A SYSTEMS VIEW OF ORGANIZATIONS AND CHANGE

By

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The management of technological progress is to a large extent responsible for the production potential of today's progressive industrial enterprises. The foundations of basic technology were developed long ago. Accordingly, much is known about the natural sciences and engineering.

In contrast to the vast amounts of technological knowledge, little is understood about the human element of the manufacturing organization. The worker was not managed as adeptly as the machines, the processes and other physical objects. Progress is being made—but as in the accumulation of knowledge in other fields of study, true progress is slow. Because of the complexity of behavioral situations, advancement may be slower than in the natural sciences.

Basic to the study of organizational behavior is the premise that much of human behavior has a pattern that can be objectively analyzed, explained, and predicted. Because of the importance of the individual to the success of a business enterprise, administrators should possess a conceptual model for viewing behavioral situations. A prerequisite to the comprehension of such a model is the understanding of an approach to the study of organizational behavioral situations.

A SYSTEMS APPROACH

Exploratory study in any new field of science will begin generally with observations of what appear to be unrelated phenomena, or activities. After much study the activities will be compared and grouped in ac-

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cordance with the judgment of the observer. Relationships linking individual groupings of activities will be developed. As knowledge of the phenomena increases, a few of the causal relationships may be better understood. Over the times, more relationships will be derived, and interdependencies will arise among groupings. Gradually higher order relationships will be developed until explainable relationships exist between all or most of the groups of activities. The explanatory and predictive power of the relationships within the field will continue to increase as higher order relationships are established. At this stage of development, the study within the field will have progressed from observations, judgments and relationships that attempt to describe several apparently unrelated elements to an analytical model comprising a set of elements, and their interrelationships which are precisely defined. The accumulation of useful knowledge within the field will have advanced to enable the use of a system approach. Of the above process, Pareto said: "The interdependence of the variables in a system is one of the widest inductions from experience that we possess; or we may alternately regard it as the definition of a system."[1]

A system comprises a set of elements and relationships between the elements. Hall defined a system as a set of *objects* with *relationships* between the objects and between their *attributes*.[2] Objects referred to parts, or components of the system such as molecules, stars, and springs. *Attributes* were properties of objects. For example, molecules have weight, linkage, and position relative to other molecules; stars have relative position, light intensity, and size; and springs have tension, constants of elasticity, and length. Relationships tie the objects of a system together. They can be molecular affinities, gravitational forces, algebraic expressions, friendships, social codes or company policies and regulations. The relationships among the objects of a system are expressions of the value, magnitudes or states of specific objects relative to corresponding simultaneous values, magnitudes or states of other

[1] Lawrence J. Henderson, *Pareto's General Sociology: A Physiologist's Interpretation* (New York: Russell & Russell, by arrangement with the Harvard University Press, 1967), p. 86.

[2] Arthur D. Hall, *A Methodology for Systems Engineering* (Princeton: D. Van Nostrand Co., Inc., 1962), p. 60.

specific objects. Mathematically speaking, the values of one object, or variable are a function of the values of other objects or variables within a system. Because of the interrelationships and interdependencies among the objects of a system, it must be considered as a whole for meaningful study.

SYSTEMS IN BUSINESS AND SOCIETY

In the business world of today, systems exist at all levels in the firm beginning with individual workers. Objects of successively higher order systems in the enterprise include work groups, units, sections, departments and the company as a complete entity. Studies of interrelationships within companies have led to innovations in structuring formal organizations with a view to fostering the adaptive qualities of the enterprise. Traditionally, business have been divided according to areas of specialization such as production, marketing and finance for convenience, and for lack of a more effective pattern of organization. When questioned about a precise definition of sociology, Pareto provided insight into the above division of organizations. He explained that no rigorous definitions of any science exist, because knowledge is divided into departments arbitrarily and for convenience, and that the convenience changes with the increase in knowledge, thereby changing the classification and delimitation of the sciences.[3] As the understanding of a field of study increases, its domain will become larger. Boundaries of convenience then will be obstacles to effective understanding, and, will give way to a systems approach to analysis. With the recent and current level of research activity in business administration, the increased use of systems and systems analysis can be expected.

It is no surprise, therefore, to find the systems approach being used increasingly in the study of organizational behavior. In the natural sciences, the word system seems commonplace—the solar, the nervous or the molecular system. Similarly, there exist many a man-made system such as a weapons, an electric utility or an automatic pilot system. Systems in the social sciences, which focus upon interpersonal relationships and organizational behavior, are relatively new.

