GST: A SIMPLIFIED PARADIGM FOR BUSINESS

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ABSTRACT

Business is defined using General Systems Theory (GST) as a paradigm. As GST theory has been used and abused for over sixty years, the article first reviews GST to establish a basic substrate upon which the author's views are based. Much of the literature in the field, in an attempt to develop GST into a polished, all-encompassing theory, includes every aspect and nuance that could be encountered. While the quest for this goal sheds new light on the theoretical side of GST, to the average business practitioner, or especially to the average student, applying GST to the study or evaluation of a business as a practical matter becomes more of a daunting challenge as the theory becomes more complicated. This article presents the business paradigm in the simplicity of the original concept of general systems theory, as offered by Ludwig von Bertalanffy, using the trusted, established concepts of business organization and management that have been studied, researched, applied, and taught for many years. The marriage of these business concepts to the explanatory power of general systems theory provides a model that is easy to understand, teach, and apply. The resulting business definition reflects von Bertalanffy's concept of the applicability of GST to organizations.

Keywords: GST, business, paradigm, Systems Theory, business systems

INTRODUCTION

In most business schools, students learn the many, but important, concepts from several disciplines, in classes that are independently taught without relating the various concepts into a single, interdependent entity. Generally, an Introduction to Business course will show students that a business is part of a superordinate economy and that management must use concepts of accounting, marketing, finance, human resource management, production and operations, and legal requirements; however this course only demonstrates a superficial integration of those concepts. The real integration is usually left until the final, 'capstone' course, when students are left to determine the integration through case analysis, using critical thinking and logic. The reason given for this is that students must learn the concepts before they can learn how to integrate them.

This author believes that the method of learning the various concepts of several disciplines in detail before learning how to best integrate them is extremely inefficient. This paradigm is reflective of the Scientific Revolution of the sixteenth-seventeenth centuries, reflecting Descartes' reductionistic concept of breaking down every problem into as many single separate elements as possible. It was this concept of reductionism, which left unanswered the questions of Aristotelian notions of holism and teleology, which led von Bertalanffy to develop a more inclusive concept: Systems Theory. The

author's view of methodological inefficiency was recognized by seeing the difficulty many students had in applying the disciplinary concepts in case analysis, due to an inability to understand the interrelationships and interdependency of business elements.

The paradigm outlined in this paper is intended to reflect a simplified version of the General Systems Theory, actually returning to the basic concept promulgated by von Bertalanffy of a simple model applicable to all fields of scientific endeavour. If students can superimpose business concepts onto a very simple model that is easily learned and understood, and can apply to all elements of a business, they can understand the interrelatedness and interdependency of the elements through the generalized model. The origins of systems theory will be examined to establish the substrate for the paradigm, demonstrating the intent of the concept.

SYSTEMS THEORY HISTORY

Although evidence of the early beginnings of the notion of system can be recognized as early as the sixth century BC, the concept of system dates from Aristotle's writings in which he expresses his notions of holism and teleology. Many had investigated the causes of objects, but no one had consolidated them into a single explanatory concept until Aristotle related the four causes (material cause – the raw material from which the object is made; formal cause – the shape or form of an object; the efficient cause – the primary source or process of change; and final cause – the reason for the object) as an inseparable combination. (Aristotle, n.d.) In fact, his four causes roughly approximate the basic elements of a system: material cause – *components*, formal clause – *structure*, efficient clause – *process*, and final clause – *purpose.*

Of course, this beginning was far from the complete theory of systems as we know it today, but it established the notion that the elements have a definite relationship among them in order to produce a result that satisfies a predetermined purpose. Aristotle is considered to be the inventor of teleology; from his interest in ends (final clause) and process (efficient clause), or the end and the means to get to the end. (Johnson, 2010) Aristotle's interest in teleology and his holistic concept that the whole is more than the sum of its parts led to his treatises on the causes.

From approximately 350 BCE until the 18th century, no significant contributions to systems theory were made. Smith (2004) cites research that attributes the concepts of feedback and self-regulation to David Hume in 1752, which were reinforced by Thomas Malthus in 1798. His paper credits Lotka, in 1925, Cannon, in 1927, and, finally, von Bertalanffy, in 1932, with developing the earlier work into the basis of systems theory as we know it today. Koehler (1938) introduced the concept of living systems as dynamic, open systems which interact with, change, and are changed by, their environment; as opposed to the static, closed systems having a definable boundary with their environment that are commonly used in the physical sciences.

In his seminal article "The History and Status of General Systems Theory", Ludwig von Bertalanffy (1972; p. 407) recognized that the notion of system is as old as European

philosophy. He quoted: "Aristotle's statement, 'The whole is more than the sum of its parts,' is a definition of the basic system problem which is still valid."

He further quoted from one of his earlier publications: "Since the fundamental character of the living thing is its organization, the customary investigation of the single parts and processes cannot provide a complete explanation of the vital phenomena. This investigation gives us no information about the coordination about the parts and processes. Thus the chief task of biology must be to discover the laws of biological systems (at all levels of organization). We believe that the attempts to find a foundation for theoretical biology point at a fundamental change in the world picture. This view, considered as a method of investigation, we shall call "*onganismic biology*" and, as an attempt at an explanation, "*the system theory of the organism".* (p. 410)

Further in that article, Bertalanffy described the evolution of his "dynamical" system theory, which became his "open system," published earlier by the American Association for the Advancement of Science (Bertalanffy, 1950a). The open system became the general systems model (Bertalanffy, 1950b), which initiated a rapidly spreading interest among researchers and led to the foundation of the Society for the Advancement of General System Theory, which was later renamed to Society for General System Research, and later still, to reflect the broadening scope of inquiry, to International Society for the Systems Sciences.

