Knowledge Area Module 3:
Principles of Social Systems

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November 11, 2008

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ABSTRACT

Breadth

General systems theory describes principles by which natural systems function and interact. In nature, human systems are referred to as the supraorganic, and they include all aspects of organization and society. Organizations are in a constant state of change and evolution. The Breadth section of KAM 3 examines the phenomena of change and evolution from the perspectives of von Bertalanffy, Laszlo, and Gladwell.

ABSTRACT

Depth

Society exists as sets of interrelated subsystems that receive inputs, processes those inputs, and generates outputs. The combination of inputs, processes, and outputs are called systems and they include small entities and larger subsystems such as organizations and communities. Systems are constrained by structural exigencies much like dams that, if understood, can be adapted to modify the manner in which systems function, controlled releases of water, say. Otherwise, systems are free to follow spontaneous and natural laws that sometimes run contrary to societal and personal well being. This Depth section examines the conduct of systems and how they affect organizational efficacy.

ABSTRACT

Application

Theories X, Y, and Z have been theories of worker motivation. Theory X prohibits worker autonomy, theory Y attempts to empower workers, and theory Z, as noted by Ouchi in his book *Theory Z*, reveals a more complex interaction between worker, management, and environment. Recent research suggests another theory of motivation. Building on the general systems theories of Bertalanffy, Laszlo, Skyttner, and Gladwell, motivation is a systemic phenomenon that has four interacting subsystems of leadership, work environment, personal psychology, and deterrence orientation. A production case study offers insight into a potential motivational model that exceed Maslow’s and Ouchi’s theory Z, a fourth theory of systemic motivation.

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BREADTH

SBSF 8310: THEORIES OF ORGANIZATIONAL AND SOCIAL SYSTEMS

Pre-Systems Thinking

In the pre-modern era, there were four perspectives from which theologians and scientists investigated and interpreted the world. They were the empirical view, atomistic, speculative view, and holistic (Laszlo, 1996). In early Europe, the *empirical* approach focused on rigorous specificity in research, accumulating very narrow, but very tenable, facts and knowledge. Empirical tended to merge with an *atomistic*, specific focus approach. The two of them became grounded in facts and provable data. *Holistic* sees all cultures as equally valid (Laszlo, 1996). There was a natural tendency for the holistic to merge with the *speculative*, the opposite of

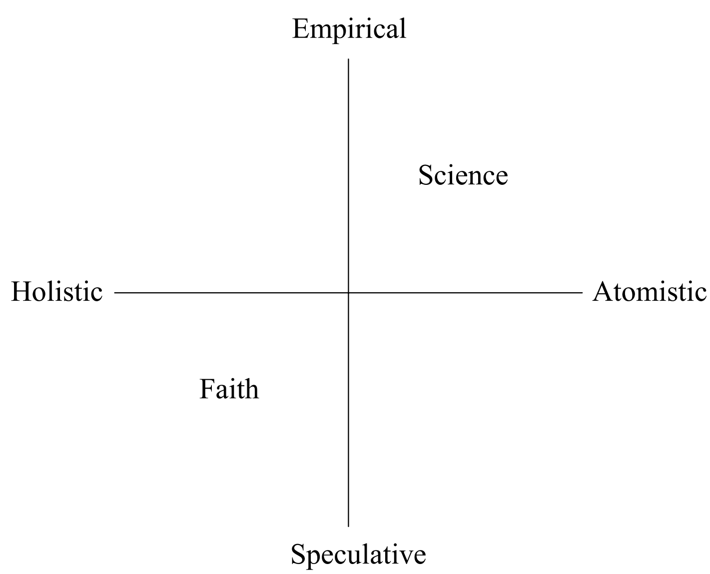

Figure 1. The polarities of inquiry

empirical. The paired methods of inquiry resulted in the dichotomies that we now know as faith vs. science (see Figure 1). However, neither approach was fully sufficient at interpreting the complexities of nature and society. At best, there was a partial understanding, or explanation of natural phenomena (Land, 1973). This manner of thinking persisted well into the 20^{th} century. The result was that science began providing tools that, when applied, had unintended consequences. For example, DDT, the synthetic pesticide that worked wonderfully well in the narrow constraint of laboratory experiments, wrecked havoc on the natural environment, nearly causing the extinction of the Bald Eagle. The scientists who developed DDT did not consider its systemic affect.

The work of van Bertalanffy, Maslow, Mead, and others, began to change how the world is viewed. They blended empiricism with a broader holistic view of nature (Land 1973). They tempered their interpretations with empirical evidence and offered little ground for embracing the speculative view. By merging a holistic view and empirically based insight, they created a shift away from reliance on faith as a means to describe the complexity of nature. By using science to understand integration of systems, new polar opposites emerged. The new polar opposite of systems thinking might be termed metaphysics. Metaphysics aligns speculative with atomistic thereby adding substance. This gives speculative view some basis in fact, but remains more theoretical and abstract, and able to theorize the spiritual nature of existence. It remains more theoretical and abstract. These shifts in thinking are shown in Figure 2 where the combination of empirical thinking and holistic thinking results the emergence of systems thinking.

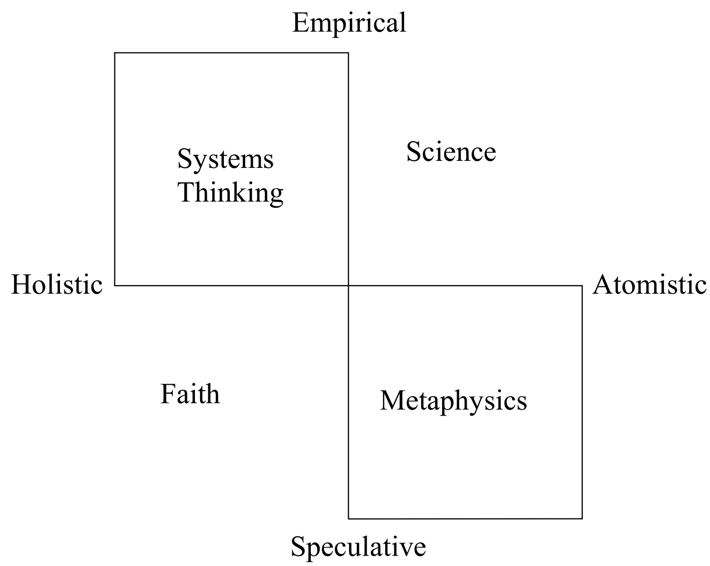

Figure 2. The emergence of systems thinking

Compartmentalization

The early European empirical/atomistic vs. holistic/speculative polarity was concurrent with a tremendous expansion of scientific knowledge and technical development. Most of the expansion, however, resulted in a narrow focus, or compartmentalized (von Bertalanffy, 1968; Laszlo, 1996). Research focused on exploiting individual capabilities of a specific types of knowledge, material, or mechanism, say plastic, steel, or a specific chemical, and why not? Compartmentalized research generated tremendous technological expansion, and waves of scientific discovery and breakthrough. The products that resulted were so numerous that there was little need to consider more than rudimentary fusion of dissimilar specializations. It was not until the mid-20th century that scientific breakthrough became less decisive, and since the 1980s, technological diversification has replaced scientific breakthrough (Sakaiya, 1991). There will always be much to gain from compartmentalized research. However, the greater discoveries may now exist in the fusion of the scientific, societal, and various technical disciplines (Sakaiya, 1991).

The Japanese, perhaps unknowingly, or because of their cultural orientation, began the tactic of embracing fusion of dissimilar materials and technologies in the middle of the 20th century (Kodama, 1991). Given current technological sophistication, it seems natural to combine, for example, computers with other mechanical devices and equipment. Yet, this was not the case in the 1950s and 1960s until the Japanese redefined the purpose of manufacturing and began to break through traditional technological boundaries (Kodama, 1991). This approach was termed mechatronics, and it became the basis for the merging of computers with robots, or computers with optical systems, and other previously segregated technologies. Fusion and mechatronics has now become so exotic that materials science in Japan has reached the point of impressive technical and technological breakthrough. Oiles America, for example, developed a process that chemically bonds metal and plastics into a homogenous material with controllable surface lubricity. The lubricity is inherent in the material and not a function of any external lubricating oils – hence oil les.[1] This type of innovation is evidence of a shift from empirical/atomistic to empirical/holistic, and moves away from compartmentalization.

Mechatronics is a component of the 2nd (or 3rd depending on the perspective) industrial revolution. This revolution involves a shift from integrated wholes (Laszlo, 1996) to complex machines that require synergistic interaction from a variety of specializations (Bertalanffy, 1968).

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[1] It is worth noting that the new Oiles technology and products are going to devastate an entire segment of automotive components. This will happen fairly quickly and result in job loss at American companies, but increased hiring in Oiles's American facility.

Consider, for example, the integration of the robot and computer. They would not work without knowledge of fluid mechanics, hydraulics, human factors range of motions, and the production knowledge to manufacture such technology. The integration of these is an outcome consistent with general systems theory. However, general systems theory is considerably more complicated, particularly when applied to social systems and organizations. We will examine general systems theory in the next section.

General Systems Theory

Life Systems

General systems theory is rooted in the biological sciences. In the living world, every organism exists by consuming inputs, processing those inputs, and excreting the byproduct as outputs. This is the life process, and it is bounded by growth and decay. In the life process, life forms are linked to other life forms by way of processes and sub-processes. The famous Chinese philosopher Lao Tzu observed life processes functioning this way over 2,600 years ago (Brunner, 1944). Consider the annual growth and decay of leaves on a tree. When shed, the leaves provide materials that interact with the environment to support other life forms and contribute as inputs to other life processes. The amount of life supported by decaying plant material is enormous, the basis of our oil economy. The contribution of annual foliage growth may be greater. Absorbing carbon dioxide and exuding oxygen allows our species to survive on a planetary scale, and directly contributes to evolution on the earth's ecosystems.

Evolution drives toward "superposition of system upon system in a continuous multilevel structure traversing the region of the suborganic, organic, and supraorganic," (Laszlo, 1996, p. 53). These are levels or domains where suborganic is physical sciences, organic is life sciences, and supraorganic is social sciences. These are bound by four propositions of natural systems. Proposition 1 states that natural systems are wholes with irreducible properties. In other words, the whole is greater than the sum of its individual parts. For example, removing a leaf from a tree does not significantly alter the tree. Clipping fingernails does not change a person's hand. Proposition 2 states that in a changing environment, natural systems manage to function and support, and perpetuate themselves. If we consider an individual tree a natural system, then it exists through the changes in seasons. If we consider a forest a natural system, then it may exist for considerably longer than the life of the trees within its bounds. It is a larger system.

Proposition 3 states that various multiple natural systems interact with other systems in the process of self creation. Natural systems evolve into different functions in a manner similar to Darwin's (1859) concept of radiate variation. Moreover, systems jointly evolve in greater variety than individual systems. Change is constant, never static, and exists in two forms, ontogenesis and phylogenesis (Laszlo, 1996). Ontogenesis refers to self-producing species that grow and mature young. Phylogenesis refers to the general evolution of the entire species. Hence, ontogenesis may exhibit new traits that are the result of phylogenesis.

Proposition 4 states that "natural systems are coordinating interfaces in nature's holarchy," (Laszlo, 1996, p. 53). A holarchic system has a small number of complex systems at the top with increasing numbers of sub-systems supporting one another. At the bottom of the holarchic system are numerous smaller systems. All of the systems interact with one another to manage their interfaces and connectedness. The human body is an example of a simple holarchic system. The Brazilian Rainforest is another, the planet, and all that is on it is another. Note that various subsystems can be removed, or become extinct, and the larger entity can survive, to a point. In other words, holarchic systems are dynamic and adaptive.

General Systems Theory Model

Von Bertalanffy created mathematical models that described the complexity of different systems. He thought that modeled natural laws apply to all systems and subsystems; regardless of their composition, or how the subsystems were related (von Bertalanffy, 1968). They were defined by the same system of simultaneous differential equations.[2] His systems of equations mathematically convert complexity into a mathematical model so that others could conceptually grasp the possibility of developing a predictive model. The point, however, was that understanding a system is not possible by focusing on one coefficient in an equation, or by isolating the individual terms. In an organic system, the same is true of trying to interpret events by isolating individual activities. Laszlo (1996) considered a model appropriate because he noticed that recurring features of a phenomenon were common within different systems.

Within the general system theory there are two fundamentally different systems. One is the closed system, or a system that exists unrelated to other systems. A closed system follows the 2nd Law of Thermodynamics. Therefore, a closed system is one that goes into entropy (von Bertalanffy, 1968). A mechanical example of a closed system is an automobile, or other technological artifact, that gradually decays and cannot regenerate. The other system is an open system, a living system. In living systems, there are inputs, processes, and outputs that are in a

[2] von Bertalanffy's equations are presented in chapter three of his book *General Systems Theory.*

state of growth or a state of decay. However, it does not go into entropy. In an open system, nature is,

> . . .a sphere of complex and delicate organization. Systems communicate with systems and jointly form suprasystems. Strands of order traverse the emerging holarchy and take increasingly definite shape. Common characteristics are manifest in different forms on each
> of the many levels, with properties ranged in a continuous but irreducible sequence from level to level (Laszlo, 1996, p. 58).

An open system exhibits growth, maturity, decay, and renewal. Its subsystems vary in life expectancy, but propagation, variant evolution, and resurgence will continue as long as the holarchic system exists. Life, in essence, will not be suppressed, and perpetuates itself in a steady state condition of equilibrium. Steady state systems remain the same regardless of the process of growth, decay, or damage to component elements (von Bertalanffy, 1968). The only substantive change would be the affect of phylogenesis.

Comparing Theorists

Laszlo, von Bertalanffy, and Gladwell have discovered dynamic interactions by which systems function, though they view how systems function from slightly different perspectives. They all perceived the same general themes of integration, connected individual subsystems, and spontaneity. Laszlo tends to focus on human systems, von Bertalanffy tends to focus on the sciences, and Gladwell focuses on human systems' change triggers, and dynamics.

Systems, von Bertalanffy (1968) observed, have five defining laws. The first is a tendency toward integration, connectedness, dependency, and interdependency (see Figure 3). The second law is that integration is the core postulate of general systems theory. The third law states that systems theory and understanding the core postulate contribute to a refinement in the exact theories of other fields and sciences. In other words the theories that apply to individual specializations, are more precisely conceptualized by understanding how that specialization and its subsystems are related. This leads to von Bertalanffy's fourth law of unity. Unity means that by applying general systems theory, other sciences are better illuminated and unified. The individual sciences are, therefore, better understood; as part of the body of sciences. His fifth law, or principle, is that teaching the sciences is more productive when taught as integrated components vs. individual specializations.

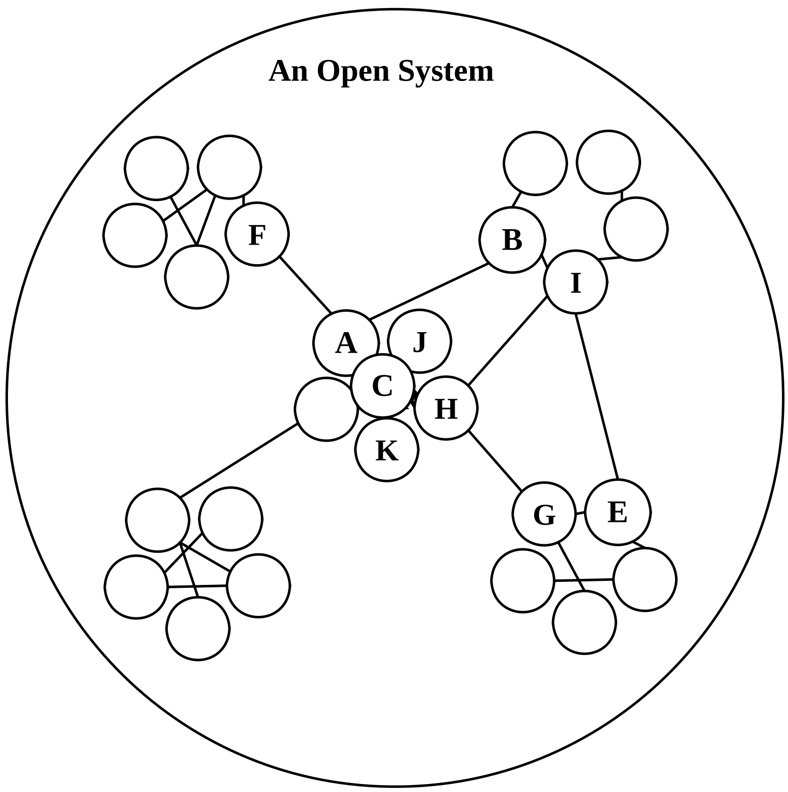

Figure 3. A holarchic system, component systems, and elements

Figure 3 shows a simple open, holarchic, system with varying degrees of integration and connectedness. The higher function in the center of Figure 3 represents the core system to which everything contributes directly or indirectly. If the lines represent dependencies, then element C, is the main component, or personality, of the high level system. It is a function of all subsystems and combinations of interaction within those subsystems. The direct dependencies, or primary connections, are A dependent upon F and B, H dependent upon I. Element I is dependent on B and E, and so on. The lines are direct dependencies, but nothing is unlinked from the entire holarchic system. It is possible to remove individual elements, but the subsystems and system will remain, though slightly altered. Element C, if removed may result in decay and loss of cohesive purpose. This can occur without impinging on the survival of the holarchic system. However, the [arts of the system may dissolve into different constituent components, J and K for example. They are not tied to the system through any links other than component C. The dissolution of C would cause, what von Bertalanffy considered a disturbance. Disturbances bring about new equilibriums. In the example of Figure 3, the dissolution of C may cause a displacement resulting in a new central element, or principle life form.