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[3] Henderson, *op. cit.*, p. 19.

In his account of a research program at Western Electric Company, Roethlisberger summarized the parts of a social system in a manufacturing plant. The two major components are the technical, and the human, organization. The latter is divided into the individual, and the social, organization, which in turn are subdivided into the formal and informal organizations—each with its own patterns of interaction and systems of ideas and beliefs. The logic of cost, and the logic of efficiency are characteristics of the systems of ideas and beliefs of the formal organization; whereas the logic of sentiments is part of the systems of ideas and beliefs of the informal organization.[4]

Fifty years ago, there seemed to be sound grounds for the relatively restricted use of the system approach in the social sciences. Pareto listed six reasons: (1) because of the large variety subjects included in the social sciences, there may be more subjects where the consideration of the social system is irrelevant compared with subjects in the other sciences; (2) it is difficult to isolate the social system for study; (3) the selection of the bounds of a social system may be more difficult than the bounds of a system in the physical sciences; (4) the establishment of an experimental model is difficult; (5) the definition and measurement of relationships is also difficult; and (6) there is a lack of suitable quantitative methods to apply.[5] Considerable progress have been made recently; however, the obstacles to the use of the systems approach still seem to exist.

THE SYSTEMS STUDY

A systems study involves a definition of the system to be analyzed, and a determination of what is happening in the system. Various concepts are available to assist in the appraisal of the situation such as functional analysis, isolation of the system from its environment, careful selection of system boundaries and an understanding of the equilibrum forces at work in the system. Once the system is understood, administrative action may be taken to introduce change or other exogenous forces into the sys-

[4] F. J. Roethlisberger and W. J. Dickson, *Management and the Worker* (Cambridge: Harvard University Press, 1956), pp. 565-6.

[5] Henderson, *op. cit.*, pp. 94-5.

tem in a manner that will evoke an adaptive response from the objects in the system.

DEFINITIONS OF THE SYSTEM

A system is defined by defining its objects, and the relationships that the objects have together. The choice of objects is important. Should an object be included in the system or in the domain surrounding the system? This choice may be relatively easy to make in a physical system of electronic circuits in which the values of the attributes of the objects, and the interrelationships between objects have been understood for years. On the contrary, the choice may be intuitive as in the beginning of a study on a virgin field. It may be on the basis of a prior analysis that is being extended. The objects should be selected, described, and classified into groups with common characteristics. For ease in analysis, the number of groups should be minimized.

When defining a system in the social sciences, the objects can be selected after careful observation. It is a more difficult task to define the interrelationships, especially the sentiments. Sentiments usually are cloaked in non-logical reasoning. Many times, there is no simple and direct relationship between a sentiment and the stated subject of the sentiment. To try to understand sentiments requires an attempt to understand the individual expressing the sentiments. Accordingly, the definition of the system leads to an appraisal of the objects in a particular situation.

APPRAISAL OF THE SITUATION

Many administrators conduct a superficial appraisal of the situation. They are prone to take action on the basis of too little information, and frequently after an erroneous appraisal. Systems are composed of subsystems and problems arise at both levels in an organization. Executives may treat problems at the subsystem level, when by viewing the interrelationships between subsystems and objects in the system a more basic problem of higher order at the system level may be identified. The neglect of interrelationships leads to an oversimplified, wrong cause-and-effect diagnosis which in turn leads to premature executive action.

Within a company, these interrelationships are directed vertically between the individual and the work groups, and higher organization units and horizontally at each level of organization. Even though a person is well acquainted with the analysis of systems, and is intuitively in a system, errors in appraisal may be committed. It is imperative, therefore, for a manager to make a conscious effort to analyze the interrelationships prevailing within a system as an early step in his appraisal of the situation.

In addition, an executive must analyze his own frame of reference as well as that of the people involved in a situation when appraising a problem from a systems point of view. Most people experience difficulty in acquiring an awareness of their personal frame of reference. The decision-maker must not become personally involved in the situation being studied. He must maintain a clinical posture, and describe only what is occurring and not what should be occurring.