Bertalanffy, in the paper for the British Society for the Philosophy of Science (1950a), discussed the types of system finality, and stated: "Finally, there is true finality or purposiveness, meaning that the actual behavior is determined by the foresight of the goal. This is the original Aristotelian concept. It presupposes that the future goal is already present in thought, and directs the present action. True purposiveness is characteristic of human behavior, and it is connected with the evolution of the symbolism of language and concepts."

This statement from Bertalanffy leads us into one of basic concepts of open systems: **a system exists to convert inputs into outputs through a transformation process**. The output (the future goal) is already present in thought, and the requirement for the output directs the present action to produce it (obtain the materials necessary to create the output and accomplish the processes needed to transform the materials into the output). Without a conversion process, a system does not exist! Many so-called systems are actually networks that are part of the structure of a system (for example, a highway 'system').

In Bertalanffy's "The History and Status of General Systems Theory" article (1972; p. 416), he explained: "It is generally agreed that "system" is a *model* of general nature, that is, a conceptual analog of certain rather universal traits of observed entities. The use of models or analog constructs is the general procedure of science (or even of everyday cognition), as it is also the principle of analog simulation by computer. The difference from conventional disciplines is not essential but lies rather in the degree of generality (or abstraction): "system" refers to the very general characteristics partaken by a large class of entities conventionally treated in different disciplines. Hence the interdisciplinary nature of general systems theory; at the same time, its statements pertain to formal or

structural commonalities abstracting from the "nature of elements and forces in the system" with which the special sciences (and explanations in these) are concerned. In other words, system-theoretical arguments pertain to, and have predictive value, inasmuch as such general structures are concerned." His caution was to ensure that general systems theory is used as intended, a *model,* rather than a description of the situation, itself, in general nature. The model is to simplify the complex situation in order to analyze the interrelations of the complex situation in order to analyze the interrelations of the set of elements within the superordinate "whole" and its relation with its environment.

The General Systems Theory (GST) concept has been associated with management as a paradigm since 1956, when Boulding (1956) provided a 9-level classification of systems:

1. Frameworks
2. Clockworks
3. Thermostats (this definition could have been "sensor-controlled systems")
4. Cells
5. Plants
6. Animals
7. Human Beings
8. Social Organizations
9. Transcendental Systems

With respect to business, our primary concern is with Social Organizations, which are generally man-made constructs for actual living systems to use, in order to accomplish some desired purpose for which they are not capable by themselves. A secondary concern is Human Beings (usually the creators of the social organizations).

The late 1960's and early 1970's was a period of robust investigation and research of GST and its possible application to business and management, with numerous publications by business and management researchers. The interest in GST seemed to drop off, replaced by an interest in other 'topics of the day', and then enjoyed a resurgence in the 1990's, but it has never caught on as a topic of enduring widespread research interest among business and management researchers. This author's opinion is that the researchers, attempting to out-do all other research with their own, introduced layers of complexity in an attempt to make the theory fit every conceivable situation; primarily aiming at methods of creating knowledge rather than applying the knowledge to actual situations in general nature. This approach rendered application of the theory unwieldy and difficult, causing loss of interest.

Prior Presentation and Application

A extensive review of the literature concerning application of systems theory to business and management will not be accomplished here; however, a sampling of some publications in the field will be presented.

GST Paradigm for Business

Johnson, Kast, and Rosenzweig

In one of the first serious efforts to harness GST to management theory, this paper outlined a systems theory model for business. The authors provided a substrate by first describing the GST rationale; they next explained Boulding's concept of system levels, to establish the place of a human organization within the concept; and finally established a linkage to von Bertalanffy's open systems concept by comparing a business organization with the description of an open system.

After establishing the foundation upon which their view of a business-specific systems theory would be built, they outlined their suggested model:

There are certain key subsystems and/or functions essential in every business organization which make up the total information-decision system and which operate in a dynamic environmental system subject to rapid change. The subsystems include:

1. A *sensor subsystem* designed to measure changes within the system and with the environment.
2. An *information processing subsystem* such as accounting, or data processing system.
3. A *decision-making subsystem* which receives information and outputs planning messages.
4. A *processing subsystem* which utilizes information, energy, and materials to accomplish certain tasks.
5. A control component which ensures that processing is in accordance with planning. Typically, this provides feedback control.
6. A *memory or information storage subsystem* which may take the form of records, manuals, procedures, computer programs, etc.
7. A goal setting unit will establish the long range objectives of the organization, and the performance will be measured in terms of sales, profits, employment, etc. relative to the total environmental system.

This is a general model of the systems concept in a business firm. (Johnson et al., 1964 pp. 272-273)

Although the goal setting unit and the control component were not specifically mentioned as subsystems, their description and placement with the list indicated that they were considered to be subsystems. As this model was developed in 1964, very little research on adapting general systems theory to business applications had been accomplished. Many theoretical writers seized on the model as something on which they could elaborate, perpetuating some of the errors included in this early model. The only subsystem that actually fits as a system is the *processing subsystem.* The *sensor, information processing,* and *memory* subsystems are tools; decision making, controlling, and goal setting are management functions, which could be combined into a single (management) subsystem.

Their well-written article accurately describes Bertalanffy's GST concept and makes an excellent case for application of the systems concept to business management, although

they do misconstrue the use of the term to include non-system arrangements (actually structural networks or components) that do not fit the requirement that systems convert inputs into outputs through processes. Although the beginning (establishing the foundation for the model) was an accurate portrayal of the systems theory concepts, it appeared to stray from the concepts in the model and application portion. It does propose that although systems are complex, they present a great opportunity for large-scale payoffs. This article spurred a vast amount of interest and further research by business and management researchers.

Katz and Kahn

Katz and Kahn (1966) developed an open system model which incorporated four phases: (a) energic input, (b) a process within the system to convert the input into outputs, (c) energic outputs, and (d) an event of recycling in which the outputs are converted into energy as inputs. In their model, inputs include not only tangible items such as capital, employees, and raw materials, but also environmental intangibles, such as community appreciation and industry recognition, among other things. The throughput conversion process converts the inputs into products and services, which become the energic outputs sent into the environment. The environment provides the inputs in the recycling process by payment for the products and services which allows purchasing of new raw materials, payment of employees, and an additional amount of energy (profit) for growth.

