1972

Relating systems theory to management concepts

Gene Paul Neely
The University of Montana

RELATING SYSTEMS THEORY TO MANAGEMENT CONCEPTS

By

Gene P. Neely

B.S., University of Montana, 1965

Presented in partial fulfillment of the requirements for the degree of

Master of Business Administration

UNIVERSITY OF MONTANA

1972

Approved by:

George J. Bruhl

Chairman, Board of Examiners

Dean, Graduate School

July 10, 1972

Date

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

The purpose of this paper is to develop and explain management concepts in terms of systems theory. The approaches used in management theory might generally be classified as: the process approach, the behavioral approach, the quantitative approach, and the systems approach. The first three of these approaches have been more extensively developed than the systems approach. The process approach relies heavily on the irregularly defined functions of planning, organizing, directing, and controlling. The process approach is probably the more complete approach, but it has failed to adequately interrelate its various functions. The behavioral approach is concerned with the social interaction in organizations, the motivation of personnel, and the techniques used to measure personnel performance. In terms of the functional entities of management, the behavioral approach is related to directing, organizing, and controlling. The quantitative approach concentrates largely on decision-making techniques, which would place it in the realm of planning and evaluating.

The fourth approach to management theory is the systems approach. The systems approach supposedly integrates concepts from all relevant disciplines. When the systems approach is evaluated on its demonstrated ability to integrate the concepts of the other approaches, it has failed. There are a number of areas to which this failing can be attributed. First, there has been no uniform definition or application of the terms and concepts commonly used in systems theory. As a whole, the literature on systems theory is a semantic jungle that is frequently inconsistent within a single source, and generally inconsistent between sources. Secondly, the functions of management have not been adequately related to demonstrate where the "system" is in the management process. To find a "system" in the management process, the outputs of the process must be identified, and the functions producing these outputs must be interrelated. Considering the functions as component parts to the management process, the systems approach has not defined what one function of management contributes to the other functions. Thirdly, the applications of systems theory have failed to either recognize or relate the basic requirements of a system to management concepts. As a result of not relating the fundamental requirements of a system to the management process, the systems approach has developed no unifying basis on which it can integrate the concepts of the other disciplines.

This paper will attempt to overcome or at least contribute to the resolution of the above three deficiencies. This is not to imply, however, that concepts from all relevant disciplines will be integrated. The semantic problems of systems theory are not resolved in this paper; they are organized by developing explicit definitions. The semantic problems can only be resolved by consistent application of terms and concepts over time.

The first step in relating systems theory and the management process will be a review of systems theory as it applies to cybernetics and the systems approach. After making this review, Chapter II will be concluded with a discussion of how systems theory might be applied to management concepts. Chapter III will analyze the management process, define and relate the function of management, and then discuss the process as it must exist in large private or public organizations. The final chapter will summarize the relationships between systems theory and management concepts.

CHAPTER II

SYSTEMS THEORY

Introduction

General systems theory is attempting to integrate the knowledge of various disciplines into an inter-disciplinary approach for examining and explaining empirical observations. An objective for systems theory might be stated as this: To provide an analytical framework[1] for guiding empirical observation, for classifying and explaining observed relationships, and for expanding the observer's threshold of awareness for these relationships. The strategy for attaining this objective seems to be the resolution of complex and commonly occurring relationships between components of the real and abstract world, isomorphism, into general and widely applicable expressions of interaction. Presently the result of this effort is the development of a rather tentative set of normative or comparative standards for analyzing a system's behavior, and a set of quantitative and highly exacting qualitative tools for isolating, testing, and describing these relationships. Systems theory -- when applied to specific areas -- attempts to define the interaction between functional and descernible components of the system in relation to their influence on other components, and on the system's attributes

---

[1]An analytical framework is considered to be a model used to think about, explain, or demonstrate relationships that are observed or deduced to exist in the "real world." Systems theory might be thought of an analytical framework for models, a general model to guide the development of more specific models.

and overall purpose. Paramount is the fact that the system has attributes which are derived from the interaction of its components; these attributes are in excess of those held individually by its components.

While systems theory is attempting to provide an organized framework for thinking about observed relationships, it is a framework that has yet to be rigidly established. Kenneth E. Boulding[2] has presented an outline for classifying systems according to complexity, and every science contains its analytical models for explaining the relationships it studies and observes. Systems theory's organized framework should provide a basis for communication between the various scientific disciplines and a means for interrelating the concepts of these disciplines. The application of systems theory to specific areas, the systems approach, is concerned with the influence of component interactions on the system's capability to satisfy its purpose or objectives. The irony is in the fact that the systems approach has little system, there is little in the way of an established or agreed structure for the systems approach. A common basis for the integration and communication of scientific disciplines, and the establishment of a systems approach, are a long way in the future. The difficulty in finding consistency in the definition of terms, concepts, and approaches can probably be attributed to the relatively recent origin of formal systems theory, the problem of creating generalities that have content and precision, and the immense, if

---

[2] Kenneth E. Boulding, "General Systems Theory--The Skeleton of Science," in <u>Management Systems</u>, Peter P. Schoderbek (ed.) (New York: John Wiley and Sons, Inc., 1968), pp. 7-15.

not impossible, task assigned to systems theory. Recognizing the poor state of systems theory, it is necessary to define the terms that will be used in relating management concepts to systems theory.

Definitions

The environment of a system is all entities not included in the system, whose attributes are changed by the activities of the system, or a change in whose attributes affect the system.[3] A system is an assemblage of objects and/or symbols that are bound by unity of purpose(s), and that have a disciplined interaction of attributes. For a system to have purpose, it must produce or have the potential of producing some output of value to its environment -- other systems. The unity of purpose and disciplined interaction provide the system attributes in excess of those held by individual components; these attributes are the capabilities of a system to satisfy environmental requirements or needs that no single component possesses by itself. The requirements or needs imposed on a system by its environment, and in highly complex systems those requirements imposed on the system by itself, give the system purpose. The main attribute is that the system has greater utility than its components summed individually. This greater utility is the synergistic property of the system -- greater utility is realized from two or more elements working together rather

---

[3]A. D. Hall, A Methodology for Systems Engineering (Princeton, N.J.: D. Van Nostrand Co., Inc., 1962).

than autonomously.[4] In economics this principle is recognized as increasing returns to scale.

The basis for discipline in a system is this interdependency of components in order to produce greater total utility. The disciplined relationship between components can exist in any of three ways: (1) a rigid or predefined positioning and use of the components, (2) limitations on the capabilities of individual components necessitating dependence, and (3) influences exerted on component behavior. The requirements of purpose and disciplined interaction are not always levied on a group of entities to qualify them as a system, but without these qualifications the term "systems" lacks resolution; it becomes analogous to the universal solvent discovered by a fabled chemist, who could then find no container in which to place it. If the systems concept is to have some utility, it must be constrained by some requirements. There must be relationships in the system that are deterministic, or at least classified as probabilistic due to our imperfect understanding of the relationships, to permit the existence and recognition of the system.

The structure of a system refers to the relative position occupied by each component in the system, and the interaction between these positions. The components assigned to each position specify how they are allocated. The position of a component defines its location

[4]John F. Mee, "The Zeigarnik Effect," Business Horizons, XII, No. 3 (June, 1969), 53-60.

in the system, how it behaves in relation to other components, and its function in relation to system purpose. The structure of a system is then defined by the priority or hierarchy of positions, and the relationships between the components which occupy the positions. The formal and informal organizations in a business define the allocation, interaction, and hierarchy of relationships between human components and between physical resources. The flow of materials, energy, and information also describe, in part, the interactions that give a system structure. If the system is dynamic, the structure includes the strategies, procedures, and routines it uses to accomplish the system's purpose. It is the structure of a system that binds diverse system components into an integrated operating unit that permits the accomplishment of purpose and generates its synergistic property.

The state of a system refers to the system's contents and the characteristics of these contents at any instant in time. A system's state is defined by quantitatively and qualitatively listing the attributes of the system, and the attributes of its components. The available resources, account balances, rate of operation, costs, and specific products produced are attributes that describe portions of many business systems.

A statement of system state and structure would completely describe the system. It is impossible to make this description, because not all attributes and relationships are discernible, understood, or presently considered significant. State and structure in practice describe those attributes and relationships that are considered significant to the system's specified purpose. Thanks be to Pareto's Law--the significant elements in a specified group usually constitute a relatively small portion of the total elements in the group.[5] The validity of this law will decline, however, as man's understanding of various systems is expanded. The state variables used in describing a system are those that describe an entity's individual capabilities and requirements relative to the system's purpose. The structural variables of significance are those that describe the components' capabilities and requirements in interaction. A prime reason for defining a system's state and structure is to specify its capabilities and constraints, to recognize what it can do, what it can not do, and what it must do to accomplish the purpose of the system.

