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GST: ITS EVOLUTION AND APPLICATION IN ORGANIZATION THEORY AND MANAGEMENT

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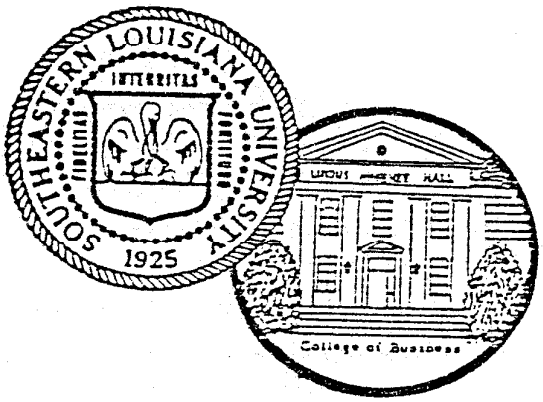

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ABSTRACT

Although Ludwig Von Bertalanffy has sired the General Systems Theory (GST), the genesis of systems theory is traceable to the seminal works of early scholars who attempted to search for order in their fields of inquiry through a systems approach. In the early 1950s various disciplines, including organization theory and management, began to apply GST hoping to understand better the intricacies of their respective fields of scientific endeavor. The general tendency has been to regard GST as a panacea; but upon a closer examination, we have discovered its limitations, especially when it is employed in the social sciences. Despite its limitations, GST equips the scientist as well as the practitioner with a methodology which is conducive to gaining knowledge about the interrelationships and interactions of complex entities such as our organizational and managerial systems.

GST: ITS EVOLUTION AND APPLICATION IN ORGANIZATION THEORY AND MANAGEMENT

INTRODUCTION

Man is an inquisitive being. Possessing an intellect and endowed with an insatiable desire for knowledge, he endeavors unceasingly to unravel the mysteries which surround him. His never ending quest for knowledge led him to understand the complexities in the universe and to wield order from chaos. Man has been endeavoring to search for order in the physical, social, and behavioral sciences. "For management, man's search for order has been expressed throughout history in attempts to rationalize and systematize the workplace and the organization's operations."[1] According to Wren, the search for order in management has been through two main schema. One has been through quantitative methods, and the other through systems theory.[2]

The search for order through quantitative methods (Operations Research, Management Science, MIS) falls under the general subject of systems analysis; it is beyond the scope of this article for want of space.

After an introduction to the subject matter of GST, the purpose of this article is to trace the evolution of GST as man's avenue for his quest

for order; then briefly delineate the scope and application of systems theory in various disciplines including in organization theory and management. Finally, the main problems encountered in applying GST to organization theory and management are explored.

DEFINITION OF "SYSTEM"

Before we embark upon the discussion of a rapidly evolving subject, a definition of "system" is deemed essential to put the reader and the writer on the same level of understanding. Most writers on GST make mention of a dictionary definition of a system as "an assemblage of objects united by some form of regular interaction or interdependence; an organic or organized whole."[3] Kast and Rosenzweig basically define the term in a similar way by stating that "a system is an organized or complex whole: an assemblage or combination of things or parts forming a complex unitary whole."[4]

Churchman's definition, however, is preferred by this author for it includes one of the most important characteristics of systems, which is the teleological attribute of systems as is made evident in the ensuing definition: ". . . all definers will agree that a system is a set of parts coordinated to accomplish a set of goals."[5]

A SYNOPSIS OF THE KEY CONCEPTS OF GST

A number of important concepts of GST have been set forth by many scholars like Ludwig Von Bertalanffy, Kenneth Boulding, A. D. Hall, James Miller, and Talcott Parsons; and many other writers have used the GST concepts in organization theory and management such as C. West Churchman, F. E. Emery, Fremont Kast, James Rosenzweig, Daniel Katz, and Robert Kahn.

To review the main characteristics derived from GST, and to understand their similarities and differences, the following key concepts have been widely accepted by scholars in this field as meaningful to the study of organizations.[6]

Open System View - Systems can be categorized as closed or open. Closed systems do not interact with their environments. Mechanical systems may be open or closed. Systems, however, can not be either perfectly closed or open; rather they are relatively open or relatively closed. In contrast, open systems exchange information, energy, or material with their environments. Biological and social systems are characteristically open systems.

System Boundaries - This concept refers to the assumption that systems have boundaries which separate them from their environments. The idea of boundaries explain further the distinction between closed and open systems. The closed system has rigid, impenetrable boundaries, while the open system has permeable boundaries between itself and a broader suprasystem. Physical and biological systems have relatively easily defined boundaries, but social systems (e.g. organizations) lack easily delineable boundaries.

Input-Transformation-Output Model - An open system is in a dynamic relationship with its environment: it obtains various inputs, transforms these inputs, and produces outputs. This concept of an open system can be viewed as a transformation model diagrammed below.

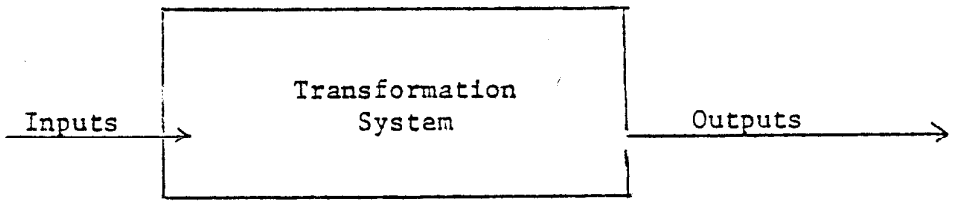

Figure 1: An organization as an open system

Holism - The whole is not the arithmetic sum of its parts. This concept is imbedded in the proposition that the system itself can be explained only as a totality. Synergism, organicism, and gestalt are related concepts.