Their model includes the open system concepts of: *negative entropy* (an additional amount of energy for growth), *dynamic homeostasis* or balancing of the interrelated components (for example, increasing or decreasing organizational support to match production capability, which, in turn, changes to match expected requirements for outputs), and *equifinality*, which posits that the organization can reach a final state by more than one path or from different initial states. The model defined five subsystems required for a business organization:

1. *Production* – the process within the system to convert the input into outputs
2. *Supportive* – the processes of acquiring inputs, exporting outputs, and accomplishing the administrative tasks related to employees (pay, training, workspace, etc.)
3. *Adaptive* – gather information from the environment about opportunities and threats and develop plans, products, and services to adapt to the environment
4. *Maintenance* – provide the right employees for the various roles and provide for conditions to keep employees satisfied (work conditions, motivation, other needs)
5. *Managerial* – directs, coordinates, and controls the other subsystems and activities, using a feedback mechanism that compares outputs to inputs.

Their book was used as a reference and a basis for many of the writings about application of systems theory to organizational behavior that followed. Given the date of the research, 1966, the model is surprisingly versatile. However, the adaptive subsystem's functional purpose is a normal function of management, the supportive and maintenance subsystems functional roles greatly overlap, and there are still many necessary functions that are not addressed by the model.

Maturana and Varela

During the period of 1964 through 1970, Humberto Maturana developed the concepts of living systems as closed networks of molecular production. Maturana and Varela (one of his students) co-authored many articles explaining the concepts, especially the concepts of *autopoiesis*, structural coupling, and cognition. Maturana and Varela distinguish between organization and structure: the organization is the pattern or set of relations describing the form; the structure is made up of the relations identifying the physical components of the system. The living system exists as a system only in its composite state of its components in their organized structure, as a singular entity, adapting to its environment. (Maturana, n.d.) Varela later explained further that there are two views of the composite entity: one in terms of the participating components, and a second as a simple entity, composed of the components plus their organization. (Whitaker, 2001)

Miller

In 1978, James G. Miller published a book to describe his Living Systems Theory. Elaine Parent, a close associate and assistant to Dr. Miller, described the theory in the ISSS Primer Project. (Parent, 1996) In this treatise, Dr. Parent explained Miller's eight nested levels of living systems (cell, organ, organism, group, organization, community, society, and supranational system) and the twenty required subsystems in each of the living systems, which process matter-energy or information or both. The theory is very comprehensive in its scope, and is extremely complex. While Miller's theory is extremely valuable, its complexity hinders the average student's ability to grasp the concepts in a practical, usable manner in evaluating a business.

Millet

Millet (1998) wrote about the dominance of systems theory in the existing literature and explored viewing the emerging explanations of complexity and chaos theories as evolutionary system theories. The paper began with an assumption that there is a definite black/white dichotomy between viewing an organization as either one that blindly defines an endpoint and is only concerned with arriving there or one that defines and redefines endpoints as conditions change.

He offered: "… The implication of sensitive dependence is that the future is unknowable. Consequently, strategic planning and the creation of visions to take the organization into the future, is questionable and dangerous. It could be more by sheer chance that some companies succeed in fulfilling their long-range plans. A structural adjustment from a functional to a process emphasis moves the stable/unstable borders with consequences for the organization's capability for self-development. Although this switch is not necessarily undesirable, it merely points out that there will be long-term consequences in the trade off between functional and customer boundaries."

It is not necessary to understand the implication of sensitive dependence or even to understand the meaning of sensitive dependence to know that the future is unknowable. We do know that much of the future is predictable, given that we evaluate the

environment and use our knowledge to define probabilities. Taking Millet's reasoning to its ultimate conclusion, we should just allow things to happen. Chaos theory would seem to militate that planning is an exercise in futility; however this negates what we have learned over centuries, nay, millennia, since Aristotle developed the concept of teleology. We have known of many examples of businesses which have grown and prospered through strategic planning and creation of visions.

THE NEW PARADIGM

Simplicity

Much of the literature in the field is concerned with furthering the research, attempting to make models that are all-encompassing and can fit to any situation. This makes the models complicated and actually not fit very well to any situation, especially if the model is to be used in a practical sense, rather than theoretical. Bertalanffy developed the GST as a general model, one which can be adapted to any discipline; however, it was not meant to be a one-size-fits-all model, and must be modified to accommodate the discipline-specific requirements. This author undertook the mission of specifically adapting the GST concepts to the fields of business and management, for the purpose of creating a platform he could use for teaching business concepts in a simple, structured manner.

In an academic setting, the primary goal of the teaching role is to convey new concepts to students in a manner that enables them to not only understand the concepts, but also to understand the relationships between concepts so they can apply them to new situations, synthesize new uses or relationships, and analyze or evaluate the concepts or results of the synthesis. General Systems Theory, which emphasizes holism and the relationships among the various elements comprising the system, is an ideal substrate for such a role. By comprehending the concepts of a simple system, and learning how simple systems can be concatenated with other systems to form such an integrated whole, through interdependent relationships, that is itself still a simple system, the student easily learns business and management concepts.

An Organization as a System

Boulding's classification of systems includes social organizations, created for purposes that generally require more than one entity to accomplish. A business is a type of social organization, and although there are business organizations that are composed of a single person, this paper will leave the distinction alone, in order to maintain the concept of simplicity. The reason for this will become apparent as the paradigm is explained. It must be remembered that a system is an abstract model; the business is a business, and the system is only a model of the business, allowing evaluation of the elements that comprise the business and their relationships among themselves that create the single entity that is the business.