Systems Classification

Systems are classified in many ways, depending on complexity, purpose, response, or type of interaction present in the system. There is a large variety of classification schemes, and only a few that are commonly applied will be presented.

Systems are frequently classified as open or closed. An *open* system is one that exchanges material, information, or energy with its environment.[6] A *closed* system makes no such exchanges with its

---

[5] C. J. Slaybaugh, "Pareto's Law and Modern Management," *Price Waterhouse Review*, XI, No. 4 (Winter, 1966), 26-33, quoted in Earl P. Strong and Robert D. Smith, *Management Control Models* (New York: Holt, Rinehart and Winston, 1968), p.15.

[6] Hall, *op. cit.*

environment. This is a distinction that is arbitrary, and represents a simplification of the real world to reduce the complexity of the model. No closed systems exist in reality, but it is a useful classification where no significant interfaces exist across a system's boundaries, or where unexplainable disturbances are to be filtered out of the system.

Systems are classified as either deterministic or probabilistic, a distinction that is made with regard to the complexity and nature of the discipline present in the system. Deterministic systems have components that interact in a perfectly predictable way. Probabilistic systems permit no prediction of the exact interaction that will occur between components, and thus no accurate prediction of their output. Systems are classified as probabilistic because the array of influences that determine their behavior and state are so complex that we either lack the reason to comprehend them, or we can not discern all the influences that define them. It is not that they lack some form of discipline; it is just that man lacks the information or reason to understand them. The classification of a system as probabilistic represents another simplification in the analytical framework, by interjecting uncertainty and complexity as a stochastic or random process. It is a useful classification, in that it assigns a property to the otherwise "black box," it identifies a technique for studying the system's behavior, and it distinguishes those relationships on which further investigation can be trained with the hope of reducing apparent complexity.

The cataloging of systems as adaptive and nonadaptive is dependent on the system's ability to modify its state and structure in response to environmental or internal changes. An _adaptive_ system can modify its structure or state to a form that facilitates the accomplishment of its purpose. These systems perpetuate their purpose, and thus their existence, by modifying their state and structure so the output they produce is of value to the changing requirements of their environment. Not all changes that a system undergoes need contribute to the environment. If the system has accumulated or stored sufficient energy or material, it may exist satisfactorily with no output or reduced output for a long period of time. Adaptive systems may select from alternative courses of action by responding to information from the environment, or from information about their own state. More complex systems react to both their own state and their environmental state. _Nonadaptive_ systems make no deliberate or purposeful response to changes in their environment, and do not adjust their state or structure to attain greater efficiency. Nonadaptive systems become inefficient or dysfunctional when the environment or system requirements are not compatible with their rigid structure.

Systems are universally classified as to their _purpose_; studying a given outcome E, you define the system as an entity for doing E.[7] This is a practical and widely used method of classification, since it aligns the classification with one of the requirements for a system--purpose. The other classification schemes, however, are better suited

---

[7]Stafford Beer, _Cybernectics and Management_ (New York: John Wiley and Sons, Inc., 1959), p. 39.

to the identification of isomorphism in systems. Isomorphism refers to the presence of similar state or structural properties in systems that are otherwise different in origin and/or purpose.

Systems whose interactions are disciplined by the exertion of influences on component behavior are classified as cybernetic systems. Cybernetic systems are adaptive systems. Beer[8] restricts this classification to those systems which are extremely complex, probabilistic, and self-regulating, but complexity and stochastic behavior are by no means universally recognized as requirements for cybernetic systems. The term cybernetics has yet to take on a formal or rigid meaning. Wiener defines cybernetics as the science of control and communication, in the animal and the machine.[9] Ashby defines it as the study of systems that are open to energy but closed to information and control.[10] The Encyclopedia of Science and Technology defines cybernetics as, "The science of control and communication in all its various manifestations in machines, animals, and organizations . . . an inter-disciplinary science."[11] Greniewsky has stated that all control is communication, and on the other hand all communication is control.[12] Communication is the

---

[8] Ibid., p. 18. Beer places complex probabilistic systems under the realm of operational research, and deterministic systems under the field of engineering.

[9] Norbert Wiener, Cybernetics (New York: John Wiley and Sons, Inc., 1948).

[10] W. Ross Ashby, An Introduction to Cybernetics (London: Chapman and Hall Ltd., 1956), p. 4.

[11] Encyclopedia of Science and Technology (New York: McGraw-Hill, 1960).

[12] Henryk Greniewsky, Cybernetics Without Mathematics (New York: Pergamon Press, 1962), p. 52.

transmission of information to influence the behavior of system components. The relay of influence is the communication of information, but not all influences are favorable or consistent with the accomplishment of a system's purpose. In contrast, Beer defines control as that attribute of a system which tends to sustain the system's structure and reinforce its cohesion.[13] The distinction is in the purpose of control; Beer has refined control to be the exertion of purposeful influence. Control is defined here to be all processes that induce or influence system and environmental entities to interact or respond in a manner consistent with a system's purpose. Influence exerted on system components that cause them to behave in a manner contrary to the system's purpose is called interference. It must be recognized, however, that what is considered interference to one system might well be the exertion of influences considered purposeful by other systems in the environment. A picket line, for example, is purposeful to the strikers but considered interference by the organization being picketed.

Contents of Cybernetic Systems

The purpose of a system has no time dimension; it is something that is continually being carried out. The purpose of systems created by man are to satisfy his basic physiological and psychological needs. In order to satisfy these needs man must transcribe them into more

---

[13] Stafford Beer, "What Has Cybernetics to do with Operation Research," in Management Systems, Peter Schoderbek (ed.) (New York: John Wiley and Sons, Inc., 1968), p. 278.

specific statements of what he wants. He must establish objectives and goals. The distinction between purpose and objectives is important, because objectives are something possessed only by those systems that can anticipate and relate to the future. At one time it could have been said that only living creatures had objectives, but hueristic programming techniques have given computers artificial intelligence to a limited degree. The point is that all systems have purpose, but many systems (cars, electric saws, equations) have no objectives. For the purpose of subsequent discussion, objectives are ascribed to a system only when man is a part of that system. A distinction will be made between objectives and goals. Objectives will be general and nonquantitative statements of what is wanted. Objectives specify man's expectations of what the system should or will do in the future to satisfy the purpose for which it was created, or for which it is maintained. Goals describe the objective in quantitative or highly descriptive qualitative terms. Goals specify a desired state and structure for the system. These goals have a high enough probability of being attained that materials and energy (resources) will be expended by the system in an attempt to achieve this state and structure. The term "objective" encompasses or implies a set of goals. In systems with human components, the creation of objectives--goals--is the first step in the process of control, because before any further meaningful influence can be exerted on the system, what is wanted, what the system is to do, must be known.

The _complexity_ of a system is due largely to the complexity of the discipline it contains. The reader is referred to Boulding[14] and Beer[15] for different classifications of complexity. In order for purposeful influence to be exerted in systems that are cybernetic, complex, adaptive, and that have a human component, the systems must contain the following:

(1) The system must be capable of formulating the potential state and structure that will yield output(s) of some value to its environment, or produce output(s) for internal use that are of greater value to the system itself than the value of the inputs consumed. This desired state and structure provides a basis on which to formulate the messages that will be transmitted in the process of communicating. Of course, as the system changes its state and structure to satisfy internal requirements or desires it must produce proportionally more output for the environment in exchange for the inputs it is receiving, or it must use materials and energy it has stored internally. The control mechanism of a system will attempt to change those state and structural attributes under its control that do not comply with what it recognizes as desirable. It will invoke these changes by communicating information. In mechanical systems the desired state or structure is referred to as a set point.

---

[14] Boulding, _loc. cit._

[15] Beer, _Cybernetics and Management_, _op. cit._

Process control computers in a pulp mill, for example, are always directing the state of the conversion system toward selected set points. To humans the desired state or structure is expressed in the form of objectives and goals. The goals are further translated into standards of performance for individual elements or subsystems in the system. These standards provide a frame of reference to compare the actual state and structure against.

(2) The system must be capable of obtaining information about the present state and/or structure of system attributes that will be modified or maintained in the process of achieving the objective state; and it must obtain information about the requirements of its environment if it is to respond to these requirements. To obtain this information the system must have a means of detecting and measuring the necessary system and environmental attributes. The elements measuring a system's performance are called <u>sensors</u> or <u>detectors</u>.[16] The measurement of a system's performance and subsequent modification of the performance based on the measurements is called feedback. The feedback element

---

[16]Peter P. Schoderbek (ed.), <u>Management Systems</u> (New York: John Wiley and Sons, Inc., 1968), p. 258. Schoderbek lists three basic elements to a cybernetic system, a detector or sensor, a selector or decision making element, and an effector.

detects deviation from the desired state or structure. The ability to detect deviation and direction of the deviation from desired levels is essential to the process of control.

