effort and takes the form of a checklist that parallels the theoretical development of the organizational model.

In developing the questions in this appendix, each element and characteristic of the model was analyzed by asking the questions: "What," "Where," "Who," "How," "When," and "What if."

In most cases, the question "How much..." could be substituted equally well for the question "What...", depending upon the method that is selected for administering the checklist. Since the thesis has been developed for a broad range of potential users, the questions are necessarily general and are not all-inclusive. It should be borne in mind, however, that in reviewing an organization and/or the knowledge utilization process, there are at least two perspectives that can be taken:

(1) The supplier (the individual/organization initiating) and the user (the individual/organization affected).

(2) What it is now and how it should be or how one would like it to be in the future.

These checklists can be used by individuals in any capacity to gain a better understanding of an organization and its knowledge utilization process. The method selected





for administering the checklist and the depth or detail of questioning are a function of the goals, roles and relationships of the supplier and user. Changes in the organization or knowledge utilization process, on the other hand, require the interest, support and planning (or at least not the enmity) of individuals within the organization who have the formal or informal power and credibility to affect the planning and production activities of the organization. Analysis and dissemination of the responses to the checklist should include the individuals, work groups, and organizations that have an influence on the organization and its output. The resulting dialog may be the most important step in understanding the organization and process before an attempt is made to control it.



## KNOWLEDGE APPLICATION PROCESS

For what purpose is the knowledge needed? (understanding, application, transfer)

What is the relationship between supplier and user? (position, degree of control, etc.)

What is the role of the supplier? What is the role of the user?

What are the links in the transfer and implementation? (individuals, communications)

What type of knowledge exchange is affected? (one-way, two-way/balanced)

What are the barriers associated with these links and this transfer? (individual, organizational, environmental)

### A. THEORY

Who are the potential suppliers?

What knowledge is available? (subject(s), quantity, detail/type)

In what form is the knowledge available?

For what purpose is the knowledge needed? (application, transfer, conversation)

What is the method, detail, length and circumstance of exposure?

What is the level of understanding? of retention?

How much processing is necessary after exposure?



What effect does the processing activity have on the knowledge? (accept, change, reject)

B. IMPLEMENTATION

What type of knowledge is required for this application? (quantity, quality, form)

How much additional knowledge and further processing are necessary before implementation is possible?

C. REVIEW/FEEDBACK

How credible or useful and complete is the knowledge (base, source, link)?

What type of feedback does the user provide?

How responsive is the supplier to user feedback?

D. TRANSFER

How much knowledge is available for transfer? (quantity, quality, detail)

How much is transferred?



## AN ORGANIZATIONAL MODEL

### ORGANIZATION

#### 1. Structure

How many individuals are employed by the organization?  
(management, research, labor, consulting)

What type of formal organization design has been implemented in this organization?

What is the span of control?

Where are the divisions, departments or individuals located?

What are the formal reporting relationships within the organization? (the organization chart)

What are the informal relationships?

##### a. Individuals

What is the motivating force for this individual?  
(self, external)

Are the individual's goals coincident with the organizational goals?

To what source(s) of reward does this individual respond? (internal, family, peer, superior, other)

What type of reward is required to motivate/control this individual's output? (responsibility, financial, time off, personal recognition, etc.)

What is the time difference between output and reward? (for the individual, for the organization)





Upon what basis does this individual derive his/her credibility? (position, knowledge, personality, output)

b. Management

What position does this individual fill within the organization's structure? (formal, informal)

What knowledge does this individual have? (How was it gained?)

What is his/her capacity to structure/use additional knowledge? (knowledge utilization)

What and how clear are the manager's personal goals? (knowledge application, transfer) (stated, operative)

What is this manager's orientation toward people? (business relationships -- superiors and outsiders, unions, public, etc.; peers, subordinates)

What is this manager's orientation toward reward? (for himself, for others)

What is this manager's orientation toward decision-making? (to make, to accept, to delegate)

What is this manager's orientation toward planning? (time horizon, frequency, detail, etc.)