Subsystems or Components - Every system must at least have two elements, and these elements should be interconnected. By definition, a system is composed of interrelated components whether it is a mechanical, biological, or social system.

Entropy and Negative Entropy - Closed systems are victims to the force of entropy, or a "running down" condition, which increases until the system fails (death). When the system moves toward maximum entropy, it turns unable to transform energy from the environment and thus dies. In open systems entropy can be checked and may be transformed into negative entropy--is the process of more complete organization and ability to transform resources--the system receives resources from its environment and transforms them.

Steady State, Dynamic Equilibrium - Negative entropy and steady state are closely related. A closed system's tendency is to eventually attain an equilibrium with maximum entropy (death or disorganization), while an open system may head toward a state where the system remains in dynamic equilibrium through the importation of continuous input of materials, energy, and information.

Feedback - The concept of feedback explains how a system maintains a steady state. Output and process information is fed back into the system as an imput which may lead to changes in the transformation process and/or future outputs. There are two kinds of feedback: positive and negative. Cybernetics is based on negative feedback (which is the informational input alerting that the system is deviating from a programmed course and that readjustment is necessary to gain new steady state).

Hierarchy - This is an essential concept that hierarchical relationships exist between systems. A system is made up of subsystems of a lower order and at the same time forms part of a suprasystem. As a whole, we could look upon the components of the system as forming a hierarchy.

Multiple Goal-Seeking - Biological and social systems manifest themselves as having multiple goals or purposes. Complex social organizations tend to seek multiple goals because such entities are composed of many individuals and subunits with different sets of values and objectives.

Differentiation and Internal Elaboration - In contrast to closed systems (which move toward entropy and disorganization), open systems tend to head toward greater differentiation, elaboration, and a higher level of organization than what they were before.

Equifinality - Mechanistic systems have a direct cause and effect relationship between the initial conditions and the final state. Open systems, on the other hand, do not have a direct causal relationship; they have the attribute of equifinality which means that certain results may be achieved with different initial conditions and in different ways. This concept suggests that biological and social systems (such as human organizations) can achieve objectives with different inputs and with various transformation processes.

Regulation - Systems tend toward self-regulation through:

1. Adjustment - the parts re-establish selves in more or less same patterns.
2. Control - typically, feedback mechanisms exist which permit the system as a whole to adjust.
3. Learning - relates to the fact that a system may rearrange its internal characteristics to better cope with that which causes disturbances and to deal with similar situations in the future.

This partial survey of the important concepts of GST may provoke considerable thought for the student of organization theory if he will conceive of examples, concrete and abstract, to test these characteristics. It is within this framework, then, that more and more authors are perceiving their work relating to contemporary organization theory and management.

A BRIEF ORIENTATION TO GST

Bertalanffy, author of the GST and a biologist by background, felt it necessary to expand his thinking into other areas of science in order to understand the complexities of his own field.[7] GST represents a vastly expanded concept of his earlier efforts. It has been described as being a "name which has come into use to describe a level of theoretical model-building which lies somewhere between the highly generalized constructions of pure mathematics and the specific theories of the specialized disciplines."[8]

The major objectives of GST, according to Kenneth Boulding, can be set out as:

1. To point out similarities in the theoretical constructs of different disciplines and to develop theoretical models applicable to at least two distinct disciplines.
2. To assist in developing something resembling a "Spectrum" of theories. Such an accomplishment, it is felt, may point out gaps in the theory that may be further explored by scientists.

3. To develop "generalized ears," i.e., to develop a framework of general theory to enable one specialist to understand relevant communications from others. Boulding points out that a crisis in science arose because of the increasing difficulty of communications among scientists as a whole, in view of their high order of specialization.[9]

Having a single frame of reference in which to explore knowledge should greatly enhance the possibilities that interdisciplinary endeavors, such as in organization theory, will grow in a rather rapid and coordinated fashion. GST purports to provide such a frame of reference. But before we discuss the application of GST to organization theory and management, we should remember Alfred North Whitehead's warning that "A science which hesitates to forget its founders is lost. . . . Everything of importance has been said before by somebody who did not discover it."[10] However, when major changes in all fields of science develop through the discovery of a new paradigm, for better understanding, we should take inventory of the early thinkers who precipitated this revolution in scientific theory.

EARLY CONTRIBUTORS TO THE SYSTEMS CONCEPT

Bertalanffy sired General Systems Theory, but he did not find the concept by serendipity nor by alone burning the midnight candle. The systems concept has a long history, notwithstanding the term "systems" itself as such was not stressed. Bertalanffy has indicated in one of his books his indebtedness to some famous figures in the field of science. The most important progenitors of the systems concept are Aristotle, Leibniz, Nicholas of Cusa, Paracelsus, Vico, Kohler and Lotka.[11] A sketchy

presentation of each one's contributions to the subject under consideration ensues:

ARISTOTLE (384-322 B.C.)

Aristotle was a Greek philosopher, educator and scientist. Before and during his time, the early Greeks raised the vital question: "Is the world really a cosmos? Or, is it only a chaos? Is it really an ordered whole? Or, is it merely a jumbled aggregate?"