This looks like chemistry, and in fact, both von Bertalanffy (1968) and Laszlo (1996) have described aspects of general systems theory as such. The concept of chemistry and atom-like polarities fit within Laszlo's perspectives of general systems theory. Laszlo (1996) posed the following isolated elements vs. integrated systems dichotomies for consideration.

- Irreplaceable machine parts vs. irreplaceable elements such as choice and flow.
- Atomistic individual vs. community and integrity in nature and society.
- All things distinct and measurable vs. flowing energy that interacts.
- Accumulation of goods and power vs. knowledge and human service.
- Materialism vs. sustainability.
- Eurocentric vs. world diversity.
- Anthropocentric vs. man as part of all life and nature.

- Competition and personal profit vs. cooperation and harmony.
- Body and mind separate vs. body and mind as an integrated system.

Laszlo's opposites reveal a fundamental philosophic difference that is at the center of the long-standing, and still contemporary, debate about the configuration of society. We see one form as the debate between free market capitalism and social responsibility. However, if von Bertalanffy's general systems theory equations hold, then the choices that Laszlo poses must be the result of conscious decisions. Various sub-elements of the system have to change before the entire system is affected. The change itself can be to any degree nature, or society, allows depending on probability (von Bertalanffy, 1968).

Gladwell (2002) applies general systems theory to the mechanisms that contributed to epidemics. He would concur with von Bertalanffy that the same systems equations apply to different fields. The phenomenon of an epidemic occurs in biological sciences, but a similar condition exists in social and organizational systems. In biological environments, only a few viruses need to combine with subsystems in such a way that they are in a position to cause an epidemic Gladwell (2002). If the conditions are at an optimum, then an epidemic can explode. Gladwell calls the mechanisms the law of the few, the law of stickiness, and the law of context.

The same set of circumstances occur in human social systems, and it is the dream of every marketer to create a product that sticks with a few key individuals in an advantageous context that results in an explosion, epidemic, of consumer demand. The fashion industry has exhibited numerous examples of Gladwell's mechanisms. The same can be said for organizations and there are numerous examples of organizational transformation that fit within Gladwell's theory. The quality movement led by Dr. W. Edwards Deming in the 1980s contributed to an expansion of the use of statistical process, control, quality circles, and 6 Sigma that transformed

American manufacturing. Deming (1986) tried to teach a portion of general systems theory that he referred to as the systems concept. We will examine that concept in a following section.

Summative and Constitutive Systems

Bertalanffy (1968) used the summative system and the constitutive system to introduce his mathematical models. He noted that there are different ways to model systems. A summative system functions as the sum of its elements. If one element falls away, another will replace it to maintain the form of the function. Any element can fit in any place within the system and the system will operate the same. Betalanffy provides the examples of molecular or atomic weight, something very predictable and stable.

A constitutive system is more complex than a summative system. In a constitutive system, the elements are not exactly interchangeable. If one element falls out, there may not be a replacement because of unfavorable or incomplete linkage mechanisms. Even if the element is accepted, it is possible that it may change the form of the system; because the system is dependent on certain subsets of elements and their specific orientation. Changes in the relation of the elements, change the system. Therefore, a constitutive system exists with greater constraint than a summative system, and has a greater probability of changing its overall form. This is because the ultimate function of a constitutive system exceeds the additive function of its individual components. Bertalanffy's equations imply that each summative system is different even within similar specie sets. Each oak tree in a forest, say, is free to take on any shape that its subsystems allow for. The forest itself can maintain the same geography so long as the subsystems maintain their equilibrium. If, however, oak wilt disease penetrates the woods, then the forest constitution and geography are forever altered.

The constitutive system has two distinct evolutionary features, progressive mechanization and progressive centralization. Progressive mechanization is an interaction within a system that causes a transition from holistic to summative behavior. We can use the example of oak wilt killing off an oak forest. The elements or subsystems would be free to function differently. Small patches of grass might become fields, poplar and maple trees may begin to dominate. The smaller tree growth could provide beaver the material to dam a stream and create ponds that would support a fish population, migratory birds, and so on. Each one of the subsystems, for a time, is autonomous and creates a summative landscape. The constraining synergy of the oak forest is gone, thereby allowing the emergence of the progressive mechanization trigger. Nevertheless, if a condition of plasticity exists, then the oak woods may regenerate (Laszlo, 1996). On the other hand, mechanization may result in subsystem autonomy and independence (Bertalanffy, 1968).

The other evolutionary path is progressive centralization (Bertalanffy, 1968). It is a natural condition of developing an organization with order and hierarchical protocol. Using the example of an oak woods exhibiting plasticity, after an oak wilt die out, oak seedlings begin sprout and grow. During the first years, they are barely taller than the grasses. After a few decades, however, they are beginning to create shade and the grasses begin to recede as oak trees grow and spread. Eventually, a savannah begins to take form thereby transforming the landscape. After hundreds of years, the oak woods may be reestablished. All plants and animals are in their niche with the oak forest controlling the habitat.

Human Systems

Human systems are Laszlo's (1996) supraorganic system, such as organizations, communities, or anything in which people engage. Human systems are incredibly complex, in part because of human psychology. Therefore, there is little understanding of how multiple influences interact to produce a social phenomenon; or how multiple components interact to from a societal or organizational form (Laszlo, 1996). Nevertheless, societal fluctuations continue, not in cycles, but as a never-ending evolution. Growth, maturity, decay, and evolving variation are the nature of social systems (Durant, 1968; Sakaiya, 1991). Moreover, human systems are organic and function in a spontaneous fashion (Gladwell, 2002) with broadly predictable, and sometimes with totally unanticipated, results.

Regarding historical events, Bertalanffy (1968) considered them a combination of leadership and social impulse that create events. Leaders, he thought, were interchangeable. In those rare cases where a leader sustains a system, the system can quickly de-centralize in the absence of that leader. Human systems flux, meld, evolve, change, sometimes disappear, and there are consistent explanations, or models, that explain why (Diamond, 1999; Grayson & O'Dell, 1988). Societies are each unique and yet they are constrained by the same natural subsystems, say, water, fertile land or climate. Political upheaval is also a potential constraint, and for all the desire and effort, complex social problems cannot be solved (Bertalanffy, 1968). Nevertheless, they do seem to function according to Bertalanffy's general systems theory.

Gladwell's Theory

Gladwell studied the mechanism that create epidemics. Defining an epidemic as a dramatic and pervasive change in systems, he found that epidemics are viral expansions caused by a tipping point (Gladwell, 2002). Tipping points are systems events that affect environmental, biological, societal, and organizational systems. He explained three laws that create tipping points and subsequent epidemics: the Law of the Few, the Law of Stickiness, and the Law of Context. The laws themselves are a subsystem working within other natural systems and when they achieve a certain dynamic energy, they cause the parent system to tip.

Gladwell's first law is the Law of the Few. Without it, the other laws would not function. The few are those carrying elements in which the potential for epidemic resides. There are a few individuals, or other organism, that are exceptional at connecting and causing epidemics. The epidemic may be biological or commercial, but the initiator is a connector capable of spreading the epidemic (Gladwell, 2002). In spreading a biological epidemic, connectors uniquely (usually unintentionally) position themselves to be in contact with a broader population. They may be international travelers, socially active, or as Gladwell calls them, mavens (databases) or connectors (social binders) who are extraordinary at providing information or connecting with others. The point is, if they are carrying and convey a virus, idea, knowledge, or information at the right time, and in the right condition, they can be the trigger. The Law of the few states the potential for epidemics reside in only a few exceptional people (Gladwell, 2002).

The Law of Stickiness is less definable than the Law of the Few. Stickiness itself is a subsystem of the tipping point system. Figure 4 shows how the parent system, subsystems, and factors relate in a non-contagious configuration. The system is always in a state of latent expectation. This is consistent with Bertalanffy's (1968) and Laszlo's (1996) concept of a constitutive system that has the potential for progressive mechanization (temporary as it may be in an epidemic) and progressive centralization (as in a post epidemic reorganization). As long as the connector (Law of the Few) and the stick (Law of Stickiness) remain apart, the system exists in a state of suspended latent expectation. However, if the connector and the stick intersect, then a tipping point is attained and an epidemic can ensue depending on the nature of the latent expectation. In the case of a cold or a virus, the latent condition may be when the weather becomes cold affecting human body temperature, thus creating the ideal condition for viruses to spread.

The latent condition, then, is the Law of Context. Latency in biology and flu epidemics is well understood. Much effort is made to control the Law of the Few by restricting travel for people who may be carriers. Consider the incredibly dangerous potential for an escape of the probability for the infected individual, the connector, to convey a virus with an extraordinarily Ebola virus, for example. There is a very thorough protocol for containing Ebola when it escapes in a military research laboratory (Kortepeter et al., 2008). This is specifically because of the high high ability to stick in an environment of near 100% probability of infection, hence contagion. Figure 5 represents the merging of the connector with a stickiness coefficient in a latent expectation system. The contagion in this example could quickly saturate then entire system.

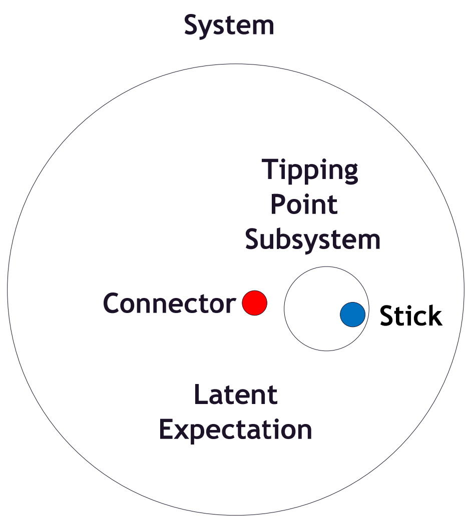

Figure 4. The Law of Stickiness subsystem

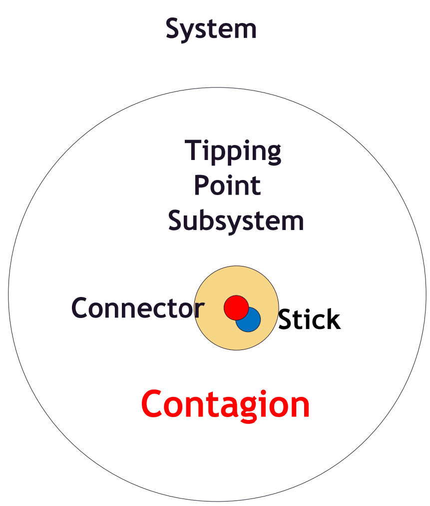

Figure 5. Contagion when connector and stickiness intersect

The same mechanisms work with ideas or social fads. This makes Gladwell's theory attractive to marketing and is a consideration for organizational transformation. Gladwell (2002) found that people exist within many different contexts; all having latent expectations that appeal to a near infinite array of personal habits and tendencies. In other words, stickiness is a message that is memorable and spurs people into action. An example may be the affect of the German sinking of the Lusitania. Prior to the sinking, there was little popular support to go to war with Germany, though there was latent anxiety. The sinking of the luxury liner created a tipping point. The ship and passengers became connectors. After the sinking, the U.S. quickly found the popular support to engage in war. It is interesting to note that popular support for political advantage uses a mechanism that increases the stickiness factor. Consider the phenomenon of false rumors used in political contests. Gladwell explains how false rumors have become epidemic. The same mechanism can be used to formulate a political ad.

- Find a kernel of truth in something.
- Distort that truth to an advantage or leveraging factor.
- Level the story so that essential details are missing.
- Sharpen the story to make important (for the story teller) details specific.
- Assimilate the story by having it make sense to carriers (needed constituents).

There are many ways to get messages to stick in societal situations, and there are reasons why people desire to have messages stick. Clearly, politics is one area, but there are many different latent expectations within the population, and nearly all of them need Gladwell's theories in order to advance. Here is a list of areas where stickiness and tipping could be useful.

- The environment.
- Energy policy.
- War and peace.
- The economy.
- Tax policy.
- Health care.

- Industrial policy.
- Education.
- Organizational change.

All of these areas can reach epidemic proportions if the right tipping point emerges, an event, a pervasive condition, or knowledge and foresight can affect all of these to the point of contagion, action. How these can envelop an organization is examined next.

Organizations

Organizations of all sizes, long-lived or short-lived, are systems that are subject to structures and relationships. They have common features such as accounting, human resources, critical core processes, and procedural systems. However, they also establish their own personalities that exist as relatively stable normative structures. Summative and constitutive growth laws apply to organizations (Bertalanffy, 1968) and society. Progressive centralization, progressive mechanization, and organizational behavior are extant mechanisms and relevant to organizational development and viability. Within each organization are latent expectations for function and behavior. The tipping point in any one of them is a matter of context and connectors. The Law of the Few, the Law of Stickiness, and the Law of Context all apply to society and institutions. Plasticity also contributes when broad-based changes occur.

When there are perturbations in the subsystems such as reorganizations, employee turnover or other adjustments, normative structures remain viable with only slight shifts and no mechanistic determination (Laszlo, 1996). Yet, to what degree can an organization change and still be the same? Is downsizing, union busting, green mailing, or widespread plant closings a slight adjustment? Or, is it a more broad based constitutive change? If entire subsystems are eliminated is it an adjustment or is the normative structure no longer the same? As Bertalanffy and Laszlo imply, it is a matter, of the size and the scope of the change.

If each organization is its own personality, then the normative values, leadership characteristics, employee psychology, and other attributes merge to form unique intrinsic value systems, or character. These become subsystems that affect overall organizational performance. Employee motivation mechanisms, for example, if consisting of optimum leadership elements, a nurturing environment, and optimal individual psyches, will function with greater organizational excellence than organizations that ignore the usefulness of organizational elements. Bertalanffy was correct, then, that systems can be modeled. If we consider the elements of motivation, or accounting practices, or employee knowledge assets, or the presence or absence of quality systems, say, as coefficients in a grand equation, we can derive limits to organizational performance. Those limits can approximate performance outcomes within the context of a larger system.