How willing is this manager to contribute to the organization's goal/output?

How ably can this manager contribute to the organization's goal/output?

How flexible is the manager when change is required?

How satisfied is the manager with output? (his own, superior's, peer's, subordinate's, organization's)



What factor contributes to satisfaction/  
dissatisfaction with the organization or job?

c. Labor

What position does this individual fill within  
this organization? (formal, informal)

What knowledge/skill does this individual have?  
(How was it gained?)

What is his/her capacity to structure/use  
additional knowledge? (knowledge utilization)

What are and how clear are this individual's  
personal goals? (stated, operative)

What is this individual's orientation toward  
people? (superiors, peers, subordinates)

What is this individual's orientation toward  
reward?

What is this individual's orientation toward  
decision-making? (to accept, to make)

What is this individual's orientation toward  
planning? (time horizon, frequency, detail, etc.)

How willing is this individual to contribute to  
the organization's goal/output?

How ably can this individual contribute to the  
organization's goal/output?

How flexible is this individual when change is  
required?

How satisfied is this individual with output?  
(his own, superior's, peer's, subordinate's, organization's)



What factors contribute to satisfaction/dissatisfaction with the organization or job?

## 2. Organization Climate

What is the quality of relations/communications between individuals in management? labor? between management and labor?

How formal/detailed are the organization's rules and procedures?

What is the basis and structure of the evaluation and reward system(s)?

Is there reward for individual, group or organizational contribution?

How central is the decision-making system?

What level of knowledge is available to support the decision-making system?

What plans/provisions are made for providing succession or continuity in filling positions? (training, hiring, redundancy, etc.)

How stable is management/the labor force? (turnover)

## 3. Production Process

### a. Planning

What is the planning time horizon? (long, intermediate, short)

What are and how clear are the organization's goals? (stated, operative)

What are the priorities? How are priorities established?



What level of detail is required/desired in planning? (aggregate, detailed)

What is the demand forecast for the organization's output (knowledge) over this time horizon?

At what point is the demand forecast made in the production process? (before production begins, during production, after production is completed)

How frequently/completely is it reviewed?

What credibility is given to sample/source?

How does the demand forecast affect the organization's goals?

How complete is the problem-identification process?

How much time is spent in problem identification?

How completely are alternatives enumerated in what detail?

Upon what basis is project selection made?

How are the details of the production schedule and personnel assignment worked out?

What is the method of dissemination? How long does it take?

What is the response time from problem identification/information input to decision? from decision to implementation?

b. Project

What is the project time horizon?

What is the output?





What type of production process is required?

What type/mix of input resources is necessary to produce the output?

What are the sources of inputs (knowledge) on which this organization draws? (internal, external)

What factors are used to measure input resources? (quantity, quality, form, timeliness)

What tradeoffs are possible between resources?

What is the physical flow of the work in process? (who, what, where, when?)

What processing occurs at each work station in the process?

How complex is the work flow?

How routine is the work flow?

How closely can inputs/outputs and tasks be defined or measured?

What information flow is required to monitor work flow? (who, what, when)

What problems and barriers can be anticipated, prevented, controlled, along the path?

c. Outputs

In what form is the output available?

What is the cost to produce the output?

What is the potential value of benefits that can be derived from using this output? (tangible, intangible)

What is the method of distribution?



What are the capacity measures for output?  
(quantity, quality, timeliness)

## ENVIRONMENT

1. Individual (may not be available or may be restricted)

What is the individual's cultural/ethnic background?

How does this background influence individual/  
family values?

What is the individual's educational/work experience?

What social (non-business) relationships does this  
individual cultivate?

What is the individual's religious preference?

2. Organization

Who are the potential users for this organization's  
output?

When are they identified? contacted?

Which individuals in the user organization may be  
helpful/should be contacted?