Each organizational system is a subsystem of a larger suprasystem, which may be a parent organization, an industry group, an industry, a government, or a society; and it has

relationships with the other subsystems which comprise the structure for the suprasystem. Each organizational system is also a suprasystem, having subsystems which comprise its structure. Each of these subsystems is also a system, with subsystems which comprise its own structure, with a purpose which is accomplished by its subsystems. The purpose of any system is to support the purpose of its suprasystem. The mission of a business is to produce output, in accordance with its purpose, and dispose of the output in a manner that will allow the business to maintain its existence (and, hopefully, to actually obtain more value in exchange for the output that will provide for growth).

By looking at the definition of a system, it is apparent that as a system exists to accomplish a conversion of inputs into outputs, there must be a subsystem to accomplish the conversion, which, for sake of maintaining the convention of established business and management terminology, we could term 'production' (it produces the output from the input). There must also be a subsystem to plan and control the production operation, which, for sake of the same convention, we could term 'management'. Thus, from the definition of a system, although we cannot infer any other mandatory subsystems, from the exercise of logic we can infer that every system must have, at a minimum, two subsystems, which we can (maintaining the conventional business and management terminology) term production and management. All natural systems, especially natural living systems, have a structure that is inherent, inseparable from the system itself. An organization, which is not natural, must have an artificially contrived structure; it must be created, maintained, and controlled in order that the transformation process for which the system (organization) was designed. The entity that accomplishes the creation, maintaining, and controlling of the system's structure must also be a subsystem of the system; for purposes of simplicity and maintaining the concept of using standard business terminology, this subsystem which administers the structure can be termed 'administration'.

A Business as a System

A mandatory function of any organization is establishing and maintaining the structure, which allows operations to occur. The operations function of a business depends on having the structure to allow the production operations to occur; the structure is defined as the plant, property, equipment, utilities, logistics, personnel, knowledge, training, plans, policies, and anything else required to allow operations to occur. For sake of convention, the subsystem to accomplish this function could be called 'administration'. As a business has other requirements, it must have additional subsystems to accomplish the requirements. It would be illogical for a business to just produce output without a means to convert the output into an exchange value that will allow it to continue its mission; although it is not the only purpose, this is the primary purpose of what is termed 'marketing' in a business. The other marketing purposes will be discussed later. As well as ensuring that output is profitably disposed of, a business cannot operate without having funds to provide the means or the costs of operating; this is what is normally called a finance function in a business. Again for the sake of convention, the subsystems to accomplish these two additional requirements which are mandatory for any business can be termed 'marketing' and 'finance'.

Reviewing the functional requirements of a business system, there are five; each has a subsystem, which are the major business subsystems: the two required for any system, production and management; the one required for any organization, administration; and those required for a business, marketing and finance. The interdependence, relationships, and combinatorial power of these subsystems can generate synergy and provide a holistic ability to accomplish the purpose (mission) of the business suprasystem. Depending on the mission of the business, a specific business model may be defined to fit the way the governance body wants the business to operate; specific subsystems will tailor the organization's major subsystems, so they are able to accomplish their missions as desired by the defined business model. Each one of the major subsystems is vital, and each has input from the environment, as well as energic (information) input from all of the other major subsystems.

Any of these functional requirements could be accomplished by a single person, as well as a large staff, to perform the management and production subsystem requirements of the major business subsystems in its role as a system, depending on the size of the business and its subsystems. Actually, all of them could be accomplished by a single person, but the functions still exist, so the subsystems still exist; the entire staff of each subsystem is just the person performing the functions of that subsystem and its subsystems. The point to be established is that as each subsystem is also a system composed of a structure of subsystems, the requirement remains for the function to perform in support of the suprasystem in which it is a component.

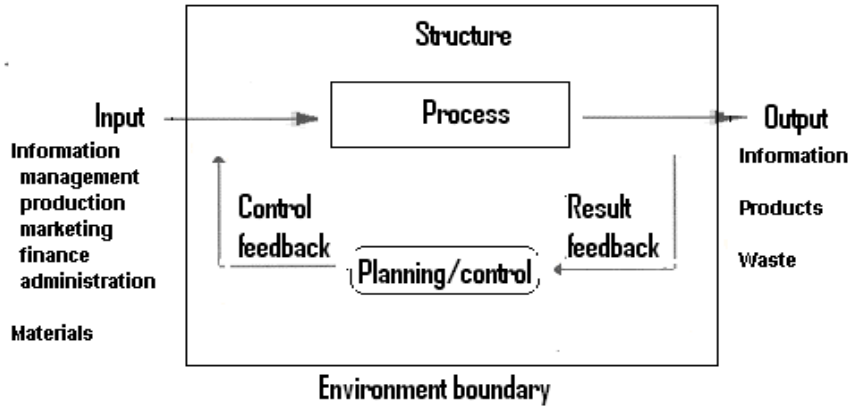

Figure 1. Diagram of a Simple Business System

The Management Subsystem

Management's primary functions are those of ensuring effectiveness of the system; planning and controlling the system's output to accomplish the mission (purpose) of the business suprasystem. In its systems theory role, it is also responsible for communication with: 1) all other major subsystems in the suprasystem structure, and 2) other systems in

the business system's environment. The communication is vital to be able to perform the primary functions. Communication with systems outside the business suprasystem is necessary to perform environmental evaluations and determine if business opportunities or threats exist, which must be dealt with through changing plans and operations, adapting the business to continue to perform in accordance with its purpose. Communications with the other major subsystems is necessary to develop or change plans and provide control over operations in accordance with the plans, also to ensure that the business can continue to perform in accordance with its purpose.

Management receives information from the environment and from all of the other major subsystems; converts the information input into plans, controls, and reports; then outputs these to stakeholders and other subsystems. Included in its output reports are requirements for its own structural growth and maintenance, which go to the administration subsystem; overviews of all operational results (including plans), which go to the governing organization, stockholders, all major subsystems, and other stakeholders. This major subsystem of the business (management), *as a system,* has a management subsystem and a production subsystem.