The most comprehensive answer came from Aristotle when he considered our experienced world an orderly system controllable by thought and rational action.[12] He amplified further by saying that the world is a cosmos (an orderly system) of

> ". . . an assemblage of diverse units so combined as to constitute an integral whole and to function in unison in obedience to some form of control. It is essential to the concept of a cosmos that its parts be interrelated, interdependent, and interacting in such a manner that, notwithstanding the diversity of the single objects as units in themselves, they conspire toward an assemblage of all together as a unit or totality of a higher order."[13]

Aristotle's concepts of interrelatedness, interdependence, and interaction within a system have provided food for thought for centuries after his death. Scholars in search of order have avidly availed themselves of Aristotle's ideas.

Moreover, his holistic and teleological approach to the world is made apparent in his famous statement which speaks volumes about his notion of system: "The whole is more than the sum of its parts' is a definition of the basic system problem which is still valid."[14] Holism is one of the basic tenets of systems theory today, and fundamentally, Gestaltism emerged from it.

GOTTFRIED WILHELM LEIBNIZ (1646-1716)

Baron von Leibniz was a German scholar, mathematician, and philosopher. In a brief philosophical essay entitled The Mondology, he expressed his view of the world as a system.[15] According to this essay, the universe consists of an infinite series of monads, ranging from the qualitatively lowest to the qualitatively highest, or God. Each monad is "windowless" [transparencies], a self-contained miniature universe of its own.[16] God by pre-established harmony so created the world that there always has been and always will be perfect synchronization among the infinite monads. So the view of the world is constructed on the basis of his monads; each person and thing is a monad, a completely separate being whose existence is in harmony with God and is separate from outer experience.

In recognition of Leibniz's contribution to systems thinking, Bertalanffy had to say the follwoing:

> "As a 'natural philosophy', Leibniz's hierarchy of monads looks quite like that of modern systems; his mathesis universalis presages an expanded mathematics which is not limited to quantitative or numerical expressions and is able to formalize all conceptual thinking."[17]

Similar to Aristotle, Leibniz spoke of the unity of elements in the universe. Each monad represented a subsystem in the hierarchical, overall system, at whose apex sits God. By reading his aforementioned classical essay, one would come across his notions of the system as a means for order from a complex, chaotic world.

NICHOLAS OF CUSA (1401-1464)

Nicholas was a German Renaissance churchman and philosopher who was appointed cardinal in 1448. His greatest contribution to systems notions comes from his ontology. He attempted to express the ultimate identification of God and the world in geometrical and mathematical terms. He

used terms such as maximum and minimum corresponding to system and subsystem. Fundamentally, Nicholas's system depends upon his adoption of the doctrine which maintains that ". . . God is the absolute maximum and also the absolute minimum, which coincide. . . . The absolute maximum is therefore a unity that is all and in all, since it is the minimum."[18]

He is remembered by systems scholars for his concept of Coincidentia Oppositorium which is admired by Bertalanffy himself as reflected in his own words:

> "Nicholas of Cusa, that profound thinker of the fifteenth century, linking Medieval mysticism with the first beginnings of modern science, introduced the notion of the coincidentia oppositorum, the opposition, or, indeed, fight among the parts within a whole which, nevertheless, forms a unity of higher order."[19]

The philosophy of Nicholas has the concept of holism, and equilibrium, which are opposing forces merging into a higher order of unity. His philosophy contains also the Aristotelian concept that "the whole is greater than the sum of its parts." The foregoing concepts are important in systems theory of the present time.

PARACELSUS (1493?-1541)

Paracelsus, a Swiss physician, pioneered in the application of chemistry to medicine and introduced the use of many drugs. Essentially, his system is based on a visionary Neoplatonic philosophy in which the life of man is regarded as inseparable from that of the universe.

He is one of the early thinkers who applied the systems approach, or the "whole man approach", in curing his patients. He believed that since man contains all elements and requires them for the curing of his diseases, the physician must know three important sciences, namely the physical sciences,

astronomy, and theology in order to cure the whole man's body, spirit, and soul.[20] Thus, he considered man to be a subsystem of various interrelated elements interacting in an orderly universe made up of the same interrelated elements.

Furthermore, Paracelsus viewed man as an open system. He did not, however, use the term as such, but he considered man and the universe as systems sharing the same characteristics, and using the same inputs to produce similar outputs as is reflected in the following translation of his work:

> "The great world . . . has all the human properties, parts, and members a man has . . . Man derives from matter, and matter is the whole Universe. Each thing in one man is like each thing in another. Man is made out of the whole. All he eats out of the great world becomes part of him, and he maintains himself by that which he is made of. The healing substances in the outer world help the members in the inner world.[21]

GIAMBATTISTA VICO (1668-1744)

Vico was an Italian philosopher, legal theorist, and historical scholar. His famous last book Scienza Nuova (The New Science) comprises five volumes.[22] Volume No. 5, The Recurrence (Ricorso) of Things in the Resurgence of the Nation, contains the seeds of the notion of "system." In this volume he lays bare his ". . . vision of history as a sequence of cultural entities or 'systems'."[23]

Vico tried to discover an ideal pattern of "universal history."[24] His doctrine may be summed up as presenting a theory of a cycle in human affairs by which mankind is led step by step from barbarism to civilization through the guidance of a benevolent Providence. This cycle, according to Vico, had run its course from primitive times to the fall of Rome, and again from the "new barbarism" of the Dark Ages to the enlightenment of his own day.[25]

This philosopher's search for order led him to view history as a biological organism which is subject to life-cycle patterns of birth, growth, maturity, and death. Today, the life-cycle pattern of an organism is an important concept of an open system of GST.