Manufacturing and System's Theory

Deming (1986) reiterated the system concept in the United States in the 1980s. He described it exactly as Bertalanffy and Laszlo described their systems. As depicted in Figure 6, it has inputs, processes, and product or service outputs. They are subject to all of the laws and rules cited by Laszlo,

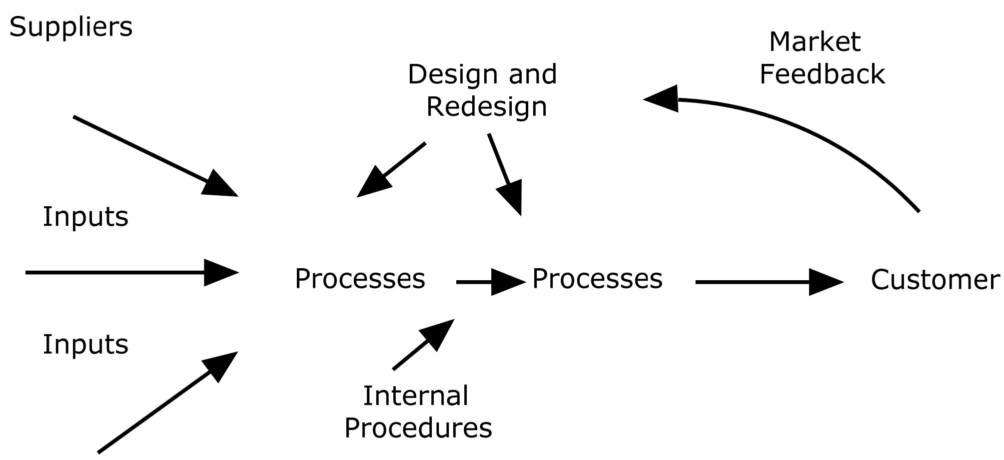

Figure 6. Adapted from Deming's system

Gladwell, and Bertalanffy. Moreover, all systems function with the same flow of activity. Deming's system at an organizational level is merely a microcosm of a larger system. Regardless of system size, they emulate each other with many simple systems supporting a holarchic type monolith. The intermediate subsystems link the lower level subsystems with the higher level whole system (Laszlo, 1996).

The economic history of civilization is a record of systems theory at a national level. Grayson and O'Dell (1988) have found that the economic domination of nations changes from century to century. Holland was the wealthiest nation in Europe in the 18th century. England was the wealthiest nation in the 19th century, and the United States in the 20th century. Japan is now the most powerful industrial nation in the world that has acculturated systems theory, Europe is closely behind, and China is the fastest growing economy in the world. The United States is in industrial decline at the beginning of the 21st century. In the 18th and 19th centuries the dominating nation leveraged productivity, transportation, and colonial systems for economic achievement. In the 20th century, the United States capitalized on technological growth, particularly after 1950. However, something different is occurring in the 21st century. The Japanese have embraced the concept of systems, and by applying Total Quality Control, continue to improve their capacity to optimize every aspect of organizational performance. This comes at a time when General Motors continues to fail as an organization; presumably because their holarchic system did not engage a future perspective, nor observe the changing nature of international economics. The long range planning and visionary leadership was missing. General Motors was also caught unaware of Taichi Sakaiya's observation that the cheap energy economy is at the end of its era (Sakaiya, 1991). It is ironic that Charley Maxwell, an oil market analyst, tried to warn General Motors of the impending oil crises, but was ignored (Halberstam, 1986) in 1973, the year of the first oil embargo.

Management, Deming (1986) once said, is prediction. It is prediction based on understanding and monitoring a system. The system embraced by Japan is Total Quality Control and it has organizational metrics applied to the three main components of a Total Quality Management system. They, and some of their subsystems, are listed below.

- Vertical integration
    - 7 management and planning tools
    - Vertical teams
    - Continuous tactical improvement
- Horizontal integration
    - Information systems
    - Audit tools
    - Customer and supplier collaboration
    - Quality assurance

- New product development

- Daily management
  - Statistical methods
  - Standardization
  - Quality circles (King, 1989, p. 1-8)

Horizontal and vertical integration link the entire system from senior management to front line worker teams, and across functions or departments. This type of integration creates unique, short-lived contributing groups that emerge and disappear based on the organizational needs of the moment. This is a true constitutive system and it can be approximated in a model, as Bertalanffy suggested. Removal or modification of any of the subsystems will result in a change, possibly suboptimal, in performance. Optimizing each subsystem should strengthen the entire system. Optimizing the integration of the entire system can yield the greatest possible organizational performance.

For the last fifty years the Japanese industry has been developing system integration while U. S. automotive companies have attempted to focus on mechanistic aggregates. The results are clear. Japan manages manufacturing as a system (Mizuno, 1988; Deming, 1986) and the U.S. does not. In effect, U.S. automotive, and companies in general, remained summative far too long. So long, in fact, that the world holarchic manufacturing environment has changed. The U. S. automotive culture is in a state of progressive mechanization while the Japanese continue to refine their organizational holarchic systems. Japanese management is better disposed to predict organizational outcomes because of their understanding of general systems theory. The contrast is simple. One nation's manufacturing keeps a view of the future while the other is trying to understand the past; all functioning with in the principles of open systems theory.

Conclusion

According to Richardson (2004), Bertalanffy and Laszlo over-simplified open systems theory. They did not explain that thinking of the whole system as the result of additive components did not explain the nature of the whole. Systems are not only summative and constitutive, but also modular, redundant, Boolean, and a wide variety of other things that, as Lao Tzu maintained, are in a state of constant rounding. Moreover, the 2^{nd} law of thermodynamics allows for more than continual decay. Depending on the size of the system, there will be subsystems that are in a state of vertical emergence. Richardson described it best when he noted that the best descriptor of the system is the system itself; and as Lao Tzu said, nothing breeds existence and existence breeds nothing (Brynner, 1944).

So, we are left with a complexity which by many accounts alludes explanation, and yet experience shows that tangibles can be controlled, shaped, and modified. Organizations and societies give direction and purpose; there is, in fact, a major difference between Japanese and American automotive companies. Human will, thus, is a force. How that force exhibits itself is the focus of the Depth study that follows.

DEPTH

SBSF 8320: THEORIES OF SOCIAL SYSTEMS

Annotated Bibliography

Citation 1: Richardson, K. A. (2004). Systems theory and complexity: Part I. *E:CO, 6*(3), 75 – 79.

Summary

Richardson explains systems theory and complexity by examining five general systems theory principles. They are the second law of thermodynamics, the complementary law, system holism principle, the darkness principle, and the eighty twenty principle. He relies heavily on Skyttner's *General System's Theory* as his primary source and supports Skyttner's perspective with the work of other theorists including the notable Thomas Kuhn. The second law of thermodynamics explains that isolated systems increasingly decay until a maximum value is reached, at which point equilibrium exists. The complementary law explains that there is no single explanation of systems, but rather competing explanations. The system holism principle examines the rule that "the whole is greater than the sum of its parts." Richardson cites Skyttner in stating that the whole is unique. He also explains some complexity issues with the concept of the whole. The eighty-twenty principle is explained using Boolean network analysis. The analysis shows that twenty percent of an organization does not yield eighty percent of the output. Rather, systems can be viewed as Boolean networks of attractors that have a reduced form of nodes with unique connectivity patterns. The nodes generate a dispersion pattern associated with the mother nodes. Overall 100% of system functionality is done by approximately 64% of the nodes.

Analysis

Richardson adequately explains the core of Skyttner's general systems theory, and relies on notable theorists. However, he does not reference two of the foundation open systems theory theorists, Bertalanffy and Laszlo. His explanation and examples of the Skyttner's principles are clear, succinct, and understandable, though he delves a bit too far into explanation of Boolean networks. The Boolean figures are a very good demonstration of network theory and are more than adequate. They make reinforce a very reasonable argument.

Citation 2: Richardson, K. A. (2004). Systems theory and complexity: Part 2. *E:CO, 6*(4), 77 – 82.

Summary

Richardson examines and explains four general systems theory laws from Skyttner's book *General Systems Theory*, the law of requisite variety, the hierarchy principle, the redundancy of resources principle, and the high-flux principle. The law of requisite variety, or Conant-Ashby Theorem, is about systems limitation. It says that channel capacity controls flow. The hierarchy principle states that subsystems cluster to form levels of hierarchies. Richardson demonstrates this by filtering Boolean network models to reveal how cellular automata emerge in different system levels. Redundancy of resources shows that redundant buffer nodes do have an affect on the system. The high-flux principle explains that systems out of equilibrium will flux through space to discover a combination of subsystems that will form balance and equilibrium. Richardson briefly discusses four network topologies as a part of modularity, random, small world, ordered, and scale-free.

Analysis

Richardson conjectures the affect of spontaneous emergence on groups of people and the possibility of manipulating social systems. Citing the work of Bastolla and Parisi, he theorizes about groups' sizes and emergence dynamics. These authors are seemingly unaware of Gladwell's studies that suggest that the maximum optimum group size for effective horizontal and vertical emergence is one hundred and fifty people; or what Gladwell refers to as a tipping point. At this point, systems exhibit the characteristics of a pandemic. Of particular importance is Richardson's Boolean modeling that shows buffer nodes add substance to systems without seeming to have a direct affect on the major interaction nodes. This suggests, for example, that viewing organizations from a direct labor perspective misses the importance of support functions, or the potential for epidemic-like organizational change.

Citation 3: Richardson, K. A. (2005). Systems theory and complexity: Part 3. *E:CO, 6*(4), 104 – 114.

Summary

Richardson continues his study of Skyttner's group theory by conducting a detailed examination of Boolean network modeling to demonstrate the laws of sub-optimization and top down and bottom up dynamics. The essential rule is that optimizing subsystems does not optimize the whole system and vice versa. The redundancy of potential command explains that to control a system, there must be a well-developed feedback loop from the system. The challenge of complexity is to acquire the proper feedback in sufficient quantity and in adequate time to affect response. Richardson also writes about the relaxation time principle which states that a system cannot reset itself if it is overloaded and analyzes other principles that explain capacity, instability, and the difficulty of establishing system equilibrium.

Analysis

Richardson seems to have a fascination with Boolean networks and goes into far more detail than is needed to demonstrate the principle of sub-optimization. There is a body of scholars who most likely appreciate Richardson's approach. However, his articles might have been more helpful if he had converted Skyttner's principles into an organizational context. How, in fact, do these principles play out in terms of organizational efficacy? To his credit, some of the principles are presented in such a fashion that parallels can be drawn with organizational dynamics. At times, however, the focus on Boolean networks overshadows the important information. Richardson also does not explain the other 26 Skyttner principles. A synopsis would have been a good addition.

Citation 4: Solow, D., Szmerekovsky, J. G. (2006). The role of leadership: What management science can give back to the study of complex systems. *E:CO, 8*(4), 52 – 60.

Summary

The research question for this paper is, how much control is needed for guidance of a complex system? The authors' main focus is the question of how leaders' control affects complex systems. The answer to these questions can have a significant affect on understanding cross-functional management, fitness landscape, and worker interactions. Solow and Szmerekovsky propose a mathematical model that assumes that workers have no output without management control. The workers are designated x_1. . . . . x_n with output of $x(0)$. . . . $x(1)$ with $x(1)$ being optimum performance. The leader's control is designated as a value λ. The influence of a leader over a worker is designated as x(λ). The authors question how much x(λ) is needed to maximize the system performance defined by the functional p(x(λ)). The authors concede that their model is not realistic, but present it to represent their concept of management control.

Analysis

Solow and Szmerekovsky have a good conceptual model to express degrees of management control. However, they do not adequately address systems' complexity nor factor in Skyttner's sub-optimization principle. They explain the obvious such as, universities need low control and prisons need high control. These are extremes at either end of $x(0)$. . . . $x(1)$. Unfortunately, in an effort, apparently, to introduce more favorable examples of high control, they list just in time (JIT) manufacturing, and statistical process control (SPC). The irony is that both methods are most productive in environments of low management control. In fact, they depend on it. Nevertheless, they do recognize that leadership is a primary driver of organizational performance.

Citation 5: Boxall, P., Macky, K. (2007). High-performance work systems and organizational performance: Bridging theory and practice. *Asia Pacific Journal of Human Resources, 45*(3), 261 – 270.

Summary

Boxall and Macky studied the relationship between human resource policy and high-performance work systems where workers are empowered through skill enhancements and incentives to enable, and motivate. They observed that the ability to leverage human resource management similar to Japanese systems is essential in the current environment of international competition. Boxall and Macky identified seven direct and indirect workplace performance drivers that affect high-involvement workplace systems and drive high-performance work systems. A simple causal chain that identifies the gap between intended workplace practices and the actual human is presented as one proposal for identifying the changes needed in resource policy to create high-performance teams.

Analysis

Boxall and Macky have identified a critical component for affecting performance improvement in work teams. Human resource policy has a significant effect on worker performance, and is a crucial component in the overall management system. Nevertheless, within the context of systems thinking, human resource policy is a small component contributing to organizational performance. Suggesting that human resources is the main reason for Japanese manufacturing superiority, oversimplifies the issue. Japanese manufacturing is approached as a total system with the major components of horizontal integration, vertical integration, and daily management of processes. Human resources is a small, but important, component of this system.

Citation 6: Wang, T. (2004). From general system theory to total quality management. *The Journal of American Academy of Business, 42*(1/2), 394 – 400.

Summary

Wang's paper links total quality management (TQM) with general systems theory (GST) and living systems theory (LST). Based on theoretical background, he categorizes organizations as higher order living systems, self-organizing life systems, that function according to the interaction, behavior, and development of its subsystems. He makes a very interesting, maybe profound, point that leadership is the most important subsystem. Yet, and in accordance with von Bertalanffy's law of requisite variety, management does not control the output. The output is controlled by elements within the subsystems. Wang further explores the concept of cybernetics, or self-regulating feedback, that maintain steady state systems. His discourse examines the connection between general systems, living systems and TQM. TQM, as a living system, is also an evolving systems that has the attributes of a learning system.

Analysis

Wang was correct that GST has been developing over the last several decades. He maintains that GST is still crude and lacking precision. However, the example of TQM companies suggests otherwise. In the paper, he is not cognizant of how TQM is structured. While correctly discovering that philosophy is important to TQM, he does not know that TQM has definable subsystems that follow a repeatable structure of vertical integration, horizontal integration, and daily management. Within each of these are tools specific to those subsystems. Wang completely misses the importance of motivation and has not recognized it as a subsystem. He writes a good paper, and his general themes are mostly correct, but he has poor examples.

Citation 7: Sice, P., French, I., Mosekilde, E. (2006). An integrated frame-of-reference for modeling management systems. *Human Systems Management, 25*( ), 247 – 254.

Summary

The authors are proposing a “coherent framework of philosophical thinking” that will bring together major dichotomies such as holism and reductionism, or relativism and absolutism. They begin by creating an operational definition of modeling, which they describe as a continuous enactment, not the result of a phenomenon. It is the act, they say, of unfolding the context known to a participant. The authors take great care describing modeling, and its perceptual, psychological, and behavioral boundaries. They have a good understanding of Skyttner’s systems laws and principles as well as von Bertalanffy’s concept of holistic personality. Moreover, they assert that validity is transient over time. Observations and models, as Skyttner’s high-flux principle would suggest, are a snapshot at a point in time. Their primary interest is management. Their theories are consistent with Skyttner’s principles of self-organization, high-flux principle, law of requisite variety, and sub-optimization principle. They also consider decay, the 2nd law of thermodynamics, as a pathological autopoiesis, or self-creation.

Analysis

The authors make an excellent argument for the challenges managers face trying to control a transient environment, and pose useful arguments explaining why managerial control are only a subcomponent of the control system. Moreover, what managers may think they are accomplishing is often not the case because of a fundamental error in thinking that is an artifact of Western society. It favors control, rigidity, and force which combine to deter systems equilibrium and communication. The paper is very insightful and consistent with general systems theory. However, it refutes the suggestion of a possible model that explains complex organizational systems. This implies a lack of understanding of the actual working of Total Quality Management systems, which by their existence poses the opposite, and suggests that there is a model, it is repeatable in its application, and generates predictable outcomes.

Citation 8: Lounsbury, M., Ventresca, M. (2003). The new structuralism in organizational theory. *Organization, 10*(3), 457 – 480.

Summary

Lounsbury and Ventresca promote new structuralism as the basis for studying organizations. It moves focus away from the compartmentalization noted by Laszlo and other general systems theorists, and provides an alternative to a narrowly focused interpretation of organizational dynamics. Lounsbury and Ventresca conducted an extensive qualitative study of relevant theory and research to arrive at their conclusion. Their findings affirmed the notion of a shift from stratified organizational dynamics to systemic interaction within, and outside of organizations. They implied the need for the use of more quantification and analysis tools including relational methods. Such tools, they cited, have been used to better interpret and understand complex social and political decision-making phenomena.