To assist the administrator in assessing a situation objectively, a diagnostic tool called functional analysis is employed. With this approach, the behavior of individuals and organizations is analyzed as something intrinsically related to the people participating in a situation and is viewed in terms of a large frame of reference—in terms of the system in which operate. When an executive applies functional analysis, he attempts to understand the behavior of his employees or organizational units in a situation as part of a larger entity such as the department or the company, and as the product of many interacting social and technical forces—rather than wrongly interpreting the behavior as a simple, isolated case that requires action. Functional analysis reveals relationships between objects in a system, but no consequences or visible changes in the system.

Function may be defined as the contribution that an activity makes to the total system of which it is a part. The concept of function was borrowed from the natural sciences. For example, questions have long been asked such as what is the function of the brain, of the heart and the appendix relative to the human body? In his treatment of social psychiatry, Leighton offered a broader definition of function. He stated: "The function of a particular organ, psychic pattern, or social arrange-

ment may be described as the part this segment plays in the over-all performance of the system, its contribution to the operating whole."[6]

The word "function" relates to the role of an element of behavior or one of the interrelationships that occurs in a system, and implies only that the behavior occurred—not that it was good or bad. Forces should be regarded as natural in the context of the personal frameworks of the individuals involved in the situation. Strictly speaking, a functional relationship consists of the change in magnitude of one variable, or object in a system associated with a change in magnitude of another. The relationship may be direct or indirect; however, "good" and "bad" should not be associated with the direction or intensity of the relationship. Not until the entire system has been appraised should the executive apply normative judgment.

In analyzing a social system, it must not be assumed that there is a teleological explanation for behavior. On the contrary, it must be assumed that a person behaved in a certain nature at that moment allowed him no other action. A conscious effort should be made to avoid the explanation that a person's behavior was performed because it was intended, and would later be advantageous to that person. If behavior is assumed to be teleological, a circular argument would result, since in analyzing a system it is desired to explain behavior—some of which appears to be teleologically directed.

It is relatively easy to accept the concept of function of a physical item. The function, or role of a circuit breaker in an electrical system is to open the circuit when the system is subjected to dangerous surges. The role of an artificial heart is to pump blood through all parts of a body in the absence of the natural heart.

The function of an object depends upon what are considered to be the boundaries of the system. The function of an automobile may be a method of transportation to a person viewing a community transportation system. The function of the same automobile can be to satisfy the status needs of its owner. Still a third function could be as a generator

[6] Alexander H. Leighton *et. al.* (ed.), *Explorations in Social Psychiatry* (New York: Basic Books, Inc., 1957), p. 14.

of carbon monoxide, and a contaminator of the atmosphere to a person viewing the automobile as one object in an air pollution system. Systems are conceived and exist to accomplish one or more specific objectives. An understanding of the objectives established for a system is an essential part of functional analysis.

It is more difficult here than in the physical sciences to think about the role, or "functioning" of an element of behavior of an individual or an organization. Why did a worker argue with his supervisor? What is the role of the worker's behavior? Why did a group of workers restrict output? What was the function of the restricted production? The complement of function is dysfunction. To make the consideration more complex, behavior may be functional in one system and dysfunctional in another.

Considering the intensity, or power of an interrelationship in a system, it must be only sufficient to maintain the system in operation. By the definition of a system, the existence of interrelationships is essential for the maintenance of a system. It may be reasoned, therefore, that function implies the occurrence of an element of behavior sufficient to maintain the system or at a level of minimal performance standards.

Unless the executive is careful, functional analysis may lead to a reinforcement of a status quo situation. Once the function of a specific behavior is identified, the fact that a function for it exists tends to be accepted as justification for its occurrence.

A model of a social system can be used as an explanatory and predictive device only if the system can be precisely defined, and, the function of the interrelationships can be identified.

CLOSED SYSTEMS

For meaningful and determinate analysis of a social system, it is necessary to assume specific types of interactions between the environment and the system being studied. Recognizing that no real system can be isolated, nevertheless, an intellectual construct of a closed system is possible. In the extreme, a state of isolation may be said to exist when there is no exchange between the system and its environment. Logical

analysis of the system, however, can proceed if there is an exchange of known value. For example, the energy for an electronic system may come from outside the system. It is a necessary and sufficient requirement that the energy values over time be known.

A closed system is not assumed to remain closed during analysis. The decision-maker must determine how the relationships between the objects in the system react to certain stimuli or changes. The model is opened to admit the change, and is closed for analysis as in the simulation of a system.