WOLFGANG KOHLER (1887-1967)

Kohler is an Estonian-American psychologist. With Kurt Koffka and Max Wertheimer, he was a founder of the school of Gestalt psychology which considers the whole pattern of behavior of greatest significance and of a different quality from the individual elements making up this totality.

Bertalanffy in speaking of Kohler's contributions to GST, wrote:

> "There had been a few preliminary works in the field of general system theory. Kohler's 'physical gestalten' (1924) pointed in this direction but did not deal with the problem in full generality, restricting its treatment to gestalten in physics (and biological and psychological phenomena presumably interpretable on this basis). In a later publication (1927), Kohler raised the postulate of a system theory, intended to elaborate the most general properties of inorganix compared to organic systems; to a degree, this demand was met by a theory of open systems."[26]

Kohler's major contribution to GST first came from his gestaltist argument put forth in his book Gestalt Psychology (1929) where he also elaborated on the characteristics of organized entities. [27]

His thesis was that the principal tasks of Gestalt psychology was that of exposing the genuine parts rather than any fictitious parts of wholes. He also reasoned that all visual things are such genuine parts of the environments ("fields") in which they occur and most systems have subordinate parts. Furthermore, he argued that behavior is best understood when studied as an organized pattern rather than as separate parts. "The very principles of organization refer to segregation of such parts as much as to their unitary character."[28]

In sum, Kohler's major contributions to GST came from his gestaltist argument, from his theory of open systems, and finally, from his discussion of the characteristics of organized entities.

ALFRED J. LOTKA (1880-1949)

Lotka was an Austrian-American mathematician. His classic book Elements of Physical Biology (1925) came closest to the objective of GST, and systems theorists are indebted to him for his basic formulations. Whereas Kohler restricted his theory to systems of physics, Lotka dealt with a general concept of systems. Because he was a statistician by profession, his interest dwelt on population problems rather than in biological problems of the individual organism. "Lotka, somewhat strangely, conceived communities as systems, while regarding the individual organism as a sum of cells."[29]

His book was a classic work on the application of mathematics to aspects of the biological and social sciences. Lotka discussed principles of equilibrium in terms of steady states, moving equilibria, displacement of equilibrium, dynamic and energetic, all of which correspond to ideas contained in GST.[30]

Although Aristotle, Leibniz, Nicholas of Cusa, Paracelsus, Vico, Kohler, and Lotka have introduced and developed notions of systems, no one pursued the subject to a high degree of sophistication except for one scholar.

LUDWIG VON BERTALANFFY*: GENERAL SYSTEMS THEORY

If we were to name one scholar who made outstanding contributions to GST, it would undoubtedly be Ludwig Von Bertalanffy. Some even call him "the father of General Systems Theory."[31]

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*(1901-1972)

His most important contributions could be classified into three broad areas: methodology, a universal framework, and the distinction between open and closed systems.

METHODOLOGY

GST was not elaborated by Bertalanffy all at once. A long evolution of views, especially on scientific methodology, was the precursor of GST. When Bertalanffy began his formulation of some systems notions, the theory of mechanism was regarded as the only scientific approach. The prevailing methodology was nothing but the Laplancian ideal which resolved the world into an aimless play of atoms controlled by the laws of chance, with the future entirely determined by initial conditions.[32]

Bertalanffy soon became disenchanted with the mechanistic approach for the reason that it was not appropriate to study systems of greater complexity, like the systems of biology and the behavioral sciences. Such systems were not additive in the sense that understanding the whole could not be accomplished simply by understanding the various parts and then adding them together.

The search for a better methodology to deal with complex entities led Bertalanffy to adopt and expand on the organismic view of scientific approach, for, as Gray states:

> ". . . the organismic view insists on studying not isolated parts of processes, but the organizing relationships themselves that result from dynamic interaction and make the behavior of parts different, when studied in isolation, than when studied within the whole." [33]

The mechanistic view led to the microanalytic approach to study a phenomenon, while the organismic view provided a macroanalytic approach

to the study of systems made up of subsystems, and thus made the search for order easier.

A UNIVERSAL FRAMEWORK

Perhaps Bertalanffy's most important legacy to science is his call and approach to the unification of science. Due to his elaboration of concepts such as wholeness, interdependence, open system, order, and steady state, he called for a General System Theory as a discipline which would facilitate unification among fields of science. His plea was:

> "There exist models, principles, and laws that apply to generalized systems or their subclasses, irrespective of their particular kind, the nature of their component elements, and the relations of "forces" between them. It seems legitimate to ask for a theory, not of systems of a more or less special kind, but of universal principles applying to systems in general.
>
> In this way we come to postulate a new discipline, called General System Theory. Its subject matter is the formulation and derivation of those principles which are valid for "systems" in general."[34]

Since the elements of wholeness, interdependence, open system, etc. are applicable to organizations, GST has been adopted as a framework for the synthesis and integration of classical, neoclassical, and modern theories of organization and management.

One essential aim of GST is, therefore, the creation of a universal science. To arrive at such an inclusive theory, there are a number of levels of system which should be first integrated.[35] Kenneth Boulding provides a useful classification of these levels:

1. The Static Structure - the level of frameworks, e.g., the anatomy of the universe.

2. The Simple Dynamic System - the level with predetermined, necessary motions, e.g., level of clockworks.

3. The Cybernetic System - level of the thermostat, the system with self-regulating capability to maintain a given equilibrium.

4. The Open System - (or the level of the cell) level of self-maintaining system with the ability of rejuvenation, growth, and reproduction.