(3) There must be alternative responses--procedures--to correct unwanted deviations or to initiate wanted deviations in the state and structural attributes being controlled. This is, in essence, recognition of the Law of Requisite Variety. The Law of Requisite Variety states that only variety from the control mechanism can deal successfully with variety in the attribute being controlled; "only variety can destroy variety."[17] Responses from the control mechanism provide means of countering or initiating changes, and total control is possible only if the system can respond to all possible states and structures that it may encounter or desire. By definition, complex systems lack this total control; they are subject to discipline or influences which are interference; they are probabilistic. Systems that are highly adaptable will be capable of formulating alternative responses; while a list of alternative responses will be provided or built into those systems that are less adaptive.

(4) There must be a basis for selecting the proper procedure from among those available or created--a decision-making element or <u>selector</u>. The selector compares the inputs from

---

[17] Ashby, <u>op</u>. <u>cit</u>., p. 207.

the feedback element or sensor and then selects the proper command signal or procedure to return the system to its desired state or structure. The selection of the procedure to be implemented is based on the direction and extent of deviation from goals and standards.

(5) Having selected the procedure or activity that must be performed to reach standards and the established goals, the system must have a means of implementing the procedure. The element that implements change in a system's state and/or structure is called an effector or actuator. The actuator closes the feedback loop to implement purposeful change. The influence relayed by the actuator is termed negative feedback if it acts to restrain or counteract a deviation from standards. The actuator's response is called homeostatic if it is intended to hold some variable between desired limits. If the feedback is intended to amplify a measured deviation from the standard it is called positive feedback. Incentive pay to a worker for exceeding standards is positive feedback.

Boundaries of a System

The distinction between environment and system is often difficult and arbitrary. Some systems have physical boundaries (cars, humans, washing machines), but the physical boundaries may not be consistent with the functions or influences being studied. Every system is a part of a larger system, and the problem is isolating the components to be included in the system to be studied. The first step in establishing a system's boundary is to recognize the purpose (and the objective) for the system to be isolated. Purpose will be recognized in those systems that have no human elements; purpose and objectives will be recognized when a person or persons affect the system. Then, the definition of an acceptable system boundary can generally be made by compliance with either or both of the following criteria: (1) Consider all distinguishable entities that affect the accomplishment of the system's purpose or objective to a specified degree as a portion of the system. The effect referred to here is an influence, but not necessarily control. Control is qualified to be those influences that cause system components to behave in a manner consistent with the system's purpose or objectives. To utilize this criterion, all candidates for inclusion in the system must be studied to determine their influence on the system's purpose or objective, and after this survey those components considered to have a significant effect on the system's purpose or objective are placed inside the system's boundaries. Utilizing this criterion results in establishing a system from components. (2) The second criterion is for application on cybernetic systems.[18] This standard is used by specifying a control mechanism (functional related control mechanisms, if more than one is specified) and a degree of control. The degree of control

---

[18]All systems that have a human element are cybernetic, or the system will soon cease to exist. They must be cybernetic to be recognized as a system, because other forms of discipline do not continually exist in a system with human elements. It may be desirable, however, to include sources of interference inside a system with human elements, in which case the first criterion must be applied also.

defines the level of significance a relationship between an entity and the control mechanism must possess to be considered part of the system. All entities that are functionally related and subject to the specified degree of influence from the control mechanism(s) are considered to be within the system's boundaries. Functionally related means that the influence a control mechanism has on the component must pertain somehow to the system's purpose or objectives. The question asked in each case is: "Can the control mechanism do anything significant about the behavior or state of the entity in relation to the system's purpose or objective?" If the answer is "Yes," then it is a part of the system. If the answer is "No," then it is part of the environment. Utilizing this criterion results in establishing a system around an entity or entities, depending on how many control mechanisms are specified.

The Application of Systems Theory

The specification of a system's present purpose or objective, and the subsequent establishment of an acceptable boundary are the first two steps in the analysis of a system. The third step is to recognize what requirements or needs are imposed on the system by its environment or itself. These steps are not accomplished sequentially, rather simultaneously. The systems approach to studying a system, or a problem in the isolated system, seems to be the intensive analysis of the system or its problem using various quantitative and exacting qualitative tools to either the limit of available resources, or to the point of considering relationships which have no significant bearing on the problem. The environment of the system is not ignored, it is recognized in the form of its requirements and inputs to the system, and it is treated as given and not directly controllable.

The study of the system may be conducted in the system itself, but models are usually used to some degree. These models may exist merely in the mind of the analyst, or they may be elaborate computer models. To accomplish the study in a model, the exogenous (environmentally defined) parameters are predefined by the analyst, and then only varied under his control. Some endogenous variables will generally be defined as parameters too. The system is then given a specific set of input variables, and the interaction in the system is then observed to determine what state will be imposed on other endogenous state variables, and to what degree the system can handle the variety of conditions that it may encounter. The purpose is to determine how the system responds to variety; and in designing a system the objective is to account for, and efficiently and effectively handle, the variety that the system will encounter. The quantitative tools used to accomplish this involve techniques such as: regression, mathematical programming, capital budgeting, cash flow, and other simulated models that use various probability distributions and numerical methods. Statistical analysis becomes a tool for isolating relationships in the systems. Statistics are a means of describing the system's state and structure. Qualitative tools include: flow charts, layout diagrams, organizational charts, narrative descriptions, and data matrices. Many tools contain both quantitative and qualitative techniques: PERT (Program Evaluation and Review Technique), CPM (Critical Path Method), some forms of decision tables, balance sheets, and input-output matrices. Each of these tools is in some way a model of some part of the system's state and/or structure.

The job of a "systems analyst" is to analyze the capabilities and significant interactions of the components within the defined system, and determine in what manner the system's state and structure can be changed to increase the system's ability to attain its objectives, or satisfy its purpose (Table 2-1). On the other hand, a "systems engineer" defines the purposes or objectives for a system, then determines what components to include in the system, their positioning, their use, and their interactions, to permit the efficient attainment of objectives. The systems analyst or engineer determines how things "should" be done. The analyst does not necessarily exert influence to make the system behave according to his model or plan, but he should have a thorough understanding of what might result when it is implemented. By inference from the definitions, there is probably no capable individual who is not a systems analyst or engineer at some time.

Systems theory is being applied in practically every academic discipline, but in many applications it is found to be of limited value. Systems theory is not a panacea that will unlock and integrate all the knowledge in the world, at least it will not do this until we develop a language that can adequately describe the relationships we perceive. F. K. Berrien approached personality as a system and made the following comment:

TABLE 2-1

FORMAT OF A SYSTEMS STUDY*

I. The System. (A description of what and where the system is, relative to the rest of the environment.)

   A. Boundaries.

   B. Components.

II. System's Present Purpose and/or Objectives. (A statement of what the system is presently attempting to accomplish.)

III. System Requirements. (What it must provide or do.)

   A. Environmental requirements.

   B. Self-imposed requirements.

IV. System State. (A description of the system's resources and their constraints or capabilities. The resources listed are those significant to the system's present purpose or requirements.)

V. System Structure. (A description of the interaction in the system. This could include among others: organizational charts, flow charts, layout diagrams, input-output matrices, and a narrative description of relationships and procedures.)

VI. Analysis of System.

   A. Its purpose and/or objectives relative to requirements.

   B. Its state relative to objectives and goals.

   C. Its structure relative to its objectives and goals.

VII. Suggested Modifications.

   A. In objectives and goals.

   B. In state.

   C. In structure.

---

*This study would not necessarily be presented or written using this format. This is a format for conducting an analysis of a system.

> In part, my reluctance to address personality as a system was an inability to specify the components of such a system. . . .We lack today the neat and explicit gram, centimeter, second, variables of the physical sciences and a clear agreed-upon set of component subsystems within the personality, as well as the criteria for effective and healthy personality. These difficulties of identifying both the bounds and the components may foreshadow a fatal flaw in the General Systems approach, or it may suggest that personality is a dead end concept like phlogeston, animal magnetism, or even the original formulation of libido.[19]

We certainly lack the variables and agreed-upon components in many subsystems, and the application of systems theory is dependent on the isolation of components. It is the author's observation that the flaw with relation to General Systems theory is as much in its application as in the theory's content. Systems theory can not be applied where purpose and components have not been isolated. More important, there is a failure to recognize and distinguish between what is a system, and what is interaction in a system. Personality is reflected in the way an individual interacts with his environment; it is perceived as the way an individual interacts with others to satisfy his needs. If components are to be isolated inside personality, the resolution will be totally arbitrary, since personality as a system is not tangible. The results of personality are visible, however, implying that it might be studied as a "black box."[20]

---

[19] F. K. Berrien, "Social Systems, Adaptation, and Personality," General Systems Bulletin, XI, No. 111 (December, 1970), p. 9.