Analysis

The new structuralism recognizes the interaction of organizations, society, and environments, and suggests that organizational understanding can be enriched using this approach. However, without explicitly stating so, Lounsbury and Ventresca skirt many of the core concepts of general systems theory. In particular, the authors do not discuss the law of requisite variety and self-organization. Perhaps the most important point they make is that the strict management of discrete organizational functions is embedded in archaic concepts of the source of power, an error implicit in western culture. Moreover, this error in thinking has led to archaic, unfounded, and antiquated organizational management practices that are contrary to the concept of systems and systems thinking.

Citation 9: Kumar, S., Ressler, T., Ahrens, M. (2005). Systems thinking, a consilience of values and logic. *Human Systems Management, 24*(2005), 259 – 274.

Summary

Kumar, Ressler, and Ahrens wrote an excellent paper that challenges the current culture of quantitative analysis as a management guiding principle. They posited that making decisions based solely on quantitative inputs can optimize short term gains, but sometimes at the cost of ethical context. That, they say, has resulted in the continued erosion of the quality of life in the United States as opportunistic CEOs saturate themselves in hundred million dollar salaries, while their companies fail and thousands of workers lose their jobs with no severance or safety net. The authors provide evidence that lack of qualitative considerations is the result of non-systems thinking. Their research quotes many notable scholars and personalities such as Lester Thurow, Edward Tufte, Friedrich Nietzche, David Hume, Edwards Deming, Mahatma Gandhi, William Whewell, Leonardo di Vinci, and others to carefully construct a qualitative argument.

Analysis

Rarely are so many notable historical figures quoted, compared, and contrasted. For example da Vinci's philosophy is compared to Deming's philosophy to establish that both were near identical in their perspectives of knowledge, psychology, variability, and systems theory. Deming clearly described that a system in the related sequence of inputs, processes, and outputs. Da Vinci recognized that everything is connected to everything else. The authors provide several graphic representations of their theory. However, a couple of them are over-complicated and difficult to interpret.

Citation 10: Luhmann, N. (2006). System as difference. *Organization, 13*(1), 37 – 57.

Summary

Luhmann suspected that a general theory of the concept of form could be developed that would transcend systems theory. He draws primarily from the work of Spencer-Brown who developed his own unique calculus of geometric forms to express his concepts. The principle clause in this theory is that systems are distinct from environment, and bound, in my words, by unitary difference. The paper goes on to explain Luhmann's systems theory that has four laws; difference between system and environment, systems as a single mode, social systems can be observed internally, and self-description. Luhmann's study poses the question of how and why does society re-describe the same phenomenon differently over time. In plain terms, how can systems be understood and affected by focusing on peripheral elements instead of the core system attributes.

Summary

Luhmann's discussion of Spencer-Brown's theories borders on the dichotomies and intrinsic sameness that Lao Tzu introduced in the seventh century B.C. Lao Tzu noted that by describing one thing, another thing is redefined. However, whereas Lao Tzu does describe the circularity of existence, Spencer-Brown seems less elegant in his attempt to describe the same principle. Luhmann seems no less at a loss for elegant descriptions and the result is an overly wordy paper replete with numerous circular, and un-interpretable, phraseologies such as " . . . the result of the distinction must function as unity, the distinction can neither be designated nor named. It is simply there." This may have been written as *a subsystem is unique and present.* Nevertheless, if the essence of the discussion can be found in the midst of constrained clarifications, the four principles seem to offer some valuable insight into the complexity of systems theory. We must suspect that something was lost in the translation from German to English.

Citation 11: la Cour, A., Vallentin, S. Højlund, H., Thyssen, O., Rennison, B. (2007). Opening system theory: A note on the recent special issue of organization. *Organization, 14*(6), 929 – 938.

Summary

la Cour, Vallentin, Højlund, Thysssen, and Rennison provide three examples that demonstrate Luhmann's theory. They explain emergent organizations using the example of difference, and the creation of public welfare states. Redefining meaning through multi-coding is demonstrated by the example of recasting action as a communicative device instead of an objective point of reference. This clearly resonates and examples of this can be found in societal improvements. Take, for example, the elimination of crime on the New York City subway system mentioned in Gladwell's book *The Tipping Point*. Crime was not stopped by head-on confrontation. Crime was eliminated by focus on the peripheral aesthetic, and functional attributes of the subway system. This seems exactly what Luhmann's theory of communication, where action is a communication, is getting at. Meaning was added to the system through the actions of removing all graffiti from all of the subway cars, and by making everyone pay tolls instead of beating the fare system. These disrupted behaviors and added a new meaning to the subway experience. The article's examples focus on how organizations emerge from the affects of different influences.

Analysis

The authors concede that Luhmann is difficult to understand and not widely studied as a result. They did an excellent job of simplifying Luhmann's theories by providing concrete examples of how organizations evolve as a unique phenomenon. They also show how Luhmann's theories add another perspective to systems theory and organizational development. The authors, nevertheless, treat the subject with too much brevity. While they provided some examples, they did not take the opportunity to expand on Luhmann's theories by adding more examples and insight to their discourse.

Citation 12: Becker, K. H., Seidl, D. (2007). Different kinds of openings of Luhmann's systems theory: A reply to la Cour et al. *Organization, 14*(6), 929 – 938.

Summary

Becker and Seidl critiqued la Cour's review of Luhmann's paper Systems as Difference, and offer their own critique of Luhmann. They concurred with la Cour that Luhmann's theories need to be merged with other discourse and organizational theory. They also commented that Luhmann's writing style is difficult to understand, making clear translation more difficult. Translations have made his theories come out as enigmatic puzzles instead of understandable theory. Some critics, the authors note, obscure Luhmann's theories and refer to incomprehensible scholasticism as pedantic "mumbo jumbo." The authors, however, call for "opening" Luhmann's theories as one of many possible theories that describe organizational dynamics.

Analysis

Becker and Seidl offer their own explanation of the Luhmann openings, theoretical, empirical, and international. They advocate widening the discourse of Luhmann's theories to benefit organizational studies and systems theory. What they did not discuss in any great detail was applying Luhmann's theories by getting good translations of his papers. If communication is action, and action creates change, then the obvious action is to translate his work so that it can be properly understood and applied.

Citation 13: Trochim, W. M. K., Cabrera, D. (2005). The complexity of concept mapping for policy analysis. *E:CO, 7*(1), 11 – 22.

Summary

Trochim and Cabrera suggest that complexity methodology include participatory mixed method approach, better known as structured conceptualization or concept mapping. They relate complexity to concept mapping in complex adaptive systems, for identifying complex systems' attributes in policy-making, for managing human systems, and leveraging systems energy to achieve objectives. Their article outlines the six steps for conducting their mixed-model method. The article provides an example of their version of concept mapping, and explains the dynamics of the process; including inside and outside mapping, or the mapping process, and the mapping application.

Analysis

Trochim and Cabrera's article presents an elegant mixed-model approach for defining, interpreting, and understanding complex social systems. These are essential for developing tenable policy. Their step-by-step algorithm for conducting a process map juxtaposed other methods for grasping complexity and developing effective plans. Of particular interest is their method for organizing and sorting data. However, the methodology requires a balanced matrix that, by definition, must exclude or constrain concepts. Complex systems do not come in N x N matrices. An alternate, more flexible, process mapping system are the 7 Management and Planning tools; an open-ended approach for capturing complexity, interactions, sequence, and flow.

Citation 14: Lemonides, J. S. (2007). Toward an Adlerian approach to organizational intervention. *The Journal of Psychology, 63*(4), 399 – 413.

Summary

Lemonides explained Adler's principles of individual psychology and how that psychology is linked to the larger system of the environment within which the individual exists. As individual units within that environment, humans can survive or perish based on how they interact with the system. Various subsystems of psychological health and dysfunction are examined in order to demonstrate the similarity between psychological systems and open systems theory. He then ties the two to organizational systems to demonstrate holistic efficacy and the potential for system entropy, the 2^{nd} law of thermodynamics. The conclusion of the paper summarizes the common themes between individual psychology and open systems theory.

Analysis

Lemonides used a qualitative argument based on prior research and published papers. He covered the subject well and did refer to several of Skyttner's general systems theory laws and principles such as holism, 2^{nd} law of thermodynamics, mutual interdependence, subsystems, and sub-optimization. The paper was exceptional in describing the commonalities between individual psychology and open systems. At least eight distinct similarities were noted. Particularly interesting was Lemonides discussion of organizational sickness based on the same principles of individual mental illness.

Citation 15: Kuhn, L. (2007). Why utilize complexity principles in social inquiry? *World Futures, 63*(3/4), 156 – 175.

Summary

Kuhn makes the point that science is not moving toward a more "accurate correspondence with reality." This is specifically because science attempts to describe reality through detailed understanding of isolated phenomenon to the disregard of the linkage of those phenomena. By embracing complexity theory the world view shifts to a holistic perspective where there is space for opposing perspectives, themes, and metaphors, because complexity recognizes the potential for exceptions while illuminating the essence. Kuhn perceives ontology and epistemology as mutually constitutive and in so doing is reinforced by systems theorists such as Skyttner and von Bertalanffy. He includes in his paper Schwartz and Ogilvy's seven shifts in thinking; and concludes with the positivist, naturalist, and complexity versions of five axioms that can be the framework for studying complexity and social inquiry.

Analysis

Kuhn's work clearly resonate the themes of general systems theory. Moreover, he rationally binds the potential for alternative outcomes which are, by the very nature of systems theory sub-system interaction, a probability outcome of that interaction, and the associated complexities. It leaves a great deal of space for a priori and a posteriori research and discussion as well as enriches the ontology and epistemology study of the nature of existence and the origins, methods, and limits of human knowledge. His message is that holism denies a beginning and an end, and allows that there are many starting places that arrive at the same location. This exposes the fallacy that every similar outcome must have a similar beginning and poses an interesting dilemma for social and organizational inquiry.

Depth Study

Systems Thinking

Deming (1986) and Senge (1990) introduced the concept of systems thinking in the 1980s and 1990s. They explained that systems have inputs, processes, and outputs. Most important, systems are comprised of interrelated subsystems. As systems thinking began to permeate American manufacturing, Deming was affirmed. There is now sufficient evidence to suggest that organizations function according to open systems theory. That this is so, is not based on philosophical debates about various approaches to postmodernism and systems thinking as discussed by Midgley (2003), nor on esoteric, philosophical ontological or epistemological debates. Rather, it is based on the a posteriori records that are rich with evidence supporting the effectiveness of systems thinking organizations over compartmentalized organizations. Take, for example, the general differences[3] between American industry and Japanese industry. Japanese organizations have applied systems theory widely (Deming, 1986; Ouchi, 1981; Mizuno, 1989; Johnson, 1982; Akao, 1991; Uchimaru, Okamoto, & Kurahara, 1993). They continue to perfect their organizations according to total quality management (TQM) philosophies and principles.

U.S. companies continue to focus on the short- term gains achieved by using Six Sigma focused on individual process improvement and barely looking at holistic ramifications or strategies. Even Gladwell's (2002) bestselling *The Tipping Point* makes little reference to

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[3] It is far too easy to compare Toyota to General Motors, though they are the quintessential example. The fact is that there are organizations in the United States, and other countries, that approach management using systems theory principles. However, as a culture we have not developed the incentive nor philosophical orientation to transition open systems theory management. Deming's admonitions seem to have fallen on deaf ears.

systems theory though the theme and examples in the book are examples of open systems theory as described by von Bertalanffy (1968), Laszlo (1996), and Skyttner (Richardson, 2004; 2005).

Laszlo (1996) classifies systems at three principal levels. They are the suborganic cellular assemblies, organic multicellular structures, and the supraorganic human systems that have agency; the ability to consciously, and non-randomly initiate actions. Supraorganic systems, unlike suborganic and organic systems, can use thought as input to the system, a prescient element in the system. All people contribute the prescient element, and it is the interaction of the force of individual agencies that define our reality; good, bad, enjoyable, or painful. Such are societies and organizations. A system does not imbue value on its internal entities. They are free to interact and evolve, but to do so within the rules, principles, and bounds that have been described by prominent systems theorists.

This paper is a study of open systems theory principles as they affect supraorganic organizational subsystems. It is a survey of systems theory principles, and their organizational behavior meaning. It is an attempt to illuminate actions that participants within those systems engage in that have predictable outcomes. In the Application section of this paper, we describe a case study of one organizational subsystem leveraged to improve a manufacturing plant's rolling throughput yield, and demonstrate an unanticipated, and significant, motivation effect.

Relatedness and Complexity

All things are connected is some fashion, either directly or indirectly. This can be observed on a daily basis in the events around us. In the environment, there is a clear relationship between weather and agriculture. There is also a correlation between weather and human activities. The first snowstorm of the year results in a surge in fender-bender car accidents due to slippery pavement, cold weather results in an increase in colds and the spread of viruses, and lack of exposure to the sun, affects human mood. Moreover, in industry and economics, the introduction of a new technology can change consumer behavior. Ascendancy of one type of industry may result in the decline of another industry. Take, for example, the use of the personal computer and its storage media. Personal computer storage began with 5.5 inch floppy disks with a few kilobytes of memory. They were, in fact, thin, floppy, and fragile. That media became obsolete due to the 3.5 inch disk. The 3.5 inch disk was much more robust, not floppy, less subject to damage, and had more memory. The manufacturers of 5.5 inch disks either adapted their processes to make the new type of storage or they quickly went out of business. For a brief time, Zip drives became the memory media of choice with an astonishing 100 megabyte memory capacity. That was only ten years ago, and now the typical type of storage media is the flash drive that can store eight or more gigabytes of data, over a thousand times more data than the Zip drive. The life cycle of the Zip drive was less than five years.

With the emergence of the flash drive, there was an associated wave of change within the organizations and industries associated with that media. Factories and production lines changed. Some people lost their jobs, others retrained for other work. Some technologies shifted to other continents. All of the manufacturing technologies changed, some became obsolete as new technologies emerged. In addition, computers changed to adapt to the new media. That changed the internal computer architecture. Ultimately, the functionality of the computer changed with each new enhancement. New software was developed, and entire software industries arose. This has had an effect on society and many of its institutional subsystems.

Recently, a software package called Second Life became available in the market. It is a software package that allows users to create a computer persona that interacts with other personas. It is a replacement for the old chat room, and has spun off into academia where research is being conducted on the potential of using the software for a virtual classroom. If we were to extrapolate the potential of a virtual classroom, we might conclude that property tax burden could be reduced by replacing brick and mortar secondary education with online classrooms. Students could receive classroom instruction through Second Life at home. How would this affect socialization and personality? The connections evolve. We have come a long way since stone tablets.

Connectedness

Laszlo's (1996) three levels, suborganic, organic, and supraorganic, are interconnected and interdependent. This is the basic premise of systems theory. People are interconnected in the environments within which they reside (Lemondides, 2007). At a basic level, such as a production line, the inputs, processes, output rates, and conformance are understood; albeit to varying degrees of effectiveness. However, if we link those production lines to inventory management, human resources, maintenance, market fluctuations, or equipment, the ability to comprehend and quantify interrelatedness becomes less precise. Thus, simple systems connect with other simple systems to form more complex subsystems. Subsystems, in turn, interact with, and affect, one another to form larger and even more complex arrangements, or systems (Solow & Szmerekovsky, 2006).

The problem that Laszlo observed was that there has been little understanding of how multiple influences interact to produce a social phenomenon, or how organizational components interact to produce an operational form. This is due to the dynamic nature of open systems that cyclically grow, decay, or regenerate when conditions of plasticity exist (Laszlo, 1996). Trying to model and interpret these interactions is transitory because complexities are affected by change over time (Sice, French, & Mosekilde, 2006). This is Skyttner's high-flux principle of constant change (Richardson, 2004). Even connectedness is in constant flux.

Skyttner's Open Systems Principles

Richardson (2004:2005) used Boolean network simulation to test some of Lars Skyttner's most prominent open systems theory principles. I will briefly examine the principles that provide the greatest insights into organizational dynamics, complexity, and behavior. First, and most prominent is the concept of holism. Holism is the interaction of subsystems to create a whole that is greater than the sum of its parts, and it is unique (Richardson, 2004). Holism means that actions in one subsystem, or part of an organization, will have affect other parts of the organization (Solow & Szmerekovsky, 2006).