The management subsystem of the management system performs the planning and controlling of the production subsystem of the management system, which actually accomplishes the mission of the suprasystem. In doing so, it functions as the communications conduit between the production subsystems of the management suprasystem and the business suprasystem.

The production subsystem of the management system has a planning subsystem to evaluate the environmental and structural information of the business suprasystem and synthesize any needed changes into plans. It also has a control subsystem, which operates the feedback mechanism to monitor, record, and store production output information and report to the planning subsystem any deviation from the existing plans.

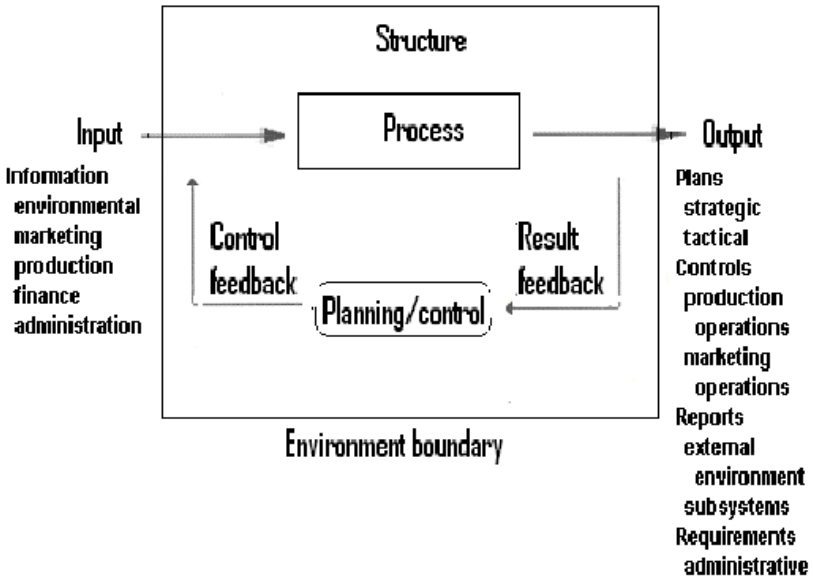

Figure 2. Diagram of a Simple Management System

The Production Subsystem

The production subsystem's purpose is to do whatever in needed to provide the output products required by the management subsystem's plans. This entails analyzing the business output requirements to determine the inputs and transformation processes needed to convert them into the expected outputs. Once the transformation processes are determined, the structure (plant, equipment, personnel, training, utilities, and technology) that will be needed to provide the processes is evaluated and compared to the existing structure to determine if additional structure is needed. After determining the requirements and planning is accomplished, the plans are implemented to actually produce the outputs.

The production subsystem receives information from the business system's environment and from all of the other major subsystems; it also receives raw materials from the environment, in the case of manufacturing operations, for conversion into product output. Included in the information received from the environment are data concerning materials which may be used as inputs, technology and equipment that may be used in production processes, and logistics to improve materials transportation. Some of the most important input data are received from marketing, which forms the substrate for all production planning. The inputs are converted into: 1) products, output to business environmental customers or marketing; 2) waste, output to the environment for disposal; and 3) informational reports, which are output to stakeholders and other subsystems. Included in its output reports are requirements for its own structural growth and maintenance, which go to the administration subsystem and operations status reports, which go to the management and marketing subsystems.

As a system, this subsystem usually has several subsystems. It has, of course, a management subsystem, with responsibility to plan and control the operations of the subsystems which comprise its structure. It also has as many operational subsystems as are needed to accomplish its mission. Depending on the mission of the business suprasystem, these could include (for example, in a manufacturing business), an inventory subsystem, which could have materials handling and warehousing subsystems of its own; a research and development subsystem, which might have research, engineering, and testing subsystems; an engineering subsystem, which could include several subsystems of various engineering fields; a production operations subsystem with possibly many subsystems for different production processes; and quite possibly more. A firm with service products would still have several operational subsystems, but designed to accommodate the requirements of its mission.

The management subsystem of the production system has a planning subsystem which has several functions that can vary, depending on the mission of the business suprasystem. As with any management subsystem, it provides planning, control, communications, and environmental analysis to its suprasystem. In every case, it evaluates the structural requirements for efficient production of the output, including

plant and equipment, technology, personnel, and any other needed element, and develops reports to submit to the administration subsystem. It determines the operations requirement for each of the subsystems in the production system and develops plans for each, which aggregate to the master production plan. It operates a feedback mechanism to monitor production operations and provide control to ensure that processes are operating as planned. It communicates all of the information to the management system for use in higher level planning; structural requirements to the administration system for purchasing, hiring, and training; financial needs to the financial system for inclusion in finance plans; and coordinates with marketing to align output processing with demand, and with external systems in the firms environment for incoming and outgoing logistics.

The operational subsystems actually perform the operations need to assure that inputs are received, handled, stored, and provided to productions processes as required, transformation processes function as required to transform the inputs into outputs in accordance with manufacturing plans, and that the product outputs are handled, stored, and provided to customers (marketing or the business customer systems) in accordance with plans.