[20] The black box approach is used on those systems whose interaction can not be discerned or empirically observed. The technique, basically, is to feed the system a specific set of inputs, observe the output, and then hypothesize what the interaction inside the system must be to produce the resulting output.

But what of management--it has functions which are component to the total activity of management--should it be treated as a system? The answer seems to be, "No." The functions are descriptions of interaction or activity performed by system components. These functions: planning, directing, organizing, and what is classically called control, are descriptive steps of the interaction that takes place when the process of management is performed. Management is that interaction we perceive in a system that is attempting to control the interaction of system components and influence the system's environmental requirements. While the functions used in the management process can be placed in an orderly flow, these functions are not sufficiently rigid or structured at present to permit the analysis of management as a system. The application of systems theory to management concepts must, therefore, develop a generalized description of those interactions we perceive in a system as being management, not analyze management as a system with boundaries, components, objectives, constraints, state, and structure. The application of systems theory that is to follow in Chapter III will analyze management as a process in a purposeful system, not analyze management as a system in itself.

CHAPTER III

MANAGEMENT

Introduction

The principle of bounded rationality stated by Herbert Simon is a reasonable description of man's approach to complex problems. Essentially, man's rationality operates within the framework of a simplified model of a real situation.[1] Management is an extremely complex process, and the various concepts of management are basically models. In order to analyze and subsequently design a more efficient system it is necessary to relate the observed or proposed activities in the system to some normative model of why this interaction is present, what it should attempt to do, and how it should take place. The activity of immediate concern is that of management. The normative model is not to be prescribed on the system itself; it is merely a framework in which observed activities can be related and evaluated in the process of developing a better system.

The various models used to describe the process of management can be classified as the process approach, the behavioral approach, the quantitative approach, and the systems approach. The process approach or functional approach to management emphases certain managerial functions that include planning, organizing, directing, and what is classically called control. The process approach is concerned with classifying and describing various tasks performed by a manager with the intent of establishing principles which can guide the execution of these tasks. With few exceptions the process approach breaks management into key functions and then analyzes these functions as discrete steps in the management process. Describing

---

[1]Herbert A. Simon, Models of Man, Social and Rational (New York: John Wiley and Sons, Inc., 1957), pp. 196-206.

the functions in the management process is essential, but what is lacking in this approach to management is a description of how the functions interact to make up the process of management.

The behavioral approach to management theory explains the basis for human motivation and effective communication, it explains the reaction of social organizations to conflict and change, and it has developed techniques for measuring personnel performance and generating incentive. By describing individual and group behavior in organizations, the behavioral approach provides a manager with a model that can be used to predict or analyze the reaction of personnel to proposed or existing situations. This model can be used to manipulate and analyze the human factors that must be considered in carrying out the functions of management, so that the manager can explain or predict the reaction of personnel to change. Successful management depends significantly on the ability to predict and control human behavior.

The quantitative approach to management is concerned primarily with decision-making and evaluation. Quantitative techniques enter the management process when measurable variables are used as criterion in selecting between alternative strategies. Quantitative management concepts use various mathematical techniques to isolate the optimum state for controllable variables, and to select the best expected state for variables that are subject to uncertainty. While quantitative techniques have an important place in defining the goals, policies, strategies, procedures, and standards that influence human behavior and system performance, the application of these techniques is beyond the scope of this paper. The reader can infer the use of quantitative techniques in any stage of management that involves planning or evaluation.

The systems label is placed on descriptions of management as a system, and on descriptions of management in a system. Regardless of the method, the results seem to be a semantic restatement of portions of the process, behavioral, and quantitative approaches. Indeed, the products of system theory might be judged as generating only a semantic contribution to knowledge. The defense rests solely on the fact that the systems approach recognizes and attempts to integrate a significant portion of all the other approaches. It is in effect an attempt to integrate this knowledge so a more comprehensive description of management might result, and a more complete understanding be developed. Some excellent examples of this integration are not labeled by their authors as a systems approach. These descriptions of management are called management by objectives, and they have a considerable flavor of both the behavioral and quantitative approach. The system, however, is a natural environment in which to develop the idea of management by objectives, since a system is created or maintained as a purposeful interaction of its components.

To conceptualize management as a flow of its functions is difficult, since its steps are not animate, and the interaction which exists between its functions is totally dependent on the arbitrary definitions of the functions. A function is the contribution which a particular activity makes to the total activity of which it is a part,[2] and to isolate a function you must identify where the contribution of one activity ceases and that of another starts. Management, therefore, will

---

[2]A. R. Radcliffe-Brown, "Concept of Function in Social Science," American Anthropologist, XXXVII (July-Sept. 1935), quoted in Maneck S. Wadia, "The Operational School of Management: An Analysis," Advanced Management Journal, XXXII, No. 3 (July, 1967), pp. 26-34.

be initially developed as a process or a form of interaction that exists within a system that contains (a) human component(s). The functions will then be described as steps in this process.

To integrate the functional approach and the behavioral approach, the following discussion will identify the key items that are generated by the various functions of management to control human behavior. The key items are: objectives, goals, policies, strategies, procedures, and standards. Subsequent discussion is based on the assumption that present actions undertaken to achieve a future state and structure will significantly determine that future state and structure. If the future desired state and structure is unknown, or if present activities are performed without regard to the desired future state and structure, the probability of achieving the "desired" is totally a chance experiment dependent on the number of possible states and structures that could be achieved. As objectives, goals, and standards are more completely and specifically defined, the behavior of a social system becomes increasingly similar to the servomechanism in cybernetic systems.

Management Process

Management is the exertion of influence on the development of a system's state and structure. In the cybernetic sense, management is control in a system that has one or more human components. It is the human component that segregates management from the control process in general, that makes it a distinguishable part of cybernetics. Timber management, financial management, labor management, production management, sales management; all management is conducted to satisfy human desires. Of course, management involves the exertion of influence on material, energy, and financial resources, but these are all performed for the satisfaction of human desires. The human component is present in all management, even if the only human directly associated with the system is the manager himself; one does manage oneself. Management is the exertion of influence on the interaction of system components to promote the efficient, effective, and hopefully ethical utilization of resources so some purpose(s) that has been restated in the form of objectives and goals might be attained. Effective is used to mean "the extent to which performance or influence is actually consistent with purpose or objectives." Efficiency is used in the economic sense, "the amount of output relative to the amount of input." Managers control by creating objectives and goals that specify what will or should be done, by establishing policies to restrict the variety of actions that are acceptable, by developing strategies and procedures that specify how goals will be reached, by implementing the strategies and procedures, and by establishing standards that specify what should result from the procedures. This control is not coercion and manipulation of unwilling individuals, it is support and direction of individuals who are at least assenting to or, more desirably, committed to system goals.[3]

The creation of objectives and goals is the first step in the control of a system; it specifies what the system will or should do to satisfy the purpose for which the system is maintained. Objectives--whether explicit or implicit--are essential to the process of management or control, because before any subsequent purposeful influence can be communicated in the system, what is wanted, what is important, must be

---

[3]Edmund P. Learned, C. Roland Christensen, Kenneth R. Andrews, and William D. Guth, "The Accomplishment of Purpose: Organizational Processes," in Robert N. Anthony, John Dearden, and Richard Vancil, Management Control Systems (Homewood, Ill.: Richard D. Irwin, Inc., 1965), pp. 65-70.

known. The objectives provide a common direction within the system, but this direction is not easily established in most cases.

The objectives of most business systems are complex and not totally consistent to any single objective like profit maximization. This complexity is due largely to inconsistencies in the environmental requirements which the system is attempting to satisfy; and to inconsistencies in the goals of personnel in the system, since these personnel are members of many different systems. The process of management is in part an attempt to integrate the various goals, to make them congruent. By translating objectives into a hierarchy of goals, the manager gives the system and its subsystems a definite quantifiable or highly qualitative state and structure to reach at some future point in time. Goals specify what the strategies or activities of a system should accomplish; they provide criteria to evaluate the effectiveness of strategies.