In organizations, holism implies that there is much more than is revealed on the surface (Richardson, 2004). Deming (1986) refers to this as the unknowable, the implication being that until managers begin to understand that they work within a system, and manage as such, they will not be managing well. The Japanese understand the principle of holism, and have created organizational systems with great concern for linkage (Boxall & Macky, 2007), and organizational interaction (Akao, 1990; Mizuno, 1988; Matsumoto, 1993). Holism also has a profound metaphysical connotation. Kuhn (2007) considered holism as having no beginning or an end. An organization, therefore, cannot reach a state of perfection, though as a subsystem to a greater whole, organizations do have an inception point, and can definitely have a termination point.

The Law of Requisite Variety

There is a tendency in subsystems for autopoiesis, or self-creation (Luhmann, 2006; Sice, French & Mosekilde, 2006). Take any group of humans, put them in any type of situation, and they will begin to make sense of the situation and self-organize (Kuhn, 2007). Trochim and Cabrera (2006) would consider them active clusters of semi-autonomous agents interacting to create an emergent complexity. Requisite variety can be a great force in the early stages of a situation or organizational development. However, the law of requisite variety has limitations. First, system or subsystem control can be exercised only if the extent of what needs to be controlled does not exceed the control vehicle, or channels (Richardson, 2004). A corollary is Ashby's Law that explains the capacity of the human brain has limitations and can be overwhelmed. Moreover, Conant-Ashby's theorem suggests that to regulate a system requires a complete understanding of the system (Richardson, 2004). Something that is not possible in large, complex systems.

What does all of this mean in terms of management? Organizational management exists within a dynamic state of continuous transition. Even between established departments, interaction creates degrees of continuous self-regeneration. Because of autonomous self-regeneration, managers do not have sole rule-making authority. The expectation of authority, as Sice, French, and Mosekilde (2006) point out, evolved out of a misunderstanding about the source of power. Too often managers believe that they are imbued with the authority, and accordingly have the ability to control the group. Requisite variety suggests otherwise. No manager has absolute control (Wang, 2004; Richardson, 2004). The up side of this is that managers can rely on subsystems to function with minimal guidance or direction. They do not need to have complete knowledge of functions to achieve specific goals. Groups work as the principle suggest; the self-organize. All that is needed is a goal, training, a vehicle, and direction. Managers can achieve high-order effects by generating small nudges (Richardson, 2004). The organization will produce the rest. A major distinction between U.S. and Japanese manufacturing is that the Japanese have developed Total Quality Control as the vehicle for self-organization. It is best exemplified by Toyota's Production System (Liker, 2004).

Modularity and Self-Organization

Two principles explain why managers can rely on minimal control (or domination) over their work force. They are modularity and self-organization. Modularity is the principle explaining that workers will break into modules. Modules can emerge spontaneously into functioning entities. Once established, they can create communication barriers that protect the entity. Richardson (2004) calls the barriers "walls of constancy" (p. 80). Modularity goes hand in hand self-organization, a principle that recognizes that order emerges from disorder (Richardson, 2004). Self-organization begins when local agents interact with the environment to evolve patterns without a prior blueprint. The dynamics of the process are affected by the nature of the organization, the character of the participants, and their relationship. The process utilizes knowledge to adapt, learn, and counteract unpredictable organizational behavior (Sice, French, & Mosekilde, 2006).

The Eight-Twenty Principle

Boolean modeling demonstrates that approximately 64% of an organization is needed to support 100% functionality. This is contrary to the misconception that 20% of an organization will produce 80% of organizational results. Unfortunately, many organizations have been sub-optimized because the 80/20 argument has been used to justify severe downsizing (Richardson, 2004). Notwithstanding the difficulty of determining which 20% produces the output, there is the complicated matter of the eighty-twenty principle. In the eighty-twenty principle, the allegedly useless percentage of workers do, in fact, have a critical function.

Boolean modeling reveals the existence of significant ‘frozen’ nodes. They are the core critical functions, sort of like an organizational skeleton. Modeling also shows that if the non-frozen, allegedly non-direct employees (stable), nodes are removed, the system becomes very unstable. The slightest influence can disrupt the frozen nodes and change the outputs. Consider, for example, a company that cuts the quality staff. The staff is not direct labor, and contributes nothing to output. However, remove them and the quality of the output is likely to change. Removing stable nodes can severely weaken an organization. The laws of requisite variety and the eighty-twenty principle pose an interesting challenge for managers because they those principles explain the potential for sub-optimization.

Sub-Optimization, Systems Thinking, and Quality Function Deployment

The principle of sub-optimization states that the potential for pathological autopoiesis is latent within complex systems. To optimize one element or subsystem will sub-optimize another part of the system (Sice, French, & Mosekilde, 2006). In addition, if all subsystems work at their optimum, the entire system will not operate at optimum efficiency (Richardson, 2005). Lemonides (2007) reasoned that sub-optimization is caused by misalignment between subsystems. That is a natural open systems dynamic.

One causal factor for organizational sub-optimization is lack of systems thinking by managers. Lack of systems thinking was Deming’s (1986) warning. Senge (1990) explained in greater detail how non-systems thinking resulted in lack of organizational cohesiveness.

Managers of organizations that do not focus on a systems process approach, cannot explain inefficiencies nor prescribe corrections. One result (or perhaps cause), as Kumar, Ressler, and Ahrens (2005) observed, is stress on quarterly dividends, visible figures, and financial rewards causes managers to focus on the wrong things. Yet, it is not unusual for managers to be at a loss to explain what generated those figures or how to improve upon them. Deming (1986) noted the same. While figures are important, they are a function of organizational efficiency.

Organizational efficiency is a function of subsystem interaction and cohesiveness. Managers can better apply their leadership by focusing on systems' cohesiveness, and cross-functional management. Luhmann (2006) noted that without interaction between subsystems, entropy will occur. We might add that varying degrees interaction will result in varying degrees of entropy. Moreover, focus on peripheral system elements can lead to substantive changes. Gladwell (2002) provided evidence to substantiate Luhmann's theory. Focus on sub-elements can have beneficial results on the entire system.

Interaction and the potential for sub-optimization can be demonstrated using quality function deployment (QFD). At a minimum, QFD has thirty matrices (Haefner & Bartell, 1993) showing the relationships between customer needs and all of the organizational functional areas that touch those needs, including ongoing improvement and redesign. For example, one matrix, the A-2 matrix, links customer needs with organization functions. The B-2 matrix links functions and cost, and the G-2 matrix tracks equipment deployment (Figure 7).

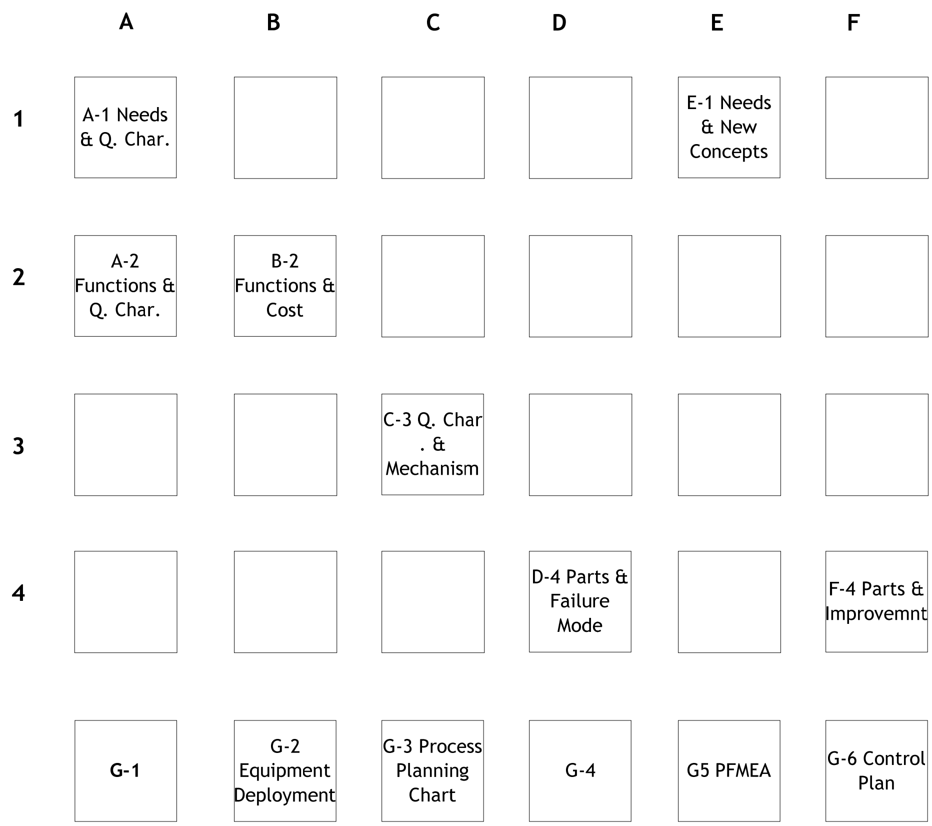

Figure 7. QFD matrix of matrices adapted from GOAL/QPC.

The QFD 'matrix of matrices' shows product development and a way to track product evolution. Within that system is the A-1 matrix that shows the relationship between customer needs and product or service quality characteristic. The A-1 matrix is the house of quality, and is a powerful tool for grasping the complexity associated with what a customer wants and how those wants are provided, the WHATS and the HOWS. This paper does not get into explaining the total features of the house of quality. However, one feature, the roof, is particularly useful because it demonstrates principles of sub-optimization. The roof at the top of Figure 8 shows powerful synergies or powerful conflicts between the HOWS. Crosses are positive synergies and lines are conflict relationships where a positive movement in one element results in a negative movement in the other. For example, a rise in gasoline prices will have a positive relationship with reduction of environmental pollution, but have a negative relationship on a family budget. QFD exposes such relationships, and serves as an excellent example of the principle of suboptimization cited by Lounsbury and Ventresca (2003).

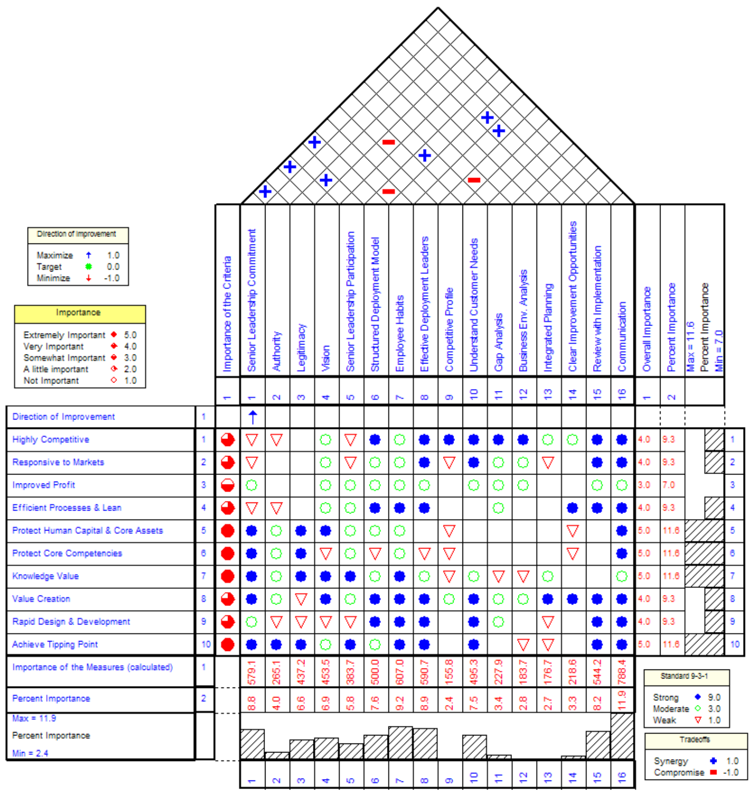

Figure 8. QFD matrix showing conflict or synergy.

Complexity

Every organization is shaped by its own social and cultural processes (Lounsbury & Ventresca, 2003). The manner in which an organization evolves and adapts can bewilder managers (Trochim & Cabrera, 2005). This is complexity, and it challenges managers' ability to comprehend and manage their unique environment. Linear thinking, partitioning functions, or non-systems thinking do not help them. However, the moment managers begin viewing their organizations as systems, they begin to construct a conceptual framework (Kuhn, 2007) that allows for much greater insight about the nature of their organization. Complexity becomes "as a paradigmatic package, a strategic orientation, with its metaphors having potential relevance across disciplines" (Kuhn, 2007, p. 164).

Kuhn (2007) has identified ontological and epistemological characteristics of complexity. First is the nature of reality. He concurs with von Bertalanffy, Laszlo, and Skyttner's theories of emergence, the high-flux principle, and self-organization; in particular, the dynamic nature of organizations, and their capacity to self-organize. Kuhn also explains the ontological nature of studying organizational complexity, noting that the act of observing alters the observed. This leads to his second consideration that the relationship between the observer and the observed is also dynamic and evolving. The act of study alters the study process and the nature of the object of study.

Kuhn (2007) also explains his third assumption that time and the context of an organization must be merged to create hypotheses. Otherwise, only the most general of principles are tangible enough for discussion. The reason for this resides in his fourth assumption of mutual interaction between organizational entities such that it is impossible to differentiate between cause and effect. While this may be an interesting epistemological debate among scholars, it is not true at a functional organizational level. In fact, Kuhn must operationally define time. Is it the moment between last month's scrap rate, or is it a decade in the history of an organization. The a posteriori record shows that many managers understand their organizations, they initiate strategies to affect positive change, and competitive advantage. Kuhn's (2007) fifth assumption, focus on values, leads to a better understanding of organizations. This observation is consistent with Luhmann's theories regarding the study of peripheral system elements as a means for understanding the system (Luhmann, 2006; la Cour, Vallentin, Hojlund, Thysen & Rennison, 2007; Becker & Seidl, 2007).

Organizational Subsystems

Most organizations are systems that contain subsystems. In a typical manufacturing organization system, ISO defines several core subsystems. They are:

1. Customer input.
2. Product realization.
3. Customer communication.
4. Product realization.
5. Production
6. Sales
7. Quality
8. Corrective actions.
9. Infrastructure
10. Human resources.

Each subsystem has an input, processes to modify the inputs, and outputs. There are also support functions such as accounting, or information technology. Moreover, there is interaction between the functions, and some loop back to each other to add another layer of complexity. Some of these contain their own subsystems. We will call those elemental subsystems. Take for example, human resources. That department is responsible for recruiting, interviewing, reference checks, pre-employment screening, hiring, orientation, training, and internal discipline. They also maintain records, manage termination issues, workers' compensation, safety, temporary workers, and more. These are smaller subsystems. They all have inputs, processes, and outputs.

The Motivation Subsystem

A critical subsystem in any organization is the motivation subsystem. Motivation has been debated since at least the beginning of the industrial revolution. It was the subject of Weber's (2002) epic tome *The Protestant Ethic and the "Spirit" of Capitalism.* Motivation was also the focus of Maslow's more contemporary seminal work *Maslow on Management*, and Ouchi's extension of McGregor's theory X and theory Y, *Theory Z.* These works demonstrate a difference in motivation mechanisms, and suggest several advantages for researching motivation in relation to systems theory principles.

First, motivation systems involve human psychological states that are subject to nuances, complex social mechanisms, and are less mechanistic than a functional organization process. Study of motivation as a subsystem presents an example of the complexities that emerge when combining organizational elemental subsystems with human psychology elemental subsystems. Moreover, there is an abundance of evidence of outcome differences from those subsystems; as well as a rich body of research and theory. Of other interest for this study is the more compelling issue that motivation has not been efficiently studied as a subsystem from the perspective of open systems theory. There are many theories showing motivation models that have inputs, some human action that is considered a process, and the human performance outcome. However, the Holy Grail of motivation has not been found, and a prescriptive approach has not been developed as a result. Ouchi, Deming, Drucker, Maslow, and the other researchers cited in this paper, presented only pieces, but not the full picture. So, an overriding research question would be, how do elemental motivation subsystems affect worker performance?

Another important reason for studying motivation, is that in an increasingly competitive manufacturing world, every possible efficiency is important to maintain a competitive edge. Almost all of the trends in competitive improvement over the last thirty years in the United States have been in technology and process improvement. Statistical process control, quality function deployment, 6 Sigma, and Lean methods have been pervasive. However, they are only piece-meal efforts to emulate world-class systems. As we know from Ouchi's (1981) study of companies in the United States and Japan, and Liker's (2004) studies of Toyota Production Systems, motivation is one of the most important, and possibly the most overlooked, competitive force. Ouchi referred to Japanese style employee motivation as theory Z, an extension of McGregor's theory X and theory Y. Most of Ouchi's observations were based on elements of Japanese culture. However, there were many companies in the United States with similar motivational cultures, demonstrating that motivation is based on tangibles that are common to all people.