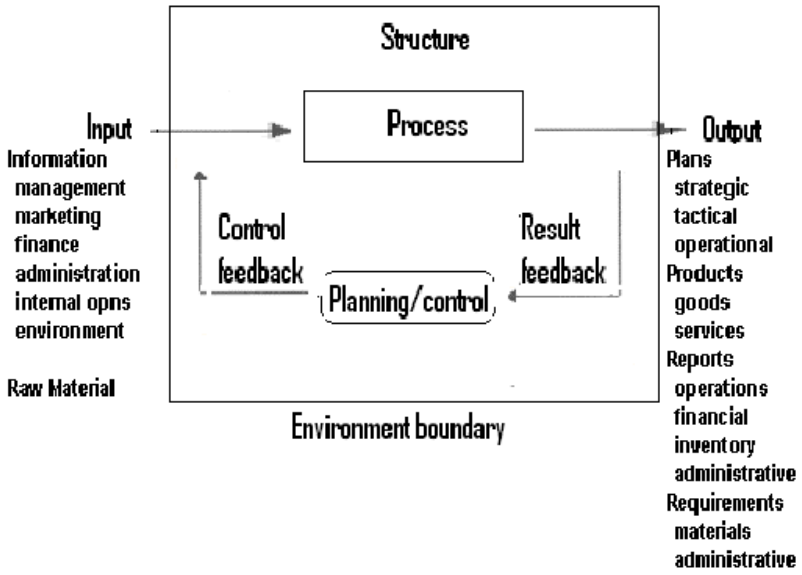

Figure 3. Diagram of a Simple Production System

The Marketing Subsystem

The marketing subsystem is a complex system, with several roles: 1) market research, vital to the activities of all the other major subsystems, which depend on the research results as the substrate for all planning activities; 2) product planning and development, accomplished in close coordination with production operations (for manufacturing feasibility), finance (for financial feasibility), and administration (for structural [personnel, training, plant and equipment, and other administrative matters] feasibility); 3) advertising and promotion, to create awareness of output within the environment

through demonstration of benefits; 4) market competitive analysis, to obtain intelligence on the competitive state of the environment (competition developments and status or research and development news of competing or substitute products, for example); 5) customer service, for quality and customer satisfaction; and 6) sales, to market the output in the environment. These functions are so vital to the business that the business survival depends on marketing. Producing the product output is necessary, but not sufficient; the firm must also have marketing to determine what customer need opportunities exist: the products, product pricing, product demand, market segmentation and location, and the competitive situation which will drive the interpretation of the opportunities. As with the other major subsystems, the marketing subsystem, *as a system*, has two subsystems, a management subsystem and a production operations subsystem, which comprise its structure.

The management subsystem of the marketing system is quite similar to the management subsystems of the other major business subsystems. It provides planning, control, communications, and environmental analysis to its suprasystem. It communicates with the environment of the business suprasystem and with all of the other major business subsystems. It plans and coordinates the operations of all of the subsystems in the marketing system, and reports the operational results to the management and finance systems. It coordinates the activities of the elements of the marketing subsystem with the production system, and reports structural requirements of all elements of the marketing system to the administrative system for planning and fulfillment.

The production subsystem of the marketing system is quite similar to the production subsystems of the other major business subsystems. It actually performs the operations needed to serve the roles previously mentioned: market research, product planning and development, advertising and promotion, market competitive analysis, customer service, and sales. Each of these roles is accomplished through a subsystem, which, for convenience, is named for the role it accomplishes.

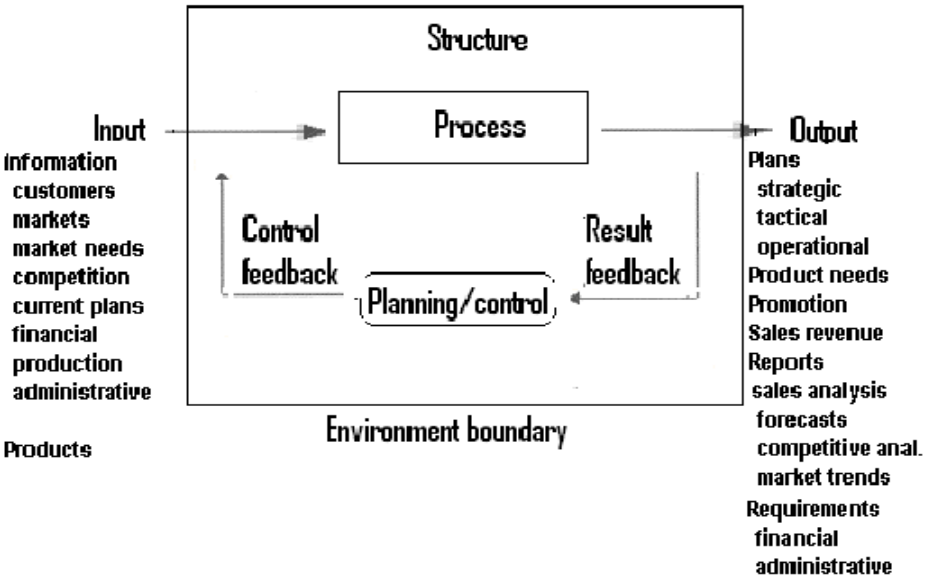

Figure 4. Diagram of a Simple Marketing System

The Finance Subsystem

The finance subsystem's purposes are 1) to ensure that the business has the financial stability to conduct operations in accordance with plans, which it does in several ways: planning financial requirements, budgeting for all systems within the business, establishing profitability levels and monitoring operations to ensure that ongoing operations are profitable and that cash flows are healthy, securing funds as needed through borrowing or equity, ensuring accuracy of the financial information and providing accurate financial data to management for informed decision-making, risk management, tax management, and controlling costs; and 2) to comply with stakeholder requirements by accurately preparing financial information as required and reporting the information to all necessary stakeholders. It receives financial data from the business environment and from all of the other major subsystems, as well as planning data from all of the management subsystems in the business. The data are analyzed and converted into information for use in planning and reporting. Strategic and operational planning input are converted into funding requirements, priorities, and sources. Financial data input is used to create output reports and budget authorizations to the other subsystems, and reports to environmental stakeholders (including creditors, crediting agencies, financial institutions, government agencies, and other interested stakeholders). In converting the inputs to outputs, finance coordinates closely with all the other major subsystems. Included in its output reports are requirements for its own structural growth and maintenance, which are communicated to the administration subsystem. Strategic funding requirements are normally submitted, along with funding and source recommendations, to the management system for disposition. As with the other major subsystems, the finance subsystem, *as a system*, has two subsystems, a management subsystem and a production operations subsystem, which comprise its structure.