Which individuals were contacted? Which were useful?

What are user problems or needs?

What is the level of need?

What knowledge may be helpful in solving these problems  
or meeting these needs? (subject, quantity, detail, form,  
etc.)

How does the user measure input resources? (quantity,  
quality, form, timeliness)



Does the supplying organization's output match a missing input (or resource) for the user organization?

Will this output need to be changed or interpreted for the user?

How long will it take to develop, change, transfer, implement the knowledge?

What value does the user place on this knowledge? (tangible and intangible costs, benefits)

What relationships (control) and interdependencies exist between supplier and user?

Who are the alternate suppliers?

What type of competition is present in the user's environment?

What are economic and business conditions? forecasts?

What is public policy/regulatory agency policy concerning this transfer? (local, state, national, international)

What legal rulings apply to the supplier, the user, the transfer?

What is the location of the potential user?

In what environment does the transfer take place? (business activity, meeting, informal exchange)

## GENERAL QUESTIONS

Which elements/characteristics facilitate the production/utilization process?

Which elements/characteristics detract from the production/utilization process?

Which elements can be controlled? Which can be changed?



APPENDIX B  
TERMINOLOGY

One of the greatest barriers in the knowledge utilization process is that of understanding the terminology. The following list of commonly used terms in the knowledge utilization process is provided in an attempt to provide a basis for discussion of the subject. Differences in terminology are often semantic, arising from an attempt to clarify or advance a concept.

1. Agent - the person who (or vehicle which) acts or has the authority to act on behalf of another in transferring knowledge. The cause of the transfer or change.
2. Application - the act of putting into use for a particular purpose or in a special way (Syn. - utilization). Shown as a movement down the vertical axis.
3. Barrier - anything (real or perceived) that restrains or obstructs progress, access, etc., and serves to bar the transfer or use of knowledge. Can be used in reference to individual, organizational or environmental elements or characteristics which cause filtering, bias or distortion. The barrier may be present in sending or receiving.
4. Communication - transmitting (one-way) or exchanging (two-way) information, messages, etc. Also used to refer to the method or vehicle (e.g., letter, technical journal, conversation, etc.) used for transmitting or exchanging knowledge. This would include such factors as the type of documentation and distribution system used.
5. Experience - skill or knowledge gained through anything or everything observed or lived through (A type of KNOWLEDGE).
6. Horizontal - pertaining to a position or individual of the same or similar level, status or function.
7. Information - the knowledge communicated or received concerning a particular fact, circumstance or subject. Used to refer to specific knowledge gained through communication, research, instruction, etc. (A type of KNOWLEDGE.)





8. Innovate (Innovator - one who) - to introduce something new or make changes to anything established. (Frequently confused with LINK or LINKER.)

9. Knowledge - the broad range of information or understanding that leads to the fact or state of knowing. Used to include INFORMATION, TECHNOLOGY and EXPERIENCE.)

10. Link - An element in a series that joins or connects. As used in this thesis, it refers to the individual or communication that transfers or uses knowledge. In the literature, various terms are used to denote the individual and characteristics of his function in the process (e.g., LINKER, one or more individuals internal or external to the organization who join suppliers with potential users of knowledge; BRIDGE, LIAISON, INTERMEDIARY suggest one outside the organization; GATEKEEPER is one who acts as a funnel through which knowledge flows into or out of an organization).

11. Pull - to exert a force so as to draw out. Refers to a user's demand for a supplier's output.

12. Push - to urge the use of or to sell the supplier organization's output.

13. Reward - something, intrinsic or extrinsic, given or received in return or recompense for service, merit, hardship, etc. The reward may be positive or coercive but usually connotes something given or received in recognition of or to encourage activities, actions, etc., that conform to higher level goals or objectives.

14. Technology - the branch of knowledge that deals with industrial arts, applied science, engineering, etc. May also refer to the terminology or technical nomenclature of the knowledge. (A type of KNOWLEDGE.)