Pundits have been excusing Japanese methods as cultural when the reality is that Japanese management simply discovered basic elements of human motivational psychology first. We know this to be true because Maslow's (1998) research demonstrated the same motivational mechanisms that Ouichi (1981) described, and was the first person to use the term theory Z. Current research suggests that motivation is systemic (Haefner, 2008) with the subsystems, leadership, environment, individual psychology, deterrence; and elemental subsystems (Table 1).

Table 1.

An Assessment Table of Motivational and a Deterrent Category.

Leadership	Environment	Individual	Non-Deterrent Behaviors
Enabling Formulation	Org. Values & Dynamics	Self-efficacy	Valued Work
Task Significance	Interest Alignment	Prosocial Motivation	Enlightened HR Policy
Natural Work Units	Trust	Commitment	Fact-based Management
Intellectual Stimulation	Autonomy	Self-monitoring	Quality Systems
Regulatory Foci	Shared Norms	Agreeableness	Consistency in Task Significance & Performance
Participative Decision-Making	Normative Intrinsic	Positive Mood & Attitude	High Perceived Utility
Job Design	Group Rewards	Intrinsic Motivation	High Task Interdependence
Extrinsic Motivation		Self-determination	Task Simplicity
Goal Setting		Goal Regulation	Low Formalization

Note: The opposite is deterrent behavior.

Each of the elements in the four subsystems above, contain complexities. Those will not be examined in this paper. However, Langfred and Moye's have a task autonomy model the demonstrates how elements can interact with other elements (see Figure 9). The inputs influence the process of task autonomy that affects the human motivation envelop. That, in turn, produces a performance output effect, a motivation effect. This is but one elemental subsystem, only one within the environment subsystem in Table 1. The environment subsystem fits into the motivation subsystem, and the motivation subsystem fits within the organization system. Figure 10 shows a graphic representation of this. Notice that Figure 10 can be a model for many other types of complex human or organizational systems.

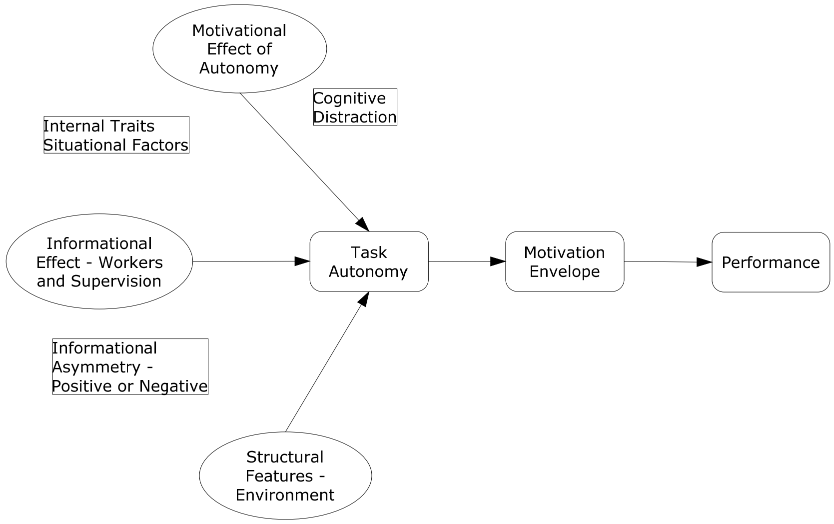

Figure 9. A variation adapted from Langfred & Moye's task autonomy model.

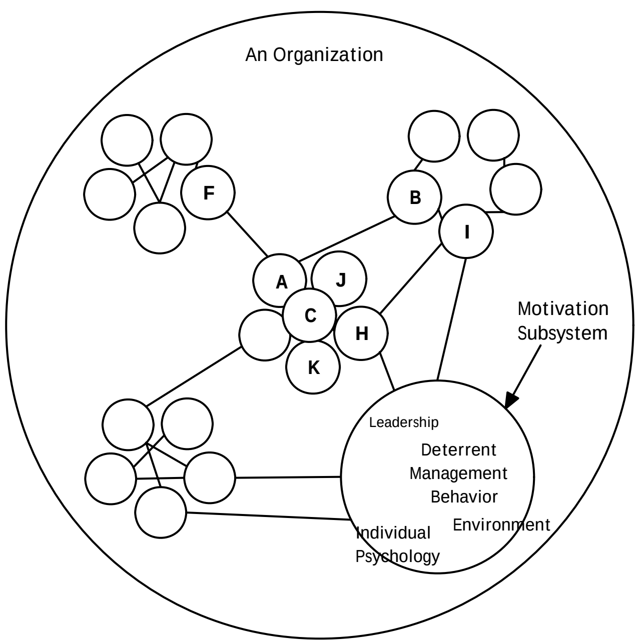

Figure 10. Motivation subsystem within an organization.

An Open System Planning Approach

The four subsystems within the motivation system are shown in Figure 11. Leadership, environment, and individual psychology, all intersect with non-deterrent management behavior. Deterrent behavior include theory X management behaviors such as micro-managing, over-control, distrust of employees, not recognizing employee contributions, and the absence of fact-based decision-making. Deterrence or non-deterrence behaviors set the standard for leadership, environment, and individual psychology. Deterring management behavior seriously undermines the potential benefits of the other motivational subsystems. Assuming that there are no serious deterrent management behaviors, the other motivational groups are free to engage.

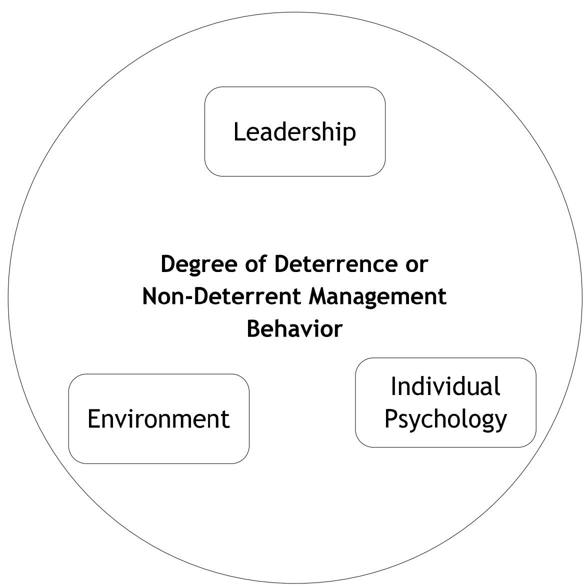

Figure 11. The motivation subsystem encased by degree of deterrence.

Deterring or non-deterring management behavior sets the tone for organizational culture and environment. Theory X management is inherently destructive (Drucker, 2007). Replacing such behavior with non-deterring behavior is an intuitive, rational, and necessary for optimum organizational performance. Systems thinking methods and tools can be used to alter the motivational subsystem. In the late 1980s, in an effort to create better instructional tools for statistical process control, GOAL/QPC came across many references to Japanese management methods and systems (Brassard, 1989). GOAL/QPC's executive members discovered the work of Shigeru Mizuno. Mizuno wrote about planning tools that helped managers understand organizational complexities and relationships. Brassard found that these tools and methods were not new. Some were even being used in the United States (Brassard, 1989).

The methods and tools that Mizuno wrote about came to be known as the Seven Management and Planning Tools, or the 7 MP Tools (Brassard, 1989). The 7 MP Tools are countermeasures for complex systems, and consistent with a systems approach to management. They help manage or modify the type of system complexities observed, and theorized by von Bertalanffy, Laszlo, Skyttner, Kuhn, Luhmann, Kumar, Ressler, & Ahrens, Richardson, Wang, Trochim & Cabrera, Lemonides, and Solow & Szmerekovsky. The tools are the affinity diagram, interrelationship digraph, tree diagram prioritization matrices, matrix diagram, process decision program chart and activity network diagram.

Table 1 is the result of an affinity[4] process that grouped the elemental subsystems into their motivation subsystems. The affinity subsystems are then linked to each other by determining what group drives the others. An interrelationship digraph is shown in Figure 12. The digraph shows the flow and relationship of the motivation subgroups. If the digraph is used

[4] Note that the affinity process was not demonstrated in this paper. The process involves grouping items by a common theme determined by participants in the process. The affinity process itself allows the group to develop operational definitions of the items and groups. In the process consensus is achieved.

as a planning tool, it shows what subsystems drive the others, dependencies, interactions, and bottlenecks. Figure 12 shows that the presence or absence of deterrent management behaviors will directly affect the nature of leadership. Leadership, in turn, directly affects the employee environment and the psychology of the individual employees. The interrelationship digraph also shows an interaction between individual psychology and environment.

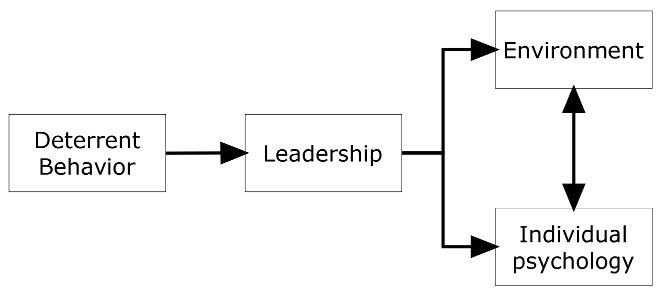

Figure 12. Motivation system interrelationship.

Deploying and Prioritizing Motivation

The interrelationship digraph shows that the first task for improving employee motivation is to address deterrent behavior. The elements in deterrent behavior are:

1. Employer undervaluing work results.
2. Punitive focus.
3. “Impression” management, non-fact based, gut instinct.
4. Not using Total Quality Management practices.
5. Inconsistent relationship between task significance and job performance.
6. Perceived utility of task is low.
7. Task interdependence is low.

8. High task complexity.
9. High formalization.

These elements fall into four categories, management attitude toward workers, manager problem solving approach, job design, and infrastructure. Using the 7 MP Tools we put these into a tree diagram as in Figure 13. The tree diagram continues to refine strategies and control complexity by creating a structured approach for organizational action.

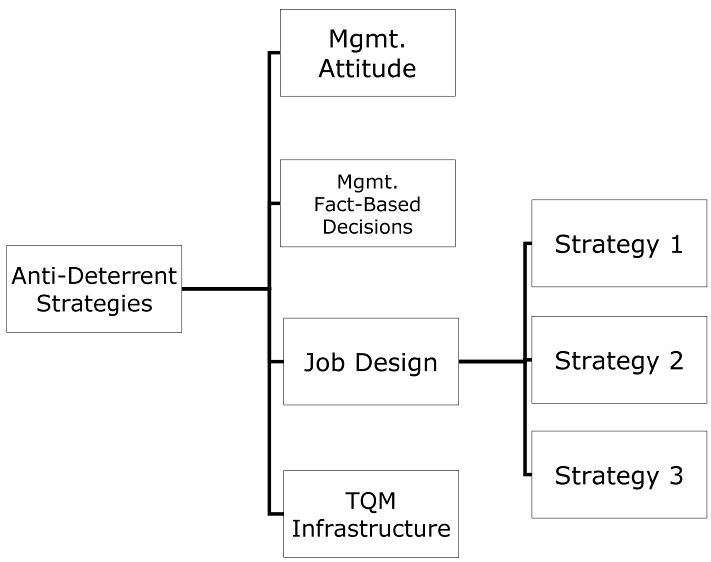

Figure 13. 7 MP Tools tree diagram for deterrent management countermeasure.

There will also be tree diagrams similar to Figure 13 for the leadership, environment, and individual psychology; although individual psychology is strongly dependent on personality. That is to say, if the strategies for improving leadership, management behavior, and environment are properly executed, then individual psychology will be improved thereby generating a motivation effect. When the tree diagram is completed and a list of projects presented, resource constraints begin to emerge. There could be dozens of action plans throughout an organization. To try and achieve all of them would introduce more complexity, and possibly become unmanageable. To address this issue of reemerging complexity, the next of the 7 MP Tool used is the prioritization matrix shown in Figure 14.

	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Row Sum & % of All Scores
Strategy 1	5	1/5	1/10	10	15.3 (15.3/total scores)
Strategy 2	X	X	5	X	X (XX.X)
Strategy 3	X	1/5	X	X	X (XX.X)
Strategy 4	X	X	X	1/10	X (XX.X)
Strategy 5	X	X	X	X	X (XX.X)

Figure 14. Prioritization matrix.

Every box in the prioritization matrix has a numerical of 1 to 10 and their inverses. Scores above one show a supporting relationship, below one are non-supporting because they add little to the final score. The scores are summed across the rows, and the percentage of the row score to the total score is calculated. The scores are the rankings for the strategies. The higher row percentage indicates strategies with greater impact. In this way the strategy, or strategies, that have the greatest affect across multiple improvement criteria will be chosen.

Often, only a couple of strategies are needed to generate a significant improvement. Management budgeting and resources determine what, and how many strategies can be deployed.

The 7 MP Tools include two additional methods for the project management of deployed strategies, the program decision program chart for planning implementations with unknown contingencies, and the activity network diagram for known deployment timelines. As a set, the 7 MP Tools are designed specifically for interpreting complex systems, and deriving rational plans that counteract the confusion and inefficiency of ad hoc planning. In addition, the 7 MP Tools control the phenomenon described by open systems theory principles.

Summary

Skyttner listed over forty open systems theory principles (Richardson, 2005) that encompass the theories of von Bertalanffy, Laszlo, Luhmann, Gladwell, and others. These principles describe the complexity of nature and society, and offer insight into organizational development. Several principles are pervasive and describe system dynamics that are frequently encountered in organizations and human systems. They are:

1. complexity
2. holism that expands system outcome (Solow & Szmerekovsky, 2006)
3. self-organization
4. law of requisite variety
5. high-flux
6. modularity
7. sub-optimization

Complexity theory states that chaotic, or random phenomenon, are part of an intact system (Kuhn, 2007). The world is comprised of systems that are linked, and there are potentially, unlimited linkages. Complexity prevents precise modeling, and allows only generalizations that may be snapshots in a transitory environment. This necessarily leads to ontological and epistemological discussions for which there are no final conclusions. As Kuhn states, there is no beginning and no end.

The holism principle states that the whole is greater than the sum of its parts. In other words, there is a synergy in complex systems, and organizations, that can interact to produce unforeseen outcomes. This principle is moral-value free, so the outcome of synergies can result in good or bad. History is a record of the destructive outcome of the interaction of poorly thought out, complex subsystems. The 2008 financial market melt-down would be an example. What is happening is an example of vertical emergence where the whole is different from the sum of its parts (Richardson, 2004). The investment banks certainly did not want to go bankrupt. The point is that there are interactions that expand system outcomes. There is also an element of non-predictability.

Self-organization is an open systems theory principle that means, order comes out of disorder. In every system there are, for lack of a better word, catalysts. The catalysts in human systems are people who work together, without any guidelines, to develop organizational patterns. Who they are, what they know, and what they develop determine their environment, their relationships, and how they feed influence back into the system. The phenomenon is dynamic, adaptive, and energized as a response to chaos and inconsistency (Sice, French, & Mosekilde, 2006). Self-organization is a societal trait and embedded in the human psyche.

Closely aligned with self-organization is the law of requisite variety, or self-creation, autopoiesis. The principle of requisite variety means that control of any system has limitations. Control cannot be exercised if the lines for control exceed the magnitude of what is being controlled (Richardson, 2004). It is the same as a computer with too little memory, or a computer processor with insufficient speed. From a management perspective, it means that managers do not have absolute control over their organization. Moreover, complexity creates additional barriers to control. So, according to Sice, French, & Mosekilde (2006), management must tolerate a certain amount of organizational autonomy.

High-flux means that new patterns will emerge in systems that are not in equilibrium. The evolution of patterns cannot be stopped because systems have a natural reaction to perturbations. This makes sense. It is just like water filling a depression. Consequently, unless the shape of the depression is known in absolute detail, the process of filling the depression cannot be modeled with complete accuracy. In other words, there may be too little or too much water to fill the depression. Modularity reinforces high-flux. It adds that social beliefs have constitutive power that generates organizing energy.