The management subsystem of the finance system is quite similar to the management subsystems of the other major business subsystems. It provides planning, control, communications, and environmental analysis to its suprasystem. It communicates with the environment of the business suprasystem and with all of the other major business subsystems. It plans and coordinates the operations of all of the subsystems in the finance system, and reports the operational results to the management system. It coordinates the activities of the elements of the finance subsystem with all of the other major business subsystems, and reports structural requirements of all elements of the finance system to the administrative system for planning and fulfillment.

The production subsystem of the finance system is quite similar to the production subsystems of the other major business subsystems. It performs the operations needed to serve the roles previously mentioned: financial research, financial planning and budgeting, financial analysis, internal auditing, treasury operations, financial reporting, and risk management. Each of these roles is accomplished through a subsystem, which, for convenience, is named for the role it accomplishes.

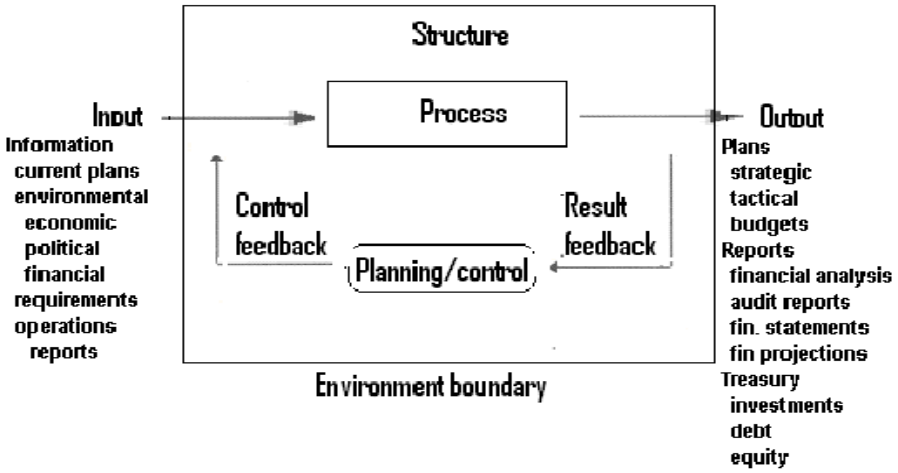

Figure 5. Diagram of a Simple Finance System

The Administration Subsystem

The administration subsystem's purpose is to create, maintain, and control the structure of the business, in order to administer support to all subsystems of the business system, allowing the business system to exist and function. As it is the subsystem which creates the structure, it is the first element of an organizational system to function as a system, and literally creates the suprasystem around itself. Without the structure, business functions could not be accomplished. Administration receives information from the environment and from all of the other major subsystems; analyzes the information input and converts it into structure requirements, priorities, and sources; then acts to obtain, maintain, or control the required structure. Administration provides the vital control information, through the accounting and information subsystems, necessary for all major subsystems to understand how well they are accomplishing their respective purposes.

The management subsystem of the administration system is quite similar to the management subsystems of the other major business subsystems. It provides planning, control, communications, and environmental analysis to its suprasystem. It communicates with the environment of the business suprasystem and with all of the other major business subsystems. It plans and coordinates the operations of all of the subsystems in the administration system, and reports the operational results to the management system. It coordinates the activities of the elements of the administration subsystem with all of the other major business subsystems.

The production subsystem of the administration finance system is quite similar to the production subsystems of the other major business subsystems. It performs the operations needed to serve the roles previously mentioned: human resources, purchasing, accounting, property management, and information systems. This is not all-encompassing, nor is it necessary to have them all; the administration system can be extremely diverse and have a myriad of functions, depending on the size and nature of the business mission. Each of these roles is accomplished through a subsystem, which, for convenience, is named for the role it accomplishes.

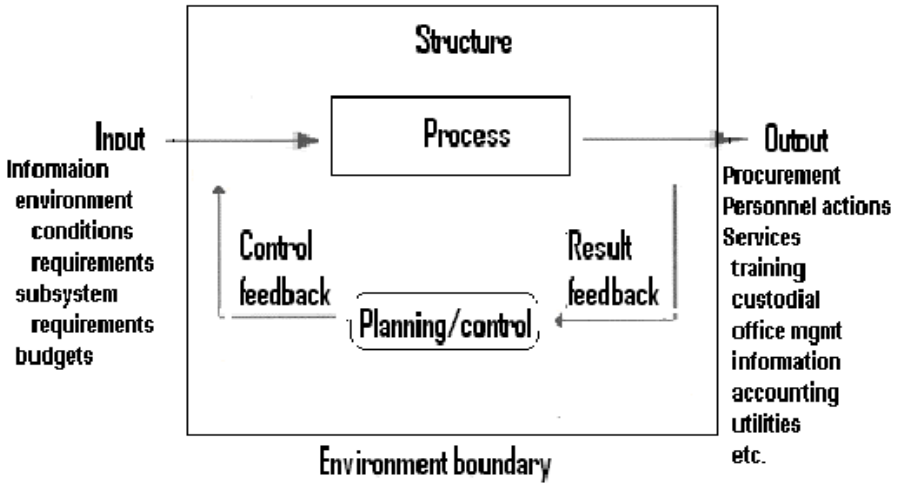

Figure 6. Diagram of a Simple Administration System

Generalizing the Paradigm

Reviewing the descriptions of the business system and its major subsystems, it is readily apparent that the basic structure, functions, elements, and any other concepts are similar throughout. Each of the subsystems of the business subsystems will have similar composition and functioning, and their subsystems will fall into the same descriptive categories. This is the beauty of the General Systems Theory. Each system is teleological; the purpose is predetermined, and the system is created to accomplish the purpose.