5. The Genetic-Societal Level - level of cell society with division of labor among cells, e.g., the plant.

6. The Animal System - level of increased mobility, goal-directed behavior, and self-awareness.

7. The Human System - the level which can utilize language and symbolism.

8. The Social System - the level of human organization.

9. The Transcendental Systems - level of "ultimates and absolutes" that exhibit systematic structure and relationship but are unknowable in essence.[36]

Adequate models exist to explain the above systems up to the fourth level. Beyond that, they are not well understood.[37]

DISTINCTION BETWEEN OPEN AND CLOSED SYSTEMS

Bertalanffy's third major contribution was to establish an advanced distinciton between open and closed systems.[38] Physical and mechanical systems can be characterized as closed in terms of relationship to their environment. In Boulding's hierarchy of levels of systems, the first three levels are considered as closed systems, while the biological and social systems are open in the sense that they are in continuous interaction with their environment.

The concept of open systems in biological and social entities has had a great impact on social sciences and organization theory. For example,

the classical theorists considered the organization to be a closed system, while the modern theorists look upon it as an open system in constant interaction with its environment.

By virtue of their characteristic of being open systems, the social sciences such as anthropology, sociology, psychology, organization theory and management, and many other disciplines have readily adopted the application of GST in their search for order.

THE SCOPE OF APPLICATIONS OF SYSTEMS THEORY

Since early 1900's scholars in many scientific fields have concentrated on analytical, fact-finding, and experiential approaches. Through such rigorous methods, as contrasted to arm-chair speculation or introspection, the aim was to develop knowledge and to understand the different details of certain subjects.

After the accumulation of different bits of knowledge in a field, the next stage presents a period of synthesis and integration of the isolated facts. Men of science now turn their efforts to unify the isolated facts into a broader theoretical framework.[39] Eddington said to this effect that " . . . when we have completed our study of one . . . [we assume that] . . . we know all about two, because 'two' is 'one and one'. We forget that we have still to make a study of 'and'."[40]

Several decades ago, systems theory provided scientists in such fields as physical, biological, and social with a framework to synthesize and integrate their harvested crops of knowledge.

The application of systems approach has been extensively adopted in the social sciences. Since there is a close relationship between GST and the concept of functionalism, the social science fields like anthropology, sociology, psychology, economics, and organization theory and management have increasingly applied systems approach.

The word functionalism used here is to connote the concept popularized by Robert K. Merton. The heart of functionalism is its emphasis upon systems of relationships and its interaction of the parts of a subsystem into a "functional whole."[41]

The quest for order through systems theory was pursued in social sciences as Robert Chin indicates:

> "Psychologists, sociologists, anthropologists, economists, and political scientists have been 'discovering' and using the system model. In so doing, they find intimations of an exhilerating 'unity' of science, because the system models used by biological and physical scientists seem to be exactly similar. Thus, the system model is regarded by some system theorists as universally applicable to physical and social events, and to human relationships in small or large units."[42]

Modern anthropology received its framework from the concept of functionalism which is akin to systems approach. Through functionalism, social systems were viewed in terms of structures, processes, and functions, and the understanding of the relationships of these elements. Functionalism stressed the idea that each element of social institution has a distinct function in the broader system.

A. R. Radcliff-Brown and Bronislaw Malinowski advanced the proposition that social customs, patterns of behavior, and institutions do not exist independently, but that these elements should be studied in relationship to the total culture.[43] Like GST, the underlying assumption here was that

social life formed a related whole, and was to be understood as an interconnected system.

Talcott Parsons espoused the concept of functionalism and general systems theory and helped sire modern sociology.[44] Parsons drew heavily upon Pareto for the concept of systems in scientific theory and adopted the open-systems approach for the study of social structures.[45] He developed a broad social system framework (and related his ideas to the organization) and explored structure and social processes of social systems within the content of the organization. Systems constructs suggest a way to extend our knowledge about the variability of human behavior, the nature and extent of social experience, and the impact of interaction between individuals and groups.[46]

The systems approach has found a great acceptance in the field of psychology. A perusal of the anthological book General Systems Theory and Psychiatry would show how behaviorism in psychological theory has been replaced by the holism of gestalt psychology.[47] The gestalt psychologists have accepted the concept of system (which is more than the sum of its individual components and which controls the activity of these components).

Kurt Lewin, for example, proposed that purely psychological explanations of personality did not afford the total picture; the individual's socio-cultural forces had to be also considered. The individual and his environment should be studied as a system.[48] Psychology was extended to embrace interpersonal and social systems in a new field called social-psychology which uses the systems approach in study of human interactions.

In modern economics, static equilibrium models of closed systems are being replaced by dynamic equilibrium which is a characteristic of open systems. Wassily Leontief and others utilized systems approach for their industrial input-output scheme in which the national economy can be regarded as a system of mutually interrelated industries.[49] All the sectors that contribute to the GNP are interrelated, interdependent, and therefore function like a dynamic, open system.

A number of other modern schools of thought that apply general systems theory are cybernetics, operations research, and mathematical general systems theory.[50] The foregoing disciplines have made extensive use of systems approach in their quest for order, and a parallel adoptation developed in organization theory and management.

APPLICATION OF GST TO ORGANIZATION THEORY AND MANAGEMENT

"All living systems, from the simple cell to complex formal organizations, nations, and societies, are open systems."[51] Since the social organization is an open system continuously exchanging materials, energy, and information with its environment, GST was readily accepted as a new paradigm for the search of order in the fields of organization theory and management.

