THE DYNAMICS OF ORGANIZATIONAL ALIGNMENT

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ABSTRACT

Organizations are challenged to meet their mission and the failure to achieve this objective is a source of concern for organizations. Models exist that explore the components that contribute to organizational success, but these models are conceptual and do not attempt to operationally define the relationships depicted in the models. Nadler and Tushman (1992) created a model of Organizational Congruence that serves as the foundation for this dissertation. The author translated that model into a systems dynamic model that mathematically defines the potential relationships of the components in Nadler and Tushman’s model. The system dynamics model is an “Executive Flight Simulator” with the capability of running simulations to see the impact of changing the values of the different components. A panel of experts, representing industry and organizational consultants, validated the model against their experience in the world and confirmed that the model matched their experience. The model provides a strong start toward understanding the physics of alignment in organizations. It explores the impact of key variables such as Communication, Leadership, and Turbulence on the realization of planned and emergent strategies within an organization. The model suggests