A business is an open system, it exists because it can transform the material, energy, and information it receives as inputs into some output desired by the environment. To establish appropriate objectives a manager must continually monitor his system's environment to determine what is wanted, and to determine the acceptable method for filling the environment's needs. The system itself may attempt to influence what the environment needs, to avoid the necessity of adapting or to increase the value of its output. Advertising is certainly the exertion of such an influence on a business system's environment, and it is a process of informing environmental components where and how they might satisfy their needs. Galbraith's discussion on managed demand is an example of a system attempting to control its environment, or exerting sufficient control to include its clientele in the system.[4] If environmental needs are not controlled or satisfied, the particular business system will become a dysfunctional component in the larger systems of which it is a part and will be removed by adaptation on the part of these environmental systems. Of course, environmental acts like government subsidies may permit the continuation of a system that has not adequately adapted to the needs of its environment.

It is the human component(s) in the system that have objectives and goals; but since a system's employees are a part of the system, the goals that these people have that are related to the system's purpose can be ascribed to the system.[5] The humans in the system and members of the environment have many other objectives and goals, however. Individuals in the system have desires for adequate salaries, good working conditions, comfortable homes, social acceptance, self-fulfillment, and self-esteem. The community has objectives and goals related to its tax base, job opportunities, and civic development. Society and government have objectives in pollution abatement, product safety, and "fair trade." All these different objectives or expectations placed on the system make the establishment of goals a very difficult task.

The system's goals will frequently be in conflict. One goal may specify a 10 percent increase in sales; while another goal may require product production at a cost that prohibits the maintenance of product

---

[4] John Kenneth Galbraith, The New Industrial State (Boston, Mass.: Houghton Mifflin Company, 1967).

[5] Glenn Gilman, "The Manager and the Systems Concept," Business Horizons, XII, No. 4 (August, 1969), pp. 19-28.

quality at a level sufficient to increase sales. The goals of a business system must be compatible with the goals held by other systems in the firm's environment, and the goals must be attainable by methods that meet environmental requirements (laws), and the significant expectations of society. Effective management requires being sensitive to and informed about the significant expectations and requirements of the environment.

The goals established for the system should be, as far as possible, compatible with those nonsystem related goals held by employees of the system. The manager must strive for a hierarchy of objectives and goals that are consistent within the system, and that are acceptable to individuals in the system, so that goals are in actuality accepted by the system's members and ascribed to the system. The manager may have to expend considerable energy creating a social state and structure in his system that makes the goals he wants accepted actually acceptable to the system's members. Goal acceptance in the end may be a process of requiring members to accept the goals if they want to maintain the capacity to achieve their other goals. This falls under the variety of, "Do it, or you're fired." If Theory Y[6] were applicable to the system's personnel, the latter form of achieving goal acceptance would not be necessary. Goals must be accepted, however, if they are to effectively influence behavior in the system. Letting individuals participate in goal establishment can assist in achieving some degree

---

[6]Douglas McGregor, The Human Side of Enterprise (New York: McGraw Hill Book Company, Inc., 1960), pp. 45-57.

of goal acceptance. For the system to be efficient, priorities must also be assigned to the goals. There must be a communicated hierarchy of goals so system components know which goals to pursue if conflict arises, and managers must continually evaluate the nature and priorities of goals in relation to the system's dynamic environment.

Simultaneous with the creation and evaluation of goals the manager is formulating policies. Policies are a set of self-imposed constraints that limit the variability in goals, strategies, and procedures to a range that can be adequately considered by the system's decision-makers and executed by the system components. Policies reduce the endless list of possible objectives and strategies to a size that can be comprehended and considered. Policies are decisions that have been made; they are decision rules that make the system's behavior predictable and consistent. Policies may be broad and specify the requirements for state or structure throughout the system. This type of policy may require employee retirement at certain age, specify the degree of product diversification, or prohibit nepotism. More specific policies may specify the proper alternatives for a given situation. Statistical decision rules are of this nature; they specify which alternative should be selected in a specific situation.[7] Regardless of scope,

---

[7]George J. Brabb, Introduction to Quantitative Management (New York: Holt, Rinehart and Winston, Inc., 1968), p. 267. This reference defines a statistical decision rule as containing: a sampling method, a sample size, a null hypothesis, an alternative hypothesis, a sample statistic, an acceptance interval, and a rejection interval. By specifying the sampling method the decision rule is, in part, a procedure.

information about the system's capabilities and constaints must continually be processed to evaluate the adequacy and validity of policies. There must also be sufficient information processed to permit the application of these decision rules.

Once goals have been established the manager must determine how to attain them. This is done by developing strategies that will lead the system along a sequential path of transformations to the goals. A strategy is a proposed program of related procedures for utilizing resources; it is a proposed pattern of interaction and allocation for the system's resources, or some part of the system's resources. The procedures that are integrated and coordinated together to form strategies are any set of sequential steps to accomplish an individual task necessary to the attainment of objectives. Procedures establish the reaction of system components to anticipated or existing events. Some procedures can be labeled routines; they establish the reaction to repetitive events. By working procedures into strategies the manager assures that the procedures are synchronized and compatible with one another. The strategies--or related procedures--provide the control mechanism with behavioral patterns to implement in the regulation or influencing of system components. Strategies also specify the timing of the structural changes needed in the transitional system[8] so it will

---

[8]A transitional system is a system progressing to the state and structure described by goals. Since there is always a future that can hold goals, the system may continually be in the transitional state.

progress to the state and structure specified by goals. The development of a PERT chart involves developing a strategy; in the case of a PERT chart this strategy can later be used as a standard for controlling performance. By applying the proper strategies, the manager is attempting to generate a series of outcomes that will lead to the fulfillment of the system's objectives.

While strategies provide a planned structure for the transitional system, standards describe the desired state for the transitional system. Standards specify what the outcome or result of a procedure should be; how much, in what form, in what size, and at what rate. As such, standards provide criteria to evaluate the system's performance against as it approaches the state specified by goals. Variances are generally established that specify acceptable deviation from the standard, if the standard is intended to be used in homeostatic regulation. This eliminates the necessity of repeatedly reacting to small deviations from standards. By establishing policies, strategies, and standards, the control mechanism is influencing how things should be done and what should result to reach goals and satisfy the objectives.

Not all objectives, policies, procedures, or standards need be formulated or explicitly stated; many of these are established by the norms, values, and ideals of the system's personnel.[9] Trade practice and technical levels of culture may define other procedures or standards. There are externally imposed constraints placed on the system by laws

---

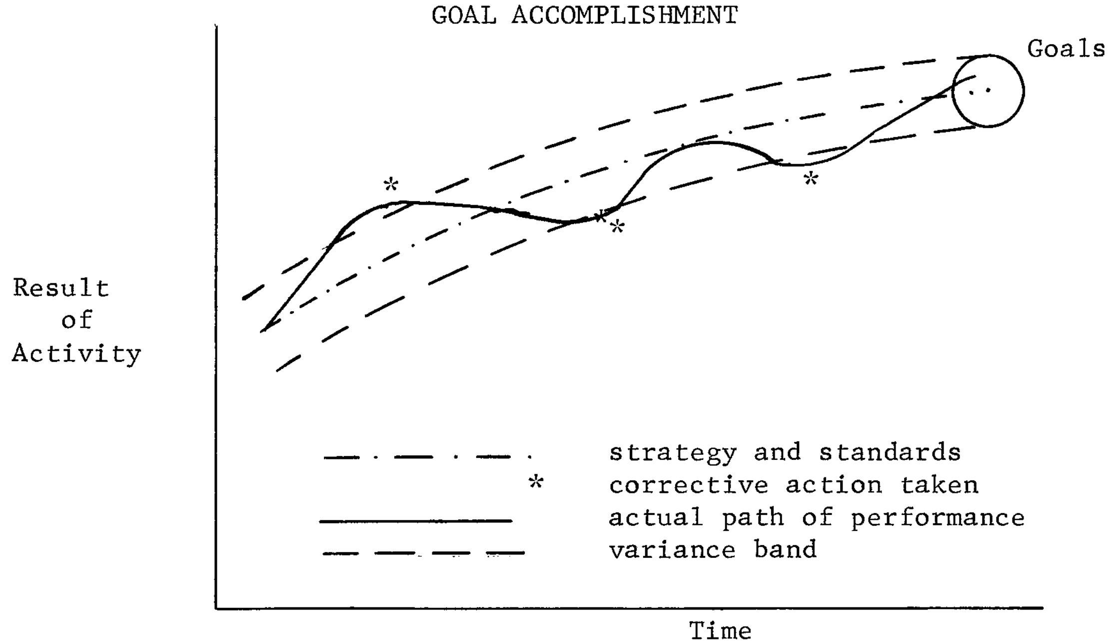
[9]Abraham Zaleznik and David Moment, The Dynamics of Interpersonal Behavior (New York: John Wiley and Sons, Inc., 1964), pp. 102-108. Definitions for these terms can be found in this reference, among many others.

and technological capabilities. Social expectations and requirements imposed on the system by its environment must be recognized and carefully considered in the process of management. In fact, the process of management as it relates to influencing people is largely a process of modifying their expectations, attitudes, and habits.