APPLICATION OF GST TO ORGANIZATION THEORY

William Scott maintains that "modern organization theory and GST are similar in that they look at organization as an integrated whole. They

differ, however, in terms of their generality.[52] Whereas GST concerns itself with every level of a system, contemporary organization theory limits itself to studying primarily human organizations. Both GST and organization theory are concerned with:

1. The parts (individuals in aggregates), and the movement of the individuals into and out of the system.

2. The interaction of individuals with the environment found in the system.

3. The interactions among individuals in the system.

4. General growth and stability problems of systems.[53]

Boulding expresses concern that this interdisciplinary endeavor may be threatened by a loss of coherence unless some coordinated pattern of studying general systems is utilized by scientists. He suggests, therefore, that two possible paths are worth exploring:

1. Identify general phenomena found in many different disciplines and build general theoretical models to explain the phenomena.

2. Arrange our empiricisms in an "hierarchy of complexity of their basic individual or unit of behavior, and try to develop levels of abstraction appropriate to each."[54]

He suggests nine levels of abstraction relating to the hierarchy of complexity for those who would choose the second path for studying systems. These abstractions range from static structures to transcendental systems and, of course, are inclusive of the systems most directly related to a study of organization theory. Boulding's classification of systems appears on page 14-15.

This approach to studying systems - finding common threads that weave throughout the various levels - offers some exciting possibilities for further exploration. Capitalizing on Boulding's format, Joseph Letterer, for example, has structured the writings in his anthology to just such a pattern.[55]

In addition to placing the organization into the framework of GST as an open social system and studying it as such, the organization is also analyzed as a structured sociotechnical system. Trist developed his concept of sociotechnical system from studies at Tavistock Institute of Human Relations in London. His system consists of a technical organization (equipment and production layout) and another work organization - relating those who do the necessary tasks to each other.[56]

Although technological organization determines the type of work organization, the latter has social and psychological characteristics which are independent of technology. Kast and Rosenzweig present the social-technical system as composed of five sub-systems:

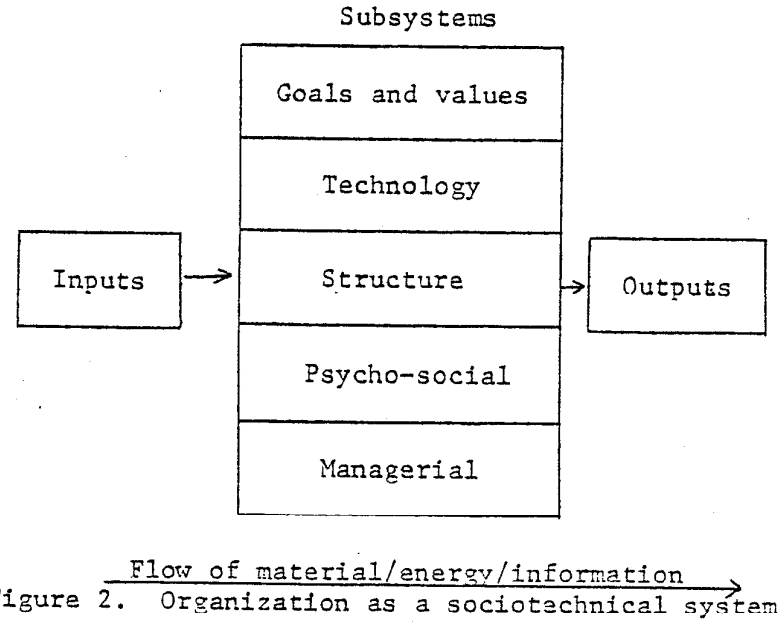

Figure 2. Organization as a sociotechnical system.[57]

The different subsystems make up the overall organization. Seiler verbalizes the creation of a socio-technical system rather vividly by stating:

> "People come into the organization with their unique backgrounds, technologies are chosen and put to work, organizational decisions are made and implemented, and a social system springs up. Out of all this come people acting, interacting, and feeling."[58]

Many properties of the organization have been researched in the image of the characteristics of GST. Greater emphasis, however, was placed on its being an open system, and as such, having a socio-technical structure.

APPLICATION OF GST TO MANAGEMENT

GST is also applied to management. Koontz & O'Donnell state that "it's sometimes forgotten that management . . . is a system just as a space satellite is a system, or an automobile, a thermostat, an assembly line, or a company."[59] The student of management, by applying the fundamental concepts of systems theory, so profitably used in engineering, can analyze management and its parts as a system and add to its practice.

Parsons proposes a framework to view management as a system. He states that complex organizations contain three managerial levels in their hierarchical structures:

1. The technical or production level.
2. The organization/managerial level.
3. The institutional or community level.[60]

The technical level comprises that subsystem (of overall managerial system) which deals with the actual task performance, namely production and distribution of products and services. The organizational level is that subsystem which has the functions to coordinate and integrate the

task performance of the technical system. "A primary function of management at this level is to integrate the input of material, energy, and information to the technical level."[61]

The institutional level is that managerial subsystem which is involved in relating the activities of the organization to its environment. To carry on its transformation activities, the organization should continuously get supporting inputs from the society.

The managerial system monitors the entire organization through the functions of directing the technology, organizing people and other resources, and relating the organization to the environment in which it operates.