The functions of the elements of the particular system are determined by the purpose of the system. The effectiveness of the business system in accomplishing its intended purpose depends on the ability of the relationships between the major functional subsystems to cooperatively function and produce synergy:

- How well does the management subsystem accomplish planning and control of all the subsystems of the business?
- How well does the administration subsystem create, maintain, and control the structure to allow the transformation processes to convert the inputs into the outputs and allow the other subsystems to perform properly?
- How well does the marketing subsystem predict the types of products (output) for the transformation processes to produce that will result in sales of the product, the market to which the product should be marketed, the method of communicating the product benefits to the target market, and the price at which the target market will buy the product at a profit to the business?
- How well does the production subsystem perform the processes to convert the inputs into the needed outputs so that the marketing subsystem can profitable dispose of them to the environmental customers?

- How well does the finance subsystem control the financial condition of the business to allow the structure to be maintained and operations of all the subsystems of the business to contribute toward purpose fulfillment?

The GST model, expressed in standard business terminology, constitutes a paradigm that allows a business to be simply defined and able to be analyzed both systemically and systematically. At each level of an enterprise, the system paradigm allows a simple input-process-output to define the level and examine it systemically. The next level below (its subsystems) can be systematically expanded to describe each of the subsystems as a simple input-process-output element, and see the relationships between and among the elements which define how the suprasystem they comprise functions in order to accomplish its purpose. The relationships can also be viewed as a system diagram:

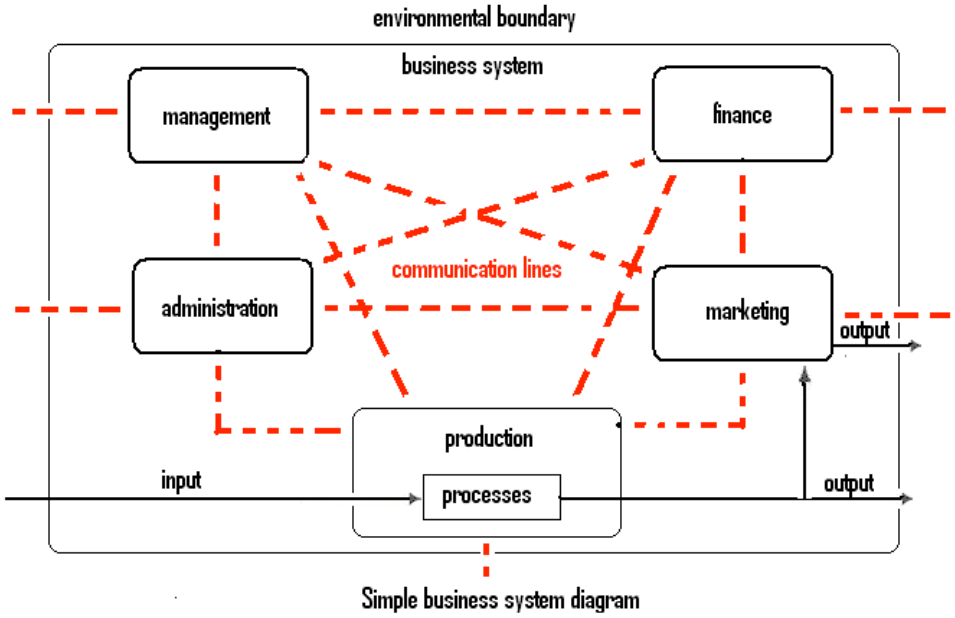

Figure 7. A System Relationship Diagram

Benefits of Using the Paradigm

This author has found that using GST as a substrate for explaining business and management concepts not only increases student understanding and comprehension of the concepts, but also simplifies modeling a business for planning and decision-making. It uses the organizational constructs that have been taught in business curricula in the past, but puts them into a format that is easy to understand and use.

In accordance with systems theory, the following are constant:

- Each system is in a system of systems, such that: it is a suprasystem to the systems that comprise its structure, by definition, a system itself, and a subsystem of the system in which it is an element.

- Each system is contained within a structure that is composed of subsystem elements that are interrelated and interdependent.
- Each system has a purpose; it accepts inputs from its environment and transforms the inputs into outputs, which are exported into its environment, in order to fulfill the purpose.
- All inputs are outputs of another system and are consumed by the transformation process through conversion into outputs; all outputs are inputs to the system in the environment which receives them.
- Although a given final form of the output could be reached with different inputs and different processes, the same input transformed with the same process will each time result in the same output.
- A change in input or a change in process will result in a change in output.

The GST paradigm expresses the following:

- Major business functions are presented as the subsystems of the business system which comprise its structure.
- Each subsystem in the business model has at least two subsystems, termed 'management' and 'production', with clearly defined functional requirements; there may be more as required to provide specialized output.
- Each management subsystem's purpose is to perform planning, control, communications, and environmental evaluations.
- Each operations subsystem will accomplish the functions required by the planning subsystem of its suprasystem: it will accomplish the planning; operate the feedback mechanism to monitor, record, control, and store the output of the process; and analyze/evaluate its environment.

CONCLUSION

Using this simplified, structured paradigm as a business model has enabled students to quickly grasp the concepts of business organization, especially with respect to the relationships of the disciplines used in a business, and management. They have found that the stable structure presented enables them to accomplish the functional requirements of planning and decision-making in a much easier manner than before they were exposed to GST. As the systems model is teleological, it reinforces the well-established principle of management that an end must be defined to accomplish the purpose, and then inputs and processes necessary to attain the end must be created. Concurrently, by examining the relationships and interdependencies among the subsystems, they see how changes in inputs or processes not only affect the end product, but also how the changes in one subsystem can affect other subsystems in the suprasystem or even the system that receives the end product as its input.

The paradigm has shown that it is adaptable to any business system and is easily understood through use of common business terminology in its description, rather than the more confusing language of scientific research.

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