Once the manager has defined and recognized those factors that influence the development and maintenance of his system's state and structure--the Objectives, Goals, Policies, Strategies, Procedures, and Standards (OGPSPS)--the manager must implement and perpetuate these influences. By acting as an actuator, the manager initiates and maintains the system at a state and structure defined by standards and strategies. Given the present condition and position of the system, the manager must insure that the necessary activities are performed to adapt or transform the system's state and structure into that condition and position specified by goals.

FIGURE 3-1

GOAL ACCOMPLISHMENT



By monitoring the actual result of activities, and then comparing the measurements with the established or tacitly recognized criteria, the manager guides the system to goals (Figure 3-1). The processes by which the manager influences the system are not rigid. New information not only leads the manager to try to influence behavior in the system, it also causes him to modify the system's OGPSPS's so they might be more acceptable, efficient, and effective. He, and/or some other specialists, will also be exerting influence on the environment to make it more compatible for his system. If a part of the manager's strategy, he or some other system component(s) will be advertising, lobbying, negotiating, and selling in an attempt to influence the environment.

Functions of Management

Control is all processes necessary to induce or influence system and environmental entities to interact or respond in a manner consistent with a system's purpose(s). Cybernetic systems were earlier characterized as having three basic elements: a selector, an actuator, and a sensor. These three elements are also implicitly contained in the functions of management. Using the cybernetic concept of control, the functions of management can be arbitrarily defined and related to this single attribute of a system. The process of management will be divided into three stages: planning, directing, and evaluating. The functions of organizing and coordinating will be recognized as being a part of both planning and directing.

Planning is the process of determining what the system should do in the future. The planning function is basically creative decision-making--the formulation, analysis, and selection of those OGPSPS's that will satisfactorily fill the system's environmental and internal requirements.

In performing the function of planning the manager is acting as a selector. The selection of appropriate OGPSPS's generally involves implementing the proposed plan in a model, in order to anticipate and evaluate the outcome of the proposal. The models may be physical reproductions of the referent, physical analogies, schematic models, mathematical models,[10] or a mere set of expectations. Some of the models may be executed in the mind of the decision-maker, on paper, or in a computer. Based on expected outcome of the plan in the real system, the decision-maker will select that plan with the highest probability of satisfying environmental and internal requirements. The decision-making process--the models used--is based on the system's constraints and capabilities; it considers the system's established OGPSPS's; and it is tempered with the expectations of the decision-maker. The quality of the decisions made by the decision-maker is significantly dependent on the quality of information that he possesses about the system and its environment.

Planning is an extremely complex process. It is in the planning process that the next message is selected for transmission in the process of directing. Planning involves formulating and selecting message content. Models are again used to anticipate how the receiver will in-

---

[10]Claude McMillan and Richard F. Gonzalez, System Analysis, A Computer Approach to Decision Models (Homewood, Illinois: Richard D. Irwin, Inc., 1968), p. 11.

terpret the message. These models include a set of expectations about how the receiver will interpret the message based on knowledge of how the receiver has interpreted previous messages. The manner in which the receiver interprets the message will significantly influence how he (or it) will respond to the message.

In carrying out the function of directing, the manager is acting as an actuator. Directing is the process of communicating the planned OGPSPS's, or implementing the plan. In directing, the manager attempts to install the objectives and goals in others; he attempts to gain acceptance of policies; he transmits the strategies and procedures that will supposedly result in the effective and efficient attainment of objectives; and he presents the standards that are to be met. The process of direction is where motivation must take place, and where formal and informal authority is used. Direction requires that noise and interference be filtered out of the message, to the extent possible. Communication between humans is made extremely complex by the variation in their previous experiences, and by their capabilities to listen empathically. Empathic listening is the ability to understand the emotional content, the feelings, and the mood of the message sender.[11]

Organizing is the process of developing (planning) and implementing (directing) a strategy or structure for the interaction and allocation of a system's resources. A system is initially organized in the process of planning, and the organization is carried out or perceived

---

[11]Henry L. Sisk, Principles of Management, A Systems Approach to the Management Process (Cincinnati, Ohio: South-Western Publishing Company, 1969), p. 438.

in the process of directing. Organizing is that part of planning that develops the system's structure. The formal organization is a strategy for the interaction of human components; it is the result of strategies that have been implemented via direction. The organization, or structure, is an attempt to specialize system components so they can more efficiently accomplish the tasks necessary to the attainment of objectives. The formal organization of a business is the strategy that defines the hierarchy of interaction between individuals, and it permits each manager to concentrate on the control of a specific subsystem.

Coordination is also a part of both planning and directing. Coordination is the process of integrating OGPSPS's so they are consistent, synchronized, and mutually reinforcing. It is through coordination in the process of planning that the decision-maker creates an optimum combination of OGPSPS's. It is the use of coordination that develops consistent and synchronized strategies out of procedures. These strategies and procedures must be initiated in the proper sequence. Coordination is thus manifested in the process of directing.

Evaluating--a function called control in classical management theory--is the process of assessing change in the system's state and structure against the OGPSPS's. It is the process of determining if what the system is doing and becoming is in accordance with the plans. The process of evaluation involves measuring, analyzing and comparing the outcome of procedures against standards, and the outcome of strategies against goals. The function of evaluation is to isolate those factors constraining or hindering the achievement of goals. It is then through planning and directing that the system's state and structure is modified to make the system more effective and efficient. Evaluation is an essential step if meaningful adaptation is to be achieved through the functions of planning and directing.

The end result- management is basically a process of planning, directing, and evaluating. It is a process of controlling the system's development and behavior. Management is the process of determining what response should be elicited from system components (planning); it is the transmission of information to implement that response (directing); it is the measuring and comparing of what resulted from the relay of information against what was intended or desired (evaluation); and it is the return to the planning process to determine what the next elicited response should be: negative feedback, positive feedback, and/or information to evoke the next procedure in the strategy. (Figures 3-2 and 3-3). The process involves the basic activities found in all cybernetic systems as listed by Peter Schoderbek[12]--selecting, effecting, and sensing--applied at an extremely complex level, in extremely complex systems, by the system's control mechanism--the manager. It is the process of management that creates and utilizes an information-feedback system. An information-feedback system exists whenever the state and structure of the system or environment leads to a decision that results in action which affects the system and environment, and thereby influences future decisions.[13]

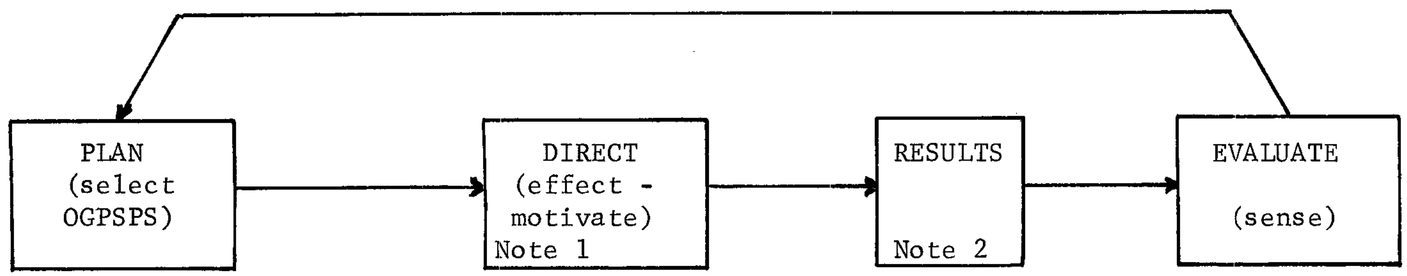
---

[12] Peter P. Schoderbek, Management Systems (New York: John Wiley and Sons, Inc., 1968), p. 258.

[13] Based on definition in Jay W. Forrester, Industrial Dynamics (Cambridge, Mass.: The M.I.T. Press, 1961), p. 14.