Petit puts the three managerial levels into a systems model: technical, organizational, and institutional levels. The technical level has a weak boundary which does not firmly shut itself off from the firm's environment; the organizational level has a comparatively more fluid boundary and thus it is more susceptible to the impact of external elements, and finally the institutional level has a relatively greater permeable boundary and so it is immensely affected by uncontrollable and unpredictable elements in the environment. These three managerial levels are combined into a system as is shown below in Petit's model:

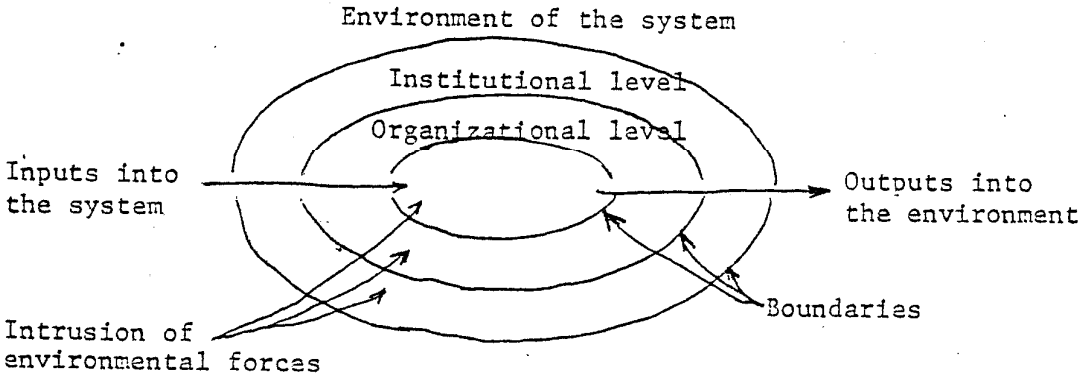

Figure 3. The firm as a composite system.[62]

Although GST is used as a frame of reference, and many of the key concepts of GST have been applied to organization theory and management, one is lead to believe that GST is perfectly compatable with and conducive to the study of organizations. Many scholars have pointed out certain areas in which important distinctions should be drawn between what GST (based on the properties of organism) holds to be true and the characteristics or idiosyncrasies of social organizations, which are contrived entities.

PROBLEMS IN APPLYING GST TO ORGANIZATION THEORY AND MANAGEMENT

There are a number of problems involved in applying GST to organization theory and management. These problems are discussed under the follwoing topics: parts of organism vs. parts of organization, organism vs. social organization, open vs. closed system, natural vs. contrived systems, criterion for system effectiveness, and methodological problem.

PARTS OF ORGANISM VS. PARTS OF ORGANIZATION

One of the most important applications of GST to the study of organization theory and management is in the adoption of an open system approach. Classical organization theory looked upon the social organization as a highly structured, closed system. Modern organization theory divorced itself from this mechanistic view, and espoused the concept that an organization is an open system consisting of five basic parts: input, transformation, output, feedback, and environment.

This revolutionary departure from a closed to an open systems approach of the GST implied a panacea to many theorists and researchers in organization

theory and management. This optimistic attitude has been questioned by asking ". . . did general systems theory free us from this constraint [imposed by closed system view] only to impose another less obvious one?"[63]

Since it is conceptually easy to draw the analogy between a living organism (on which GST was founded) and social organizations, our tendency is to accept them as similar. Though intuitively the two entities are analogous, there is an essential difference between physical parts of the organism and the parts of the social system. The socially contrived system (e.g., human organization) has one added dimension not found in the other, and that is ". . . the essential social-psychological facts of the highly variable, loosely articulated character of social system.[64] The caution here is that we should not take this analogy too literally, for organizations can be regarded as systems, but not as natural systems.

ORGANISM VS. SOCIAL ORGANIZATION

Another problem coming from GST is the further distinction between organism and organization. GST maintains that systems are organized, (that they are made up of interdependent components related to one another in some way). Therefore, one could conclude that social organization is just another system. Physical, biological, and social systems are organized, but the question is, are all systems organizations? Here is one clue:

> "All systems may be considered to be organized, and more advanced systems may display differentiation in the activities of component parts - such as the specialization of human organs. However, all systems do not have purposeful entities. Can the heart or lungs be considered as purposeful entities in themselves or are they only components of the larger purposeful system, the human body? By contrast, the social organization is composed of two or more purposeful elements."[65]

The organization consists of elements that possess and can exercise their own wills, whereas an organism does not have purposeful elements that can act at their own will.[66] This distinction is important for the very reason that an organism responds (internally adapts to environmental forces) to externally generated input stimuli, while a social organization can change and adapt within its boundaries without receiving an external stimuli for its, say, adaptation.

OPEN VS. CLOSED SYSTEMS

Still another problem is coming from GST: the dichotomy of open and closed systems. The issue here is that GST has the tendency to classify systems as either open or closed. "We have been led to think of physical systems as closed, subject to the laws of entropy, and to think of biological systems as open to their environment and possibly, becoming negentropic."[67]

Strict adherence to such a dichotomy creates difficulties when such polarization is applied to social organization. Actually, social organization (and its subsystems) may be either partially open or partially closed.

There is another tendency to regard an open-system approach as good and a closed-system approach as bad. From the technical side of enterprise, we try to use closed-system concepts to reduce or eliminate uncertainty and increase predictability for better control and performance.

NATURAL VS. CONTRIVED SYSTEM

GST is based on the living organism and overlooks the contrived nature of social organizations. The student of organization theory and management is led to underestimate the special characteristics of social organizations.

Compared to organisms which occur naturally in the environment, social organizations are contrived by man and they have structure. However, theirs is a structure of events rather than physical components. This structure of events cannot be separated from the process of the system.