15. Transfer - to convey or remove from one place, organization, individual, etc., to another concrete or abstract knowledge. The means or system of moving knowledge from one environment or application to a related kind.

16. Utilization - to put into action or service. Knowledge is exercised whereas other resources are consumed, expended, or allocated in varying degrees during the process.

17. Vertical - pertaining to positions or individuals of dissimilar level, strata or function.



## BIBLIOGRAPHY

- The Jerusalem Bible, Doubleday and Company, Inc., Garden City, New York, 1968.
- Carlisle, Howard M., Situational Management: A Contingency Approach to Leadership, AMACOM, New York, 1973.
- Fremgen, James M., Accounting for Managerial Analysis (3rd ed.), Richard D. Irwin, Inc., Homewood, Illinois, 1976.
- French, Windell L. and Cecil H. Bell, Jr., Organization Development: Behavioral Science Interventions for Organization Improvement (2nd ed.), Prentice Hall, Inc., Englewood Cliffs, N.J., 1978.
- Lewis, Phillip V., Organizational Communications: The Essence of Effective Management, Grid, Inc., Columbus, Ohio, 1975.
- Marshall, Paul W., William J. Abernathy, Jeffrey G. Miller, Richard P. Olsen, Richard S. Rosenbloom, D. Daryl Wyckoff, Operations Management, Richard D. Irwin, Inc., Homewood, Illinois, 1975.
- McGill, Michael E., Organization Development for Operating Managers, AMACOM, New York, 1977.
- Reilly, William J., The Twelve Rules for Straight Thinking, Harper Brothers, New York and London, 1947.
- Rogers, Everett M. and Rekha Agarwala Rogers, Communication in Organizations, The Free Press/McMillan Publishing Co., Inc., New York, 1976.
- Uyterhoeven, Hugo E. R., Robert N. Ackerman, John W. Rosenblum, Strategy and Organization, Richard D. Irwin, Inc., Homewood, Illinois, 1977.
- Webber, Ross A., Management: Basic Elements of Managing Organizations, Richard D. Irwin, Inc., Homewood, Illinois, 1975.
- Jolly, James A., J. W. Creighton, Peter A. George, Technology Transfer Process Model and Annotated Selected Bibliography, Naval Postgraduate School/Naval Aviation Executive Institute, Washington, D.C., 20361, Aug., 1978.
- Journal of Technology Transfer, Vol. 1, No. 2, Spring, 1977.



1977 Technology Transfer Directory of People, prepared by  
California State University at Sacramento and the Naval  
Postgraduate School, Monterey, CA, for NSF.



## INITIAL DISTRIBUTION LIST

	No. Copies
1. Defense Technical Information Center Cameron Station Alexandria, Virginia 22314	2
2. Library, Code 0142 Naval Postgraduate School Monterey, California 93940	2
3. Department Chairman, Code 54 Department of Administrative Sciences Naval Postgraduate School Monterey, California 93940	1
4. Professor J. W. Creighton, Code 54 Cf Department of Administrative Sciences Naval Postgraduate School Monterey, California 93940	10
5. Assoc. Professor R. A. McGonical, Code 54 Mb Department of Administrative Sciences Naval Postgraduate School Monterey, California 93940	2
6. LCDR Gale Dean Brink, USN 130 Jones Street Middletown, Rhode Island 02840	1









189021  
29 AUG 82

128035

Thesis  
B80877  
c.1

Brink

A primer and check-  
list for the technol-  
ogy transfer/knowledge  
utilization process.

189021

189021  
29 AUG 82

128035

Thesis  
B80877  
c.1

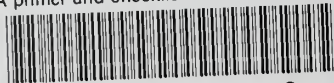
Brink

A primer and check-  
list for the technol-  
ogy transfer/knowledge  
utilization process.

189021

thesB80877

A primer and checklist for the technolog



3 2768 002 08100 2

DUDLEY KNOX LIBRARY