FIGURE 3-2

MANAGEMENT-CONTROL LOOP

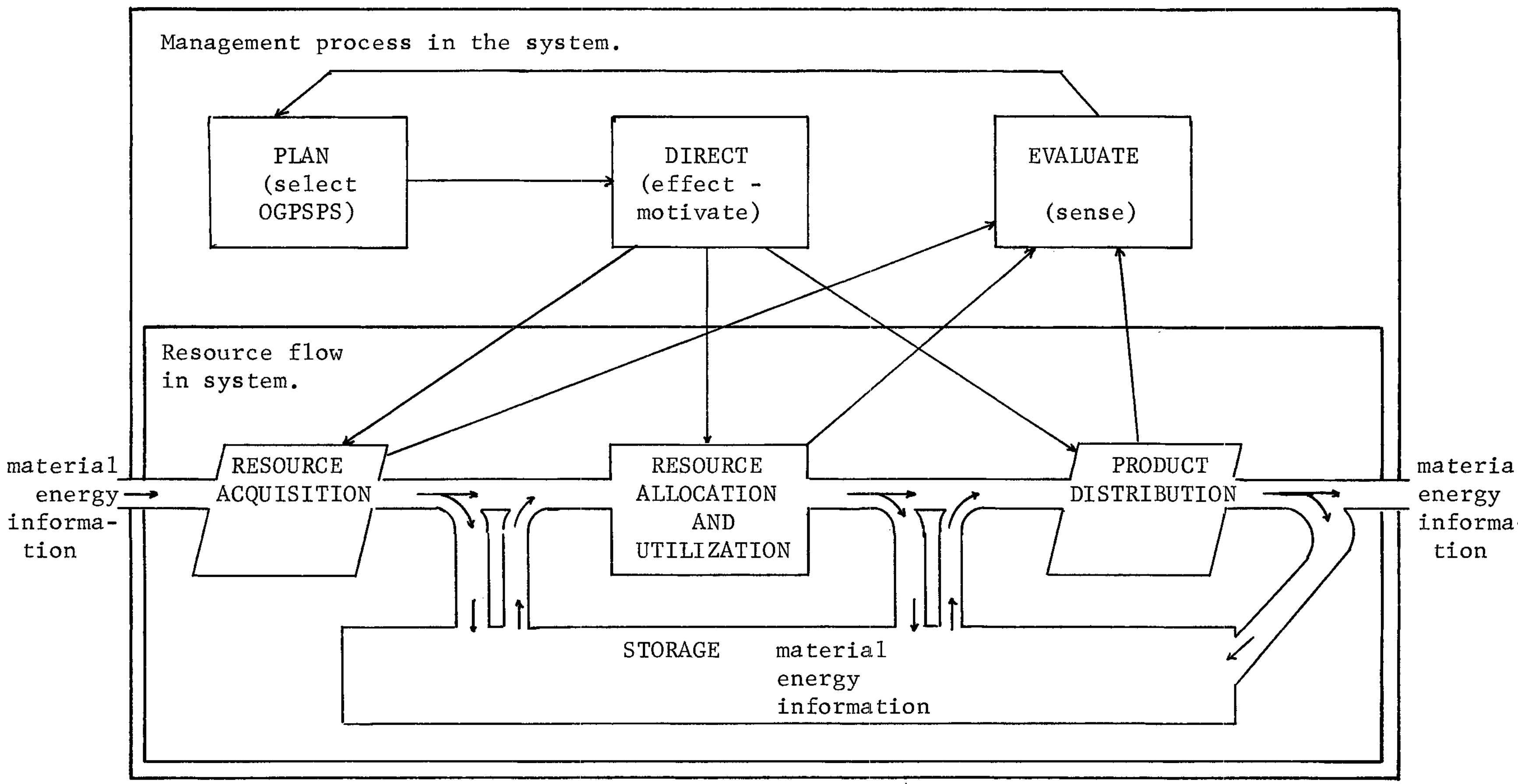


Note 1 - This step may be directed at the system, its environment, or a model of the system. When conducted in connection with a model the process would be simulation.

Note 2 - This box represents the performance of some strategy or procedure, see figure 3-3.

FIGURE 3-3

MANAGEMENT PROCESS AND RESOURCE FLOW



Control and Autonomy

Parallels between the process of management and the cybernetic concept of control have been developed. Management can be considered a process of control, but inside any relatively large system it is not "total control" by a single individual. In keeping with the concept of "the total system", it must be recognized and considered that management is not solely that done by a manager; it is that done by a group of managers. Given human capabilities and the highly complex areas of technology now being employed in many business systems, it would be virtually impossible for one individual to exercise "total control". Rather, control is attained by placing semi-autonomous subsystems inside a framework of OGPSPS's. Management of a system entails the creation of a hierarchy of objectives, goals, policies, strategies, procedures, and standards by many managers specializing in certain areas of the system's structure. From the top down in the hierarchy of control, each level of management creates a more specific and complete statement of the OGPSPS's needed for its portion of the system to contribute effectively to the system's goals.

Where this heirarchy of control exists the subsystems become semi-autonomous units in the system. A subsystem could not be totally autonomous by definition, since it would lack the disciplined interaction with other system components that is necessary to consider it a part of the system. If a subsystem in a business were completely free to disregard the system's OGPSPS's, the interaction of elements that give a system greater total effect than elements working independently would be lost. There must be a certain amount of procedural control and standardization exercised over activities like accounting practices, filing systems, and reporting formats. A semi-autonomous unit has procedural control exercised over its interaction with the system, to specify how and where it will interact in the system, but its level of operation and performance is controlled primarily by what is expected of it in the form of results, and by the broad policy statements and environmental constraints that are generally applicable to the system. The subsystem participates in the establishment of the objectives and goals that define what is expected of it, and the subsystem develops or recognizes most of the specific strategies, procedures, and standards that will be used to accomplish its goals. Control is thus attained by many managers creating a set of OGPSPS's for their particular subsystems that are consistent with the OGPSPS's established higher in the system's hierarchy of control.

A certain level of autonomy is not only essential due to the complexity of controlling a large system, but it is desirable because it permits individuals at all levels to participate in the control of the system. The behavioral approach to management advances the well-founded principle that people must be involved in the process of developing OGPSPS's, if they are to be committed to the system's effort. Participation permits each individual in a system to exert some influence on the system's development, and the system's OGPSPS's become, in part, the prodigy of each individual's effort. Individuals in the system become responsible for what they agreed to do, and not responsible for what they were merely told to do. By helping to formulate changes in the system's state and structure, individuals acquire an understanding of why the changes are made and what the changes are expected to accomplish. This involvement and understanding can reduce the anxiety and resistance frequently associated with changes in goals, policies, strategies, procedures, and standards. The semi-autonomous approach also permits different managers to apply a more diverse body of knowledge to decision-making, thus permitting more variables to be considered. Participation in the control of a system close to the point of activity will permit more timely feedback and make the system as a whole more responsive. A degree of autonomy in the system will also reduce the quantity of information that need be transferred through different levels of the system. What will be reported to higher levels is results, and the reported results will be compared with the established goals to find variances in the system's performance.

The critical question is how much autonomy should a subsystem be granted. The greater the degree of autonomy the higher the risk of losing the synergistic property of the system. The greater the degree of centralized control over subsystems the lower the level of participation from subsystems that must be committed to the system's goals. The dilemma is in finding the proper blend of procedural control and control by results in the form of semi-autonomous subsystems. The proper balance between the detailed procedural control and partial autonomy will depend on several factors which include: the size of the system, the complexity of the work activity, the capabilities of personnel, the cost of incurring deviations from standards, and the compulsion of personnel to accomplish established objectives. The smaller the system and the less complex the work activity, the easier it is to control from a single level by establishing a global set of OGPSPS's. The higher the expected cost of deviating from standards, and the less capable the personnel, the greater the need for procedural control over their activities. The greater the compulsion in system's personnel to close on an objective, the greater the degree of autonomy that can be permitted. The compulsion inherent in some people to complete a task or to achieve a given result has been labeled the "Zeigarnik effect."[14] The Zeigarnik effect is sometimes called "a compulsion to close."

The exact blend of autonomy and control that should be used is dependent on the above factors, which are situation dependent. The use of autonomy simplifies the process of control and permits various individuals to specialize or concentrate on particular goals that make up the system's objectives. Where conditions permit, control should generally be obtained by establishing expected results rather than dictating specific procedures intended to produce results. The results that are to be expected are specified by the objectives and goals that are established, and the procedural control is delegated to a level close to the activities being performed. When subsystems are semi-autonomous, however, the function of evaluation becomes extremely important. Managers at all levels must continually review the OGPSPS's from above and below to insure consistency between the hierarchy of OGPSPS's in the system.

---

[14] John F. Mee, "The Zeigarnik Effect," <u>Business Horizons</u>, XII, No. 3 (June 1969), pp. 53-60.

CHAPTER IV

SUMMARY AND CONCLUSION

The process of management has been developed as the control of material, energy, and information resources in a system with human components. It is control through participation in the development of objectives, goals, and policies, and in the development and application of strategies, procedures, and standards. It is the presentation of these challenges and specifications so structured that they require or invoke the desired expectations or self-directed responses in individuals so as to achieve the preconceived ends or objectives.