Two distinguishing characteristics of socially contrived organizations are that they can be established for a myriad of purposes and that they do not follow a life-cycle pattern of biological systems, such as going through birth, growth, maturity, and death.

This distinction between the natural organism and the social (contrived) organization cautions the student of organization theory and management against making an exact analogy between the two aforementioned systems.

CRITERION FOR SYSTEMS EFFECTIVENESS

An additional problem that GST presents to students of organization theory and management is the question of systems effectiveness. The biological system's criterion of effectiveness is perpetuation of its species. The goal of the organism is directed toward survival. But survival is only one measure of effectiveness for social organizations. Next to survival, social organizations may exist to be of benefit to society, maximize profits, etc. Therefore, it is quite a complex problem when we deal with the question of systems effectiveness of social organizations contrary to what GST leads us to assume.

METHODOLOGICAL PROBLEM

Due to limitations of behavioral tools of analysis, many important variables are not included in the research studies. The general system approach handles many variables; however, "modern organization theory

needs tools of analysis and a conceptual framework uniquely its own, but it must also allow for the incorporation of relevant contributions of many fields."[68]

Modern organization theory has taken a partial systems view and thus is unable to understand all the interrelationships among the parts of a system. "Under the more traditional process approach to the study of management, we were able to do an admirable job of delineating and discussing planning, organizing, and controlling as separate activities."[69] However, the management scholars were much less successful in discussing their important activities as integrated and interrelated in a single system.

CONCLUSION

Without gainsaying the problems involved in applying GST to the study of organization theory and management, we should not shy off from such a valuable tool for its advantages outweigh its few drawbacks.

Since everything in a system is interacting and interrelated, GST gives us the framework for the study of complex social organizations. Scott has indicated that most sciences go through a macro-micro-macro cycle of emphasis.[70] For example, traditional bureaucratic theory focused on the macro level and administrative management developed macro principles of management to be applied to all types of organizaitons; human relations movement shifted the attention to micro; and now modern organization theory and management have reached the macro level for understanding the individual, the group, and the organizaiton as a whole.

Therefore the systems approach enables us to cope with the macro level of analysis. Until we invent a better paradigm to study social organizations as whole entities in order to design more effective organizations and to improve the practice of management in the GST framework, some ideas are suggested to alleviate the shortcomings of using GST to organization theory and management.

In certain situations when we are unable to apply general systems approach to a particular study of organization, we could return to the mechanistic view. In this case general systems approach should be used as an extension rather than a replacement of the mechanistic view. Phillips contends that "there is a case for claiming that every method used by adherents of systems theory must be an extension rather than a replacement of the mechanistic view."[71]

A plumber, for example, cannot effectively work with the same tool in every repair situation. He had better take his tool box with him to a house call. By the same token, whenever GST does not lend itself to be properly utilized in fact-finding, the mechanistic view (tool) can be used either in conjunc on with GST or by itself.

An alternative approach to alleviate the problems involved in applying GST is to shift down a level of abstraction. GST emphasizes an extremely high level of abstraction which is classified by Phillips as a third-order study that tries to formulate macro concepts germane to all organizations - biological, physical, and social.[72]

The second level of abstraction will be based on GST but will deal with more specific characteristics and relationships in human organizations.

The emphasis will be more on the relationships among the subparts of a system. This approach is called by some scholars the "contingency view," or a search for "configurations among subsystems," popularized by two Harvard professors, namely Lawrence and Lorsch. Their basic approach to the study of patterns of relationships is made clear in the ensuing excerpt:

> "During the past few years there has been evident a new trend in the study of organizational phenomena. Underlying this new approach is the idea that the internal functioning of organizations must be consistent with the demands of the organization task, technology, or external environment, and the needs of its members if the organization is to be effective. Rather than searching for the panacea of the one best way to organize under all conditions, investigators have more and more tended to examine the funcitoning of organizations in relation to the needs of their particular members and the external pressures facing them. Basically, this approach seems to be leading to the development of a 'contingency' theory of organization with the appropriate internal states and processes of the organization contingent upon external requirements and member needs."[73]

In other words, the degree of effectiveness of an organization design is contingent upon the demands of the environment (technology and market forces) in which it operates. A proper organization design would yield an effective managerial practice. The contingency view is then defined as:

> "The contingency view of organizations and their management suggests that an organization is a system composed of subsystems and delineated by identifiable boundaries from its environmental suprasystem. The contingency view seeks to understand the interrelationships within and among subsystems as well as between the organization and its environment and to define patterns of relationships or configurations of variables. It emphasizes the multivariate nature of organizations and attempts to understand how organizations operate under varying conditions and in specific circumstances. Contingency views are ultimately directed toward suggesting organizational and mangerial designs and managerial systems most appropriate for specific situations."[74]

On a continuum of paradigms ranging from the GST to mechanistic approach, the contingency view provides a halfway approach, neither has the rigors of GST nor does it have the elementarism of the mechanistic approach.

A FINAL NOTE

Despite the problems presented by GST, the drive to expand the frontiers of knowledge and understanding of our intricate organizational and managerial systems depends heavily one systems approach. The methodology of GST appears to be well entrenched in most social science disciplines, and it will continue to be so until a new paradigm is found for man's search for order, because we are heading toward an age of "metabureautechnocracy," the advanced stage of the organizational tendency to 'band together' into organizations.[75]

Therefore we will need GST to deal with a world which is going from a complex to a supracomplex organizations. However, the search for order for the time being has diverged from the path of "one best way" to "it all depends."

FOOTNOTES

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