Finally, sub-optimization is the dynamic that prevents the total optimization of the system. To optimize all subsystems will result in a sub-optimized system, and vice-versa. Sub-optimization also increases when subsystems are out of alignment. However, even with balanced alignment, or organizational equilibrium, optimizing an entire system is not possible according to this principle. Optimizing subsystems will be at the expense of other subsystems (Sice, French, & Mosekilde, 2006).

There are additional open systems principles. Skyttner's *General Systems Theory* is a succinct source. Luhmann has also made significant contributions to open systems theory. His work, however, is obscured by the poor translation from German to English. Open systems theory is tremendously important because of the complexities of the world's growing economic community. To acknowledge the possibilities of open systems theory removes the blindness of not knowing.

Conclusion

Open systems theory is not enigmatic. The theory explains the dynamic, adaptive, and evolving nature of the world, or organizations. The concepts are simple, but making the transition from non-systems thinking to systems thinking, linear thinking to multi-dimensional thinking, is challenging for some managers. The benefit of making this transition is significant because it changes the way organizations are perceived, and enables managers to make more appropriate business decisions. Instead of dealing with moment-to moment-issues, they are dealing with transitory paradigms that generate previously unknown concepts, themes, and metaphors. And, according to Luhmann, it is those that have the most powerful affect on the system.

The new themes require the use of new tools, methods, and techniques for comprehending complexity. Tools such as system maps, flow diagrams, and 7 MP Tools are very useful. They are the calculus of complex systems, or graphic language tools. Moreover, it cannot be ignored that statistics and systems engineering techniques are requisite. This implies a new type of manager. One of the key elements, for example, of the motivation subsystem is intellectual stimulation. That literally means that the manager has the skill to comprehend technical obstacles and the ability to resolve or overcome them. Lacking that skill diminishes worker motivation and associated output because the organization becomes locked into process obstacles. It is worth noting that one very key distinction between the typical Japanese or German manager and the typical American manager is the amount of training and education. Juran (1951/1988) published the type of training that infused Japanese culture in the later half of the 20th century. There is a clear focus on statistics and technical skills that simply did not exist (in intensity) in the United States, statistical process control for example.

Kuhn (2007) concluded that systems theory and viewing the world as a complex system leaves room for different perspectives; a welcome thought in our sometimes polarized world. It is OK to have different perspectives. It is natural. There are ways to deal with differing perspectives; the mere act of adopting systems-thinking, helps groups deal with complexity. Take, for example, our consideration of motivation subsystem. One element for improving motivation is fact-based decision-making, non gut-feel decision-making. This involves the use of statistics, the 7 MP Tools, 6 Sigma, Lean, and a cadre of other tools, techniques, and methods. Consider also, that those tools go beyond mere deductive or inductive thinking. Methods such as quality function deployment actually morph graphic language tools into an inductive approach for understanding complexity, and developing appropriate systems for addressing complexity.

Finally, it must be asked, what type of management system is a systems-thinking management system? Japanese literature leaves little doubt that they have acculturated the techniques of systems thinking. The systems they evolved have been improperly named total quality control, or total quality management in the United States and Europe. The moniker of TQM seems like an attempt to get at the size, breath, and scope, hence the word total. It was also trying to capture a qualitative essence, hence the word quality. The word quality is misleading. It was never about quality. It was always about complexity. Losing that focus resulted in initial over-concern about statistics, and a bunch of confusion over Deming's 14 Points. Deming himself missed the point. The issue was, and continues to be, system complexity; how to address it. We should refer to such systems as TCC, total complexity control.

Future research questions may be, do successful managers, managers that move organizations, say Jack Welch with his 6 Sigma, actually leverage systems thinking principles to achieve their goals? Do they understand what they are doing, or are they just intuitively disposed to think and do the way they do? The answer to these questions might lead to a real prescriptive approach that could become the core curriculum for business and engineering schools.

APPLICATION

SBSF 8330: PROFESSIONAL PRACTICE AND SOCIAL SYSTEMS

A Case Study and Application

This study examines systemic motivation as described by the subgroups leadership, environment, individual psychology, and deterrence orientation, and their elements listed in Table 1. It contrasts the difference between a management and supervisory environment that inhibits motivation and creates a low motivational (low M) saturation environment; and a management environment that leverages these motivational behaviors, a high saturation motivation (high M) environment. The study is consistent with the models shown in Figures 1, 2, and 3, and suggests a prescriptive approach that can be replicated. Moreover, the contrast between those two behaviors is documented using production throughput, a response, demonstrating the potential for a model of systemic motivation. This study forms a foundation for further research on motivation and productivity.

In this section we present a case study of the affects of the two motivational environments and the affects of those on worker productivity. The initial, low M, environment was characterized by substandard leadership, negative deterrence orientation, and a debilitated functional environment that led to suppression of intrinsic worker motivation. The result was a production throughput loss of about $ 9 million. The environment that replaced the low M environment leveraged the potential of a high M environment, resulting in a recovery of the throughput loss, plus an additional, unprecedented motivation bonus of about $ 1 million.

A description of the low M system

In 1995, a state-of-the-art Japanese battery manufacturing line that produced hundreds of batteries per minute, had been sub-optimized and was losing production throughput on the second and third shifts. The production lines were designed to work continuously and did so as long as strict raw material and process parameters were met. However, for reasons unknown at the time, production throughput on the D cell line deteriorated on the 2nd and 3rd shifts, with the 3rd shift producing less than 50% of line capacity. The net loss in salable product approached $9 million per year.[5] The units produced per shift[6] in average batteries-per-person (bpp) throughput is shown in Table 2, a substantial productivity loss. The anomaly of satisfactory 1st shift production contributed to management suspicions about 2nd and 3rd shift personnel. It was a union shop, and the tension between supervision and maintenance was substantial. In the absence of a solution, and in an atmosphere of suspicion and distrust, the working integrity between workers, maintenance, and supervision deteriorated, further compounding the problem.

[5] Line speeds varied based on battery size. The data in the paper is based on a slower line speed. The actual throughput losses were higher.

[6] The data is taken from the average productivity rate per shift. The production rate was amazingly consistent day for day. It appeared as if the process decayed for each hour after the day shift.

Table 2.

Average Production Throughput Per Person Per Shift

	Shift 1	Shift 2	Shift 3
Units per Shift	153000	107100	76500
Avg. Units/Employee	25500	17850	10929

Changing Supervisors

As the peak Fall (pre-holiday) production period approached, senior management was understandably nervous and decided to change supervisors. Changing supervisors had been tried before with little success, so they modified their approach and asked a recently hired systems engineer to volunteer to supervise the night shift and also try and solve the throughput problem. The engineer had already completed several notable production improvements at the plant, one generating over a million dollar improvement. He had an advanced degree from the University of Wisconsin's College of Engineering, with specialization in systems and quality engineering. The University of Wisconsin's program was steeped in Deming philosophies, Juran's pragmatism, Box's statistics, and Japanese manufacturing techniques. He was, therefore, well-grounded in industrial statistics, fact-based decision-making, Japanese management systems, Deming philosophy, an array of tools, techniques, and methods including the 7 Step Improvement Process; a superior and more flexible problem solving model than 6 Sigma's DMAIC.[7]

[7] DMAIC is define, measure, analyze, improve, control.

Fixing Production

The engineer/supervisor (ES) immediately began a collaborative, fact-based approach to study the production problem. On the first night shift, he began working with the maintenance worker, and the line operators to improve production. The ES set the goal of full production, (though the maintenance worker was doubtful) and began experimentation and sensitivity studies to bracket production parameters. By the end of the first shift, progress was made setting bounds to the production parameters. By the end of the week, 3rd shift production improved to the level of the 2nd shift. Motivational elements that were useful during the first week were fact-based management, intellectual stimulation (having technical skills helpful for solving the problem), enabling formulation, goal setting, and participative decision-making (see Figure 15).

Notice that the ES was leveraging the constitutive potential of the system. He engaged the key person, the maintenance technician, to help restore equilibrium. A new pattern was established, the systems theory high-flux principle, by collaboration between maintenance, supervisor, engineer. This blend of skill and technical ability leveraged a synergy that had not existed. The ES was also leveraging modularity, or the constitutive power of systems.

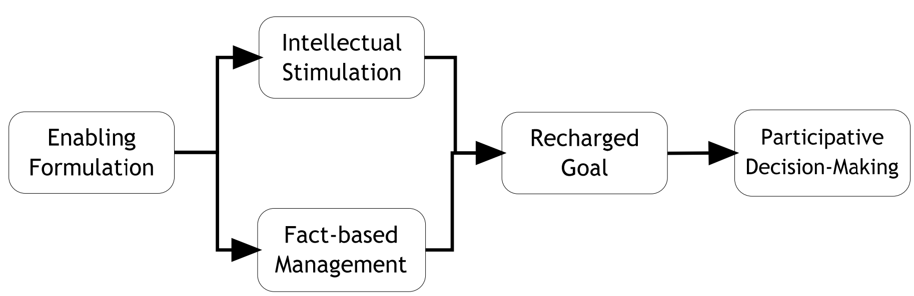

Figure 15. Week 1 motivational elements

By the end of the 2nd week's collaboration, the 3rd shift average number of units per worker had increased to near full production. The problem had been solved. The failure in the production line was associated with cathode breakage[8] at the cathode forming station. The operators set the forming machine to the process control parameters indicated on the process control plan. They were to adjust the process to target the nominal physical product specifications. Three cathode characteristics were tracked using statistical process control $\bar{X}$ & R charts. They were cathode height, weight, and width. The 2nd and 3rd shifts tried to follow the 1st shift statistical process control charts. Figure 16, cathode weight $\bar{X}$ & R chart is in statistical control and reveals no process problems. The cathode height and width control charts were similar.

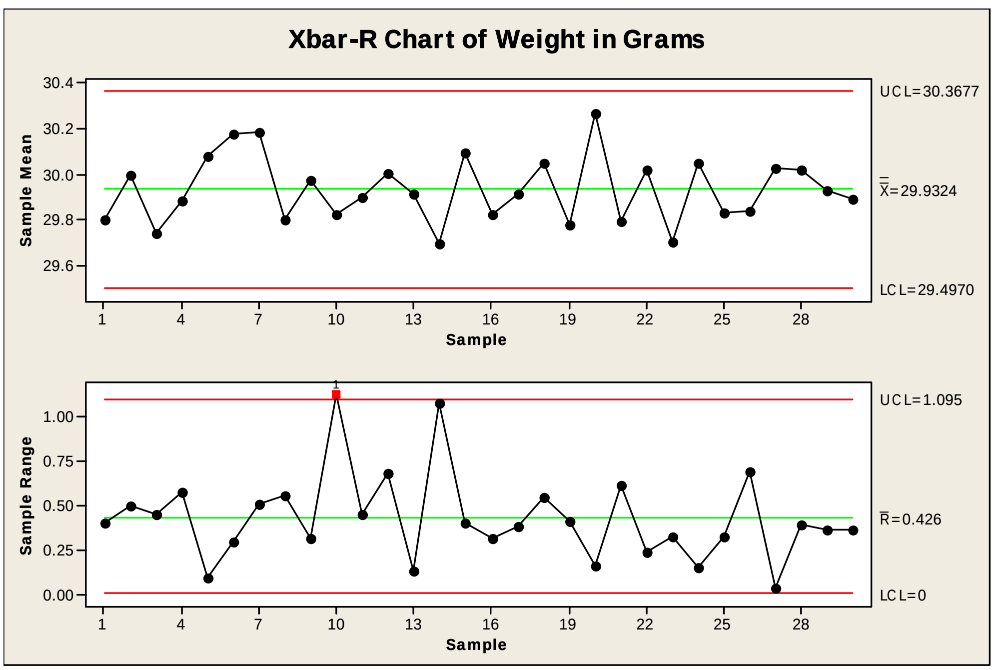

Figure 16. Weight statistical process control chart

[8] The cathode is a tube that is inserted inside the steel battery can. If it does not have the proper strength and density, it will crumble on insertion. This was the failure mode.

With the exception of a point beyond the three sigma limit[9] in the weight range control chart, the processes looked very stable on the 1st shift. After the first shift, they deteriorated. The ES guided the 3rd shift team to study the process parameters and found a combination of parameters that made sufficiently strong cathodes. However, when weight and height were charted, the 3rd shift SPC charts were different from the 1st shift's SPC charts. When the 1st shift and 3rd shift data was put on the same control chart, there was a clear shift in weight on the 3rd shift. Yet, both shifts were now running full production (see Figure 17). A simple trial proved that the 1st shift settings did not work. The ES visited the 1st shift operator to inquire why.

The 1st shift operator who controlled the cathode process told the ES that she knew what process parameters worked. She also knew that the target means on the control charts did not work. In order to make the control charts look good, she made a temporary adjustment to the process, collected parts, readjusted the process parameters back, recorded the data from the altered process and went on with her job. She didn't let management know because of fear. It was obvious to her that the control chart process parameters were wrong. The atmosphere was confirmed when the manager who set up the process was informed that the control charts were wrong, he became enraged and publically embarrassed himself. Astonishingly, he couldn't grasp that the process parameters he set up were dependent, and that the control charts were ill-conceived.

[9] Note that the data is close to the actual process parameters in the production facility. However, for proprietary reasons the numbers are randomly generated.

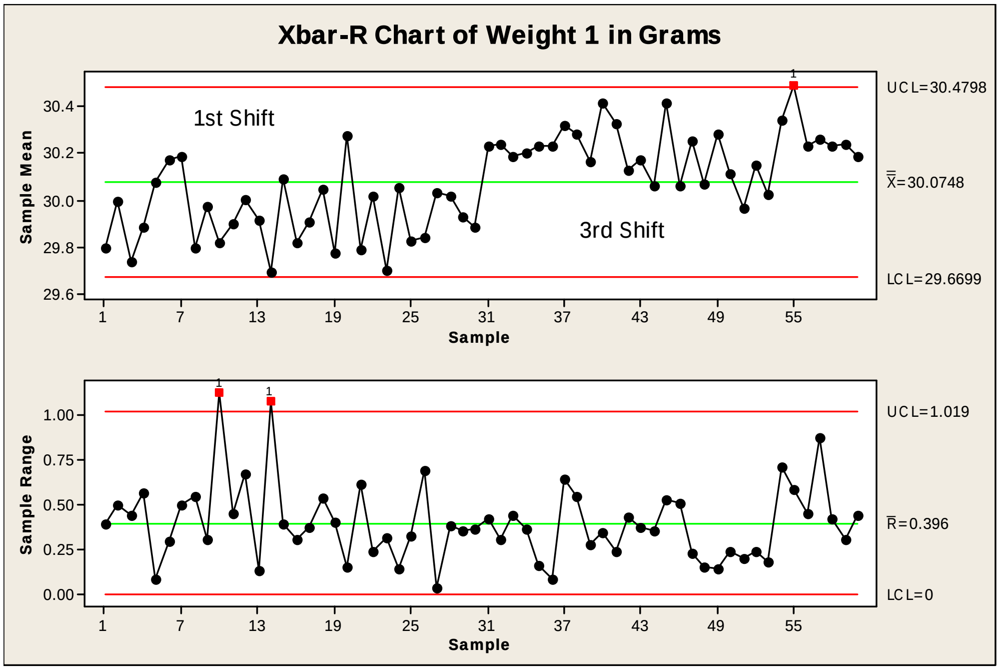

Figure 17. Weight comparison 1st shift to 3rd shift

The affect of deterrent management orientation at this company was a low M environment. Only six of a possible thirty five motivational elements were engaged. Poor leadership and shortcomings in technical ability (intellectual stimulation) deterred the other motivational elements; in effect, demonstrating von Bertalanffy's progressive mechanization, or movement from holistic to individual summative behavior, dysfunctional at that. For example, goal setting was useless and de-motivating with an unattainable goal. Ineffective natural work units with high task interdependence backfired in the face of production throughput problems. Organization values, dynamics, and task simplicity had no meaning in these conditions.

Table 3.