The process of management controls a system by defining the set of resources it will utilize, and by developing the structural relationships in the system that influence the interaction of resources. The state and structural properties that permit a system to effectively fulfill its purpose can only be efficiently developed based on a set of objectives that focus the system's resource consumption toward the desired results. The objectives are further qualified and quantified into definate goals that must be accomplished over time. The set of simultaneous and sequential state and structural changes that the system will follow to reach the established goals has been referred to as a strategy. Policies are developed in the form of standing decision rules to guide the system's activities and eliminate the need of continually reconsidering all possible state and structural forms. Procedures are established for performing the tasks required to reach the objectives. Standards are created as a reference to evaluate the requisite system performance, and to isolate subsystems or components in the system that are not responding properly.

The discussion has been largely theoretical, but there are a number of benefits to be derived from the systems approach to management. From the academic standpoint, the concept of control provides a nucleus around which the functions of management can be organized and interrelated. Each of management's principle functions--planning, directing, and evaluating--can be organized into an orderly step of activities that produce, implement, and monitor the development and maintenance of a system. If management theory is to become an organized discipline, the purpose of its various functions must be interrelated and defined relative to the purpose of management. The purpose of management is to influence the allocation, interaction, and utilization of material and energy resources to fulfill the purpose for which a system is created and maintained.

An analytical framework in which the observed activities of a manager can be related and evaluated is also provided by the systems approach. A management audit should isolate and ascertain the adequacy of the objectives, policies, strategies, and procedures used in a system being evaluated. The recognition of goals, procedures, and standards that are explicitly stated or implicitly assumed may reveal numerous reasons why a system is not performing according to expectations. Identification and analysis of the interaction between environmental and self-imposed constraints can reveal barriers to system development. Developing a description of a system's resources and the structure within which the resources interact may isolate areas of inadequacy or interference in the system. The management audit can, in effect, be an evaluation conducted under an expanded version of the outline for a systems study on page 23.

The systems approach can also provide a manager a conceptual model of the steps required to manage an effective organization. The manager must develop consistent objectives, goals, policies, strategies, procedures, and standards in the function of planning; he must implement these controlling influences via direction; and, he must recognize where modification of these influences is required in the function of evaluating. His planning process will involve the use of various models to predict the reaction of his system to proposed influences. In directing, he will attempt to develop a commitment to the system's goals. Evaluating will require him to compare results with the expectations specified by goals and standards, and this evaluation will identify areas where additional planning and directing are required.

BIBLIOGRAPHY

Ackoff, Russell L. A Concept of Corporate Planning. New York: John Wiley and Sons, Inc., 1970.

Argyris, Chris. Integrating the Individual and the Organization. New York: John Wiley and Sons, Inc., 1964.

Ashby, W. Ross. An Introduction to Cybernetics. London: Chapman and Hall Ltd., 1956.

Beer, Stafford. Cybernetics and Management. New York: John Wiley and Sons, Inc., 1959.

Berrien, F. K. "Social Systems, Adaptation, and Personality," General Systems Bulletin, Vol. XI, No. 111, December 1970.

Bertalanffy, L. Von. "General System Theory: A New Approach to Unity of Science," Human Biology, Vol. XXIII, December 1951, pp. 302-361.

Blumenthal, Sherman. Management Information Systems. Englewood Cliffs, N.J.: Prentice-Hall Inc., 1969.

Brabb, George J. Introduction to Quantitative Management. New York: Holt, Rinehart and Winston, Inc., 1968.

Churchman, C. West. The Systems Approach. New York: Dell Publishing Co., 1968.

Cyert, Richard M., and James G. March. A Behavioral Theory of the Firm. Englewood Cliffs, N.J.: Prentice-Hall Inc., 1963.

Dale, Ernest. Management Theory and Practice. 2nd ed. New York: McGraw-Hill Book Company, 1969.

Demerath, Nicholas, and Richard A. Peterson. System, Change, and Conflict. New York: Free Press, 1967.

Dewan, Edmond M. (ed.). Cybernetics and the Management of Large Systems. New York: Spartan Books, 1969.

Dickson, G. W. "Management Information-Decision Systems," Business Horizons, Vol. XI, No. 6, December 1968.

Drucker, Peter F. The Practice of Management. New York: Harper and Row, Publishers, 1954.

Ellis, David O., and Fred J. Ludwig. Systems Philosophy. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1962.

Forrester, Jay W. Industrial Dynamics. Cambridge, Mass.: The M.I.T. Press, 1961.

Gilman, Glenn. "The Manager and the Systems Concept," Business Horizons, Vol. XII, No. 4, August 1969.

Greniewsky, J. Cybernetics Without Mathematics. New York: Pergamon, 1960.

Hall, A. D. A Methodology for Systems Engineering. Princeton, N.J.: D. Van Nostrand Co., Inc., 1962.

Hartman, W.; H. Matthes, and A. Proeme. Management Information Systems Handbook. New York: McGraw-Hill Book Co., 1968.

Head, Robert V. Real-Time Business Systems. New York: Holt, Rinehart and Winston, Inc., 1964.

Howell, Robert A. "Managing by Objectives," Business Horizons, Vol. XII, No. 1, February 1970.

Johnson, Richard A.; Fremont E. Kast, and James E. Rosenzweig. The Theory and Management of Systems. 2nd ed. New York: McGraw-Hill Book Co., Inc., 1963.

Kelly, William E. Management Through Systems and Procedures. New York: John Wiley and Sons, Inc., 1969.

Koontz, Harold, and Cyril O'Donnell. Principles of Management. 3rd ed. New York: McGraw-Hill Book Company, Inc., 1964.

Malcolm, D. G.; A. J. Rowe, and L. F. McConnell (eds.). Management Control Systems. New York: John Wiley and Sons, Inc., 1960.

McDonough, Adrian M., and Leonard J. Garrett. Management Systems: Working Concepts and Practices. Homewood, Ill.: Richard D. Irwin, Inc., 1965.

McGregor, Douglas. The Human Side of Enterprise. New York: McGraw-Hill Book Company, Inc., 1960.

McGregor, Douglas. "Do Management Control Systems Achieve Their Purpose?" Management Review, Vol. LXI, No. 2, February 1967, pp. 4-18.

McMillan, Claude, and Richard F. Gonzalez. Systems Analysis, A Computer Approach to Decision Models. Homewood, Ill.: Richard D. Irwin, Inc., 1968.

Mee, John F. "The Zeigarnik Effect," Business Horizons, Vol. XII, No. 3, June 1969, pp. 53-60.

Miller, David W., and Martin K. Starr. The Structure of Human Decisions. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1957.

Miller, Ernest C. "Objectives and Standards: An Approach to Planning and Control." American Management Association, AMA Research Study 74, 1966.

Orlicky, Joseph. The Successful Computer System. New York: McGraw-Hill Book Company, Inc., 1969.

Payne, Bruce. "Steps in Long-Range Planning," Harvard Business Review, Vol. XXXV, No. 2, March-April 1957.

Porter, Arthur. Cybernetics Simplified. New York: Barnes and Noble, Inc., 1970.

Raia, Anthony P. "A Second Look at Management Goals and Controls," Management Review, Vol. LV, No. 8, August 1966, pp. 65-69.

Schoderbek, Peter P. (ed.). Management Systems. New York: John Wiley and Sons, Inc., 1968.

Seymour, Tilles. "The Manager's Job--A Systems Approach," Harvard Business Review, Vol. XLI, No. 1, January-February, 1963, pp. 73-81

Simon, Herbert A. Models of Man, Social, and Rational. New York: John Wiley and Sons, Inc., 1957.

Sisk, Henry L. Principles of Management, A Systems Approach to the Management Process. Cincinnati: South-Western Publishing Company, 1969.

Strong, Earl P., and Robert D. Smith. Management Control Models. New York: Holt, Rinehart and Winston, 1968.

Vardaman, George T., and Carroll C. Halterman. Managerial Control Through Communications. New York: John Wiley and Sons, Inc., 1968.

Wiener, Norbert. Cybernetics. New York: John Wiley and Sons, Inc., 1948.

Williams, L. K. "The Human Side of a Systems Change," Systems and Procedures Journal, Vol. XV, No. 4, July-August 1964, p. 199.

Wortman, Max S., and Fred Lathams (eds.). Emerging Concepts in Management. New York: The MacMillan Company, 1969.

Wrapp, H. Edward. "Organization for Long-Range Planning," Harvard Business Review, Vol. XXXV, No. 1, January-February 1957, pp. 37-47.

Young, Stanley. Management: A Systems Analysis. New York: Scott, Foresman and Company, 1966.

Zaleznik, Abraham, and David Moment. The Dynamics of Interpersonal Behavior. New York: John Wiley and Sons, Inc., 1964.