SELECTION OF BOUNDARIES

A system is defined relative to the objects included in the system. It is readily apparent, therefore, that definition of system boundaries is an early, essential step in the approach to a problem from a systems viewpoint. Hall advocated that two boundaries must be established:

1. The boundary setting off the universe of thing of interest in a given problem.
2. The boundary between the system and the environment.[7]

The executive must establish the boundaries of a system depending upon the problem to be solved. Many times the boundaries of a system are established too narrowly. Generally, the result is a suboptimized solution to the problem. It is not surprising that Hall claimed that much of the work of defining a systems problem could be called defining boundary conditions.[8]

EQUILIBRIUM OF THE SYSTEM

A social system has a network of human interrelationships which can be said to be internally consistent, or stable—in a state of equilibrium. Hagen has defined equilibrium as a system state that occurs when all of the attributes of objects, or variables in a system remain constant in value, not by assumption but by the interaction of the objects.[9]

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[7] Hall, *op. cit.*, p. 62.
[8] *Ibid.*, 102.
[9] Everett A. Hagen, *On the Theory of Social Change* (Homewood, Illinois: The Dorsey Press, Inc., 1962), p. 57.

For the analysis of a system to be determinate, it is necessary for the system to have a state of equilibrium. It is useful to construct systems that are in equilibrium. For the study of the system, an exogenous force is introduced through one object in the system. This force, in turn, will influence the other objects in the system through the patterns of interrelationships. It may then be observed whether the system: (1) assumes a new equilibrium; (2) assumes a moving equilibrium with a continuous change in the values of some of the attributes of the objects in the systems; (3) remains in a continuous transient condition; or (4) destroys itself. The equilibrium of a system is stable if the final state of the objects is identical to the original state, prior to the introduction of the exogenous force.

If some of the values of the attributes of the objects return to their original magnitudes after the system is disturbed with an externally originated change, a condition of homeostasis prevails. Homeostasis does not mean that no change has been effected in the system. Examples of homeostatic systems are: (1) the world when parts of it are subjected to small wars or famines; (2) the human body when subjected to a small illness; (3) a work group in an industrial operation when a new worker is admitted who possesses most of the values, ideas, and beliefs already held by the workers in the group; or (4) a metallic spring when subjected to a shock. In each case, the system tends to adapt to the change in an explainable and predictive manner with many of the attributes of the objects reverting to their original value after the change has been effected.

As may be inferred from the above, equilibrium is not necessarily a static state. It may be static, moving, or dynamic. Dynamic analysis refers to the study of the path of change of a system as it moves from one state to another after an exogenous change has been introduced.

Change in a system is effected with minimum resistance when the conditions of equilibrium are understood, and the specifications of the exogenous disturbance is known. If a work group is in a state of equilibrium; and if the values, sentiments, ideas and beliefs of the workers in the group are known, and the similar attributes of a new worker are also

known, the behavior of the group and the new member can be explained and predicted. Change in the system is thereby facilitated.

FUTURE

A manufacturing organization can be viewed as having two major functions which are interrelated and interdependent:

1. To produce a product.
2. To create and distribute satisfaction among individual members of the organization.[10]

The first is generally considered to be economic, and is assessed in such terms as cost, profit and technical efficiency. This function may be regarded as a problem of external balance in which the corporation attempts to remain in balance with exogenous needs created by customers competition and society. The second function is generally considered to be social, and is assessed in such terms as absenteeism, labor turnover, employee attitudes, and employee attitudes and employee suggestions. It is this function that is one of internal equilibrium.

Executives must understand the human situations that they are administering. When an administrator is intentively aware of the individuals in each subsystem of his enterprise, views his business as a social system with boundaries and an environment, is cognizant of the relationships between people and organizations within his company, and is aware of the conditions that foster equilibrium, he can then effect change within his system; so that adaption is accomplished, and his industrial enterprise continues to perform its two basic functions.

Organizational behavior and systems analysis is relatively new compared with systems analysis applied to the natural and physical sciences. The application of systems analysis to the behavior of groups, communities, and societies is a complex problem. The discipline of organizational behavior is progressing with improved understanding of basic causal relationships. Equally important, social systems are analyzed using existing conceptual schemes of organizational behavior. Such analyses can lead to

[10] Roethlisberger, *op. cit.*, p. 552.

the improvement of existing schemes and the development of new frameworks of analysis. Executives may then manage organizations that possess greater possibilities for adaption.