An Assessment Table of Motivational and a Deterrent Category

Leadership	Environment	Individual	Negative
Enabling Formulation	**Org. Values & Dynamics**	Self-efficacy	Valued Work
Task Significance	Interest Alignment	Prosocial Motivation	Enlightened HR Policy
Natural Work Units	Trust	Commitment	Fact-based Management
Intellectual Stimulation	Autonomy	Self-monitoring	Quality Systems
Regulatory Foci	Shared Norms	Agreeableness	Consistency in Task Significance & Performance
Participative Decision-Making	Normative Intrinsic	Positive Mood & Attitude	High Perceived Utility
Job Design	Group Rewards	Intrinsic Motivation	**High Task Interdependence**
Extrinsic Motivation		Self-determination	**Task Simplicity**
Goal Setting		Goal Regulation	Low Formalization

Note: The highlighted items are engaged motivational elements.

The ES conducted meetings with all of the shift operators and maintenance to discuss the proper operating parameters. New control chart targets were established resulting in an effective quality control system. Shift-to-shift working relations improved. Secrecy and anxiety were removed. Process tweaking and unnecessary adjusting of process parameters stopped. System equilibrium and task consistency was established, and perceived utility increased. These in turn, improved the normative culture and the individual psychology element of commitment (see Figure 18).

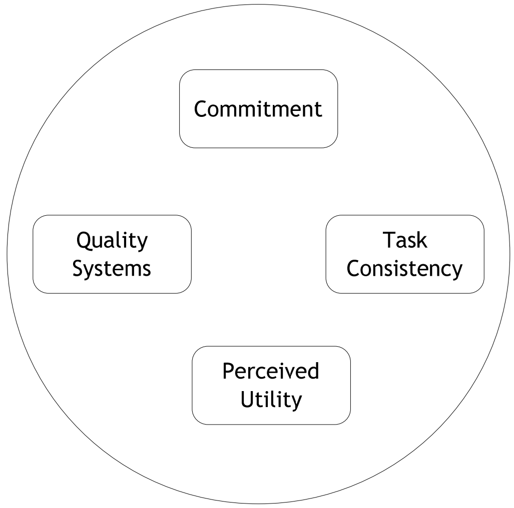

Figure 18. Week two motivational elements

Aligning Interests

After full production was achieved, there remained two impediments to full production. One was related to working the night shift, and the other was related to the time of year, harvest season, and how it affected the workers associated with farming. Both affected employees' ability to get to work and stay awake. The ES relaxed work rules so that employees could drink coffee or soda on the production line. Candy and gum were also allowed, though company rules prohibited those. Workers were also encouraged to take slightly longer breaks to nap for a few minutes.

However, the most challenging obstacle to production had to do with harvest season. The factory was located in a rural, dairy farming region. During harvest, the daily routine changed to focus on harvesting the crops. While the men were in the fields, the women picked up the normal chores, milking the cows, feeding the animals, as well as maintaining care of the kids. Depending, on variability the weather, it was not unusual for farms to operate in crisis mode.

That affected several of the women working the night shift. Some nights, they were barely able to stay awake, and were subject to disciplinary action for dozing off. The woman responsible for starting D-Cell production was one such person. She was sometimes late, and this prevented production from starting on time thereby lowering the throughput rate. Under normal circumstances, she would have been fired. That would have caused hardship as her income was needed to support the farm. When she was at work, she was an excellent worker. There were no issues with her during the non-harvest season. The ES discussed the issues with her and negotiated an agreement that allowed her to be late as long as she called at the earliest possible moment to alert the shift.

The entire production team was extended the same privilege with the understanding that the team would modify job responsibilities to cover positions whenever someone was going to be late or absent. Workers job skills were identified so that any position could be covered in the event of any worker's tardiness or absenteeism. The result was that full production was usually maintained. Motivation elements that emerged from this strategy are shown in Figure 19. These are in the environmental motivational factors category of which one of the most important is interest alignment where worker interests and needs merge with company interests and needs. It is a win/win situation if interests are properly identified and alignment is achieved. These modified practices exhibited the systems principles of modularity and flux.

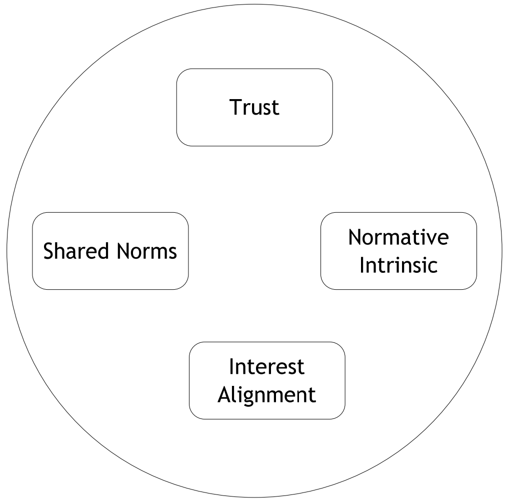

Figure 19. Addressing worker interests

The Tipping Point

Gladwell (2002) theorized that latent behaviors reside in people. When the right conditions exist, the behaviors can be released. A tipping point occurs, and a latent behavior becomes epidemic, having widespread, and unique effects. The conditions leading to tipping are a carrier, a message or behavior that gains acceptance, and environmental context. All three conditions emerged in the D-Cell production line. The ES provided the message, the production problems were resolved, and the motivational system was dramatically altered. Changes in the motivation system created a new normative environment that resulted in something unanticipated and unique, individual psychology motivational elements began to emerge (see Figure 20).

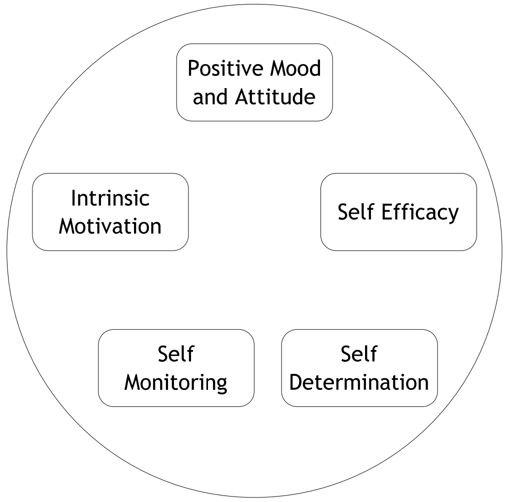

Figure 20. Emerging individual psychology motivational elements.

Within two months, the first production record was set. The individual production workers self-organized. They exhibited the principle of requisite variety, or self-creation, autopoiesis. The principle of requisite variety also has limitations. Control cannot be exercised if the lines for control exceed the magnitude of what is being communicated. When a system is broken, the lines of communication become overloaded. This seems to have been the case, because the solution to the actual problem was known by at least one operator. Nevertheless, once communications were opened and system equilibrium was achieved, the workers became self-motivated. As a team they made the decision to break production records. There were no meetings or motivation sessions, they just worked efficiently and took advantage of opportunity. They learned ways to make things more efficient, specifically because they were given autonomy and the company's interest aligned with their interest. This created a learning opportunity, and maybe even a game, to see how work activity could be rearranged and still meet production demands. Toward the end of the ES's tenure, the D-Cell workers were so intent on setting another production record that they continued to work into their cleanup period and did not stop until the next shift was in place and ready to work.

Table 4 shows an improvement in motivation within the organization. Most of the motivational elements were engaged, motivational saturation. This was the result of the ES instituting the leadership component concurrent with shifting deterrence orientation to positive reinforcement. The environment was modified and this affected and improved the workers' individual psychology so that they became self-motivated and absorbed in the experience of flow (Csikszentmihalyi, 1993). The work itself became engaging and a systemic motivational energy resulted in self-efficacy. Maslow (1999) describes what the workers experienced as self-validation or peak experience.

Table 4.

Motivational elements in production.

Leadership	Environment	Individual	Negative
Enabling Formulation	**Social Interaction**	**Self-efficacy**	**Valued Work**
Task Significance	**Interest Alignment**	Prosocial Motivation	**Enlightened HR Policy**
Natural Work Units	**Trust**	**Commitment**	**Fact-based Management**
Intellectual Stimulation	Autonomy	Self-monitoring	**Quality Systems**
Regulatory Foci	**Shared Norms**	**Agreeableness**	**Consistency in Task Significance & Performance**
Participative Decision-Making	**Normative Intrinsic**	**Positive Mood & Attitude**	**High Perceived Utility**
Job Design	Group Rewards	**Intrinsic Motivation**	**High Task Interdependence**
Extrinsic Motivation		**Self-determination**	**Task Simplicity**
Goal Setting		**Goal Regulation**	**Low Formalization**

The original objective for changing supervisors was to return 3rd shift production to a normal level. However, the manner in which that goal was accomplished had an unanticipated effect, a motivation effect (see Figure 21). The production team achieved moments of Maslow's (1968/1999) peak experience, and Csikszentmihalyi's (1993) flow. The result was nearly one million dollars of additional, unanticipated production throughput.

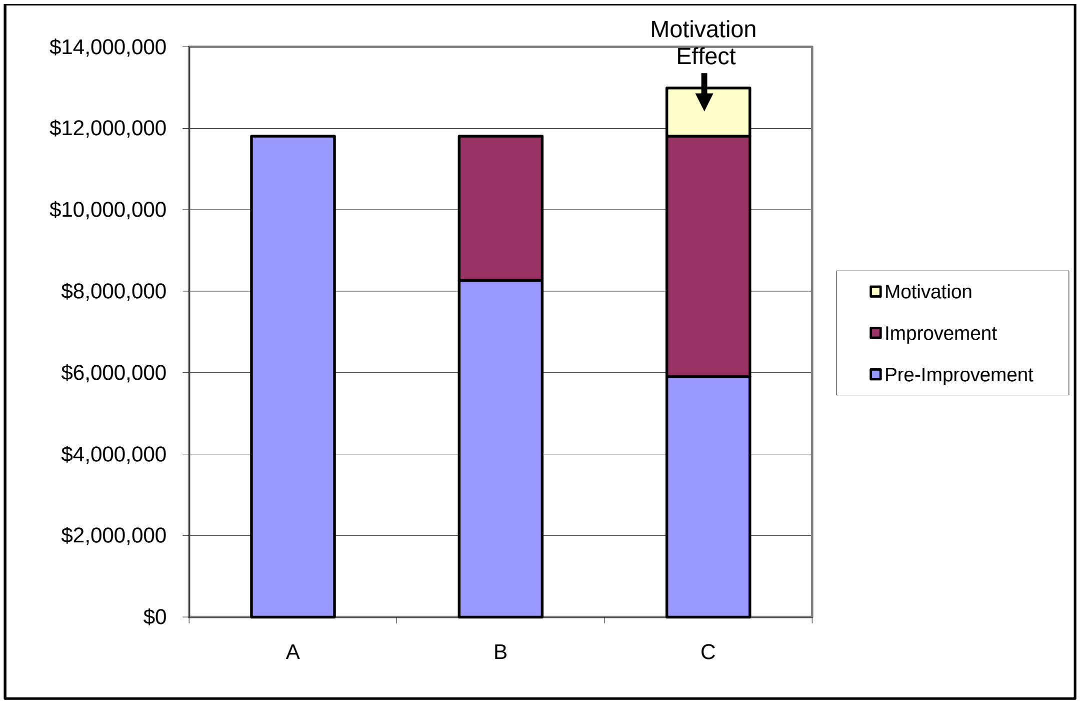

Figure 21. Motivation effect

Conclusion –The Fourth Theory of Motivation

The changes that occurred on the 3rd shift are an example of system dynamics described by von Bertalanffy (1968), Laszlo (1996), and Skyttner (2001). In von Bertalanffy's language, what occurred was a constitutive system reorganizing itself. Motivation was a catalyst subsystem that moved through a predictable sequence of activity. The motivation subsystem stopped entropy (the 2nd Law of Thermodynamics) and reestablished equilibrium. Leadership was a principal component. By providing technical support that helped remove impediments to production, and modifying the work environment, a new motivational system emerged. It freed workers to be responsive to other motivational affects, and created a growth interaction resulting in greater productivity and performance, exactly what motivation theory suggests should occur.

The Fourth Theory

The fourth theory of motivation is based on the work of modern psychologists such as Maslow, Csikszentmihalyi, and Pinker; and modern open systems theorists such as von Bertalanffy, Laszlo, and Skyttner. It maintains that worker motivation is based in the interaction of normal human psychology, leadership, and the work environment. It is not culturally dependent, though some cultures and organizations have stumbled upon many of the key elements in the motivational model, and are using them effectively to improve worker performance. Those organizations and cultures have competitive advantage.

The fourth theory is a model comprised of the subsystems of leadership, environmental context, and individual psychology. All of these can be seriously undermined by the presence of the fourth subgroup with negative deterrence orientation. The elements of the model are universal, repeatable, and predictable. Motivational saturation is the degree to which positive elements are effective within an organization. High motivation saturation optimizes a positive worker environment, high M. The theory suggests that organizations can deploy strategies to improve the motivation. Deployment involves the interaction of all elements of which the first step is to remove negative deterrence orientation in supervisory behaviors. This includes instituting Deming's philosophies and fact-based decision-making. It can only be enhanced by adopting a total quality management structure (TQM).[10]

Leadership has to lead, but it requires knowledgeable leaders who can make the changes that lay the foundation for motivational saturation. This includes technical and organizational skill, or the ability to hire and retain skilled employees at every level. Ouchi (1981) observed that

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[10] Adopting a TQM system is no small task. However, TQM components are well understood, deployment can be done in a rational fashion, ISO type systems can be used as vehicles for deployment, but we leave discussion of that topic to upcoming papers.

the Japanese system is fused by intense amounts of cross-training. Gladwell (2002) suggests that there are key individuals who are knowledgeable in specific areas and can connect with others to create tipping points. Durand and Calori (2006) refer to this type of leader as *practically wise.* The ES in the case study may have been one such individual. Leadership, therefore, must set the foundation for the environment.

Environment, traditionally, has been referred to as culture. Inability to change culture has become the scapegoat for many organizational change failures. This need not be. Much of what has been written about culture change is correct, and within the context of the fourth theory, culture change is a given phenomenon. What may have been missing is understanding how subsystem interactions affect change, the motivation subsystem being one. As Ouchi and Deming have indicated, most of leadership's effort should go into affecting organizational environment.

Something unique occurs with the absence of negative deterrence orientation behavior, the presence of good leadership, and an efficacious environment. Individual personal motivation increases. Self-efficacy, self-determination, self-monitoring, goal regulation, and commitment are free to emerge. Maslow wrote about peak experiences and self-validation. Csikszentmihalyi explained the concept of flow, a near transcendental state of being in total sync with work. The fourth theory of motivation helps understand these.

If we were to diagram the fourth theory, it would look like Figure 22. It depicts a system with positive core values. Orientation behavior centered around those values are equally important subsystems, leadership, environment, and individual psychology. Their linkage is fragile, denoting the nature of dynamic systems, and without the positive core values, the individual subsystems are autonomous, individual sets that may or may not interrelate to affect each other. Leadership is a balancing action based on positive core values. If core values are properly leveraged, they in firmly orient the three subsystems, secure their relationship, and positively control environment and individual psychology; the perfect integration of systems and motivation theory.

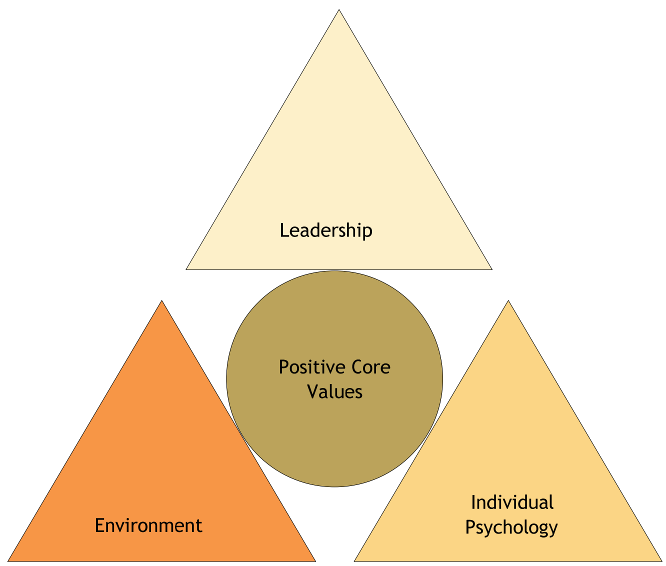

Figure 22. The fourth theory of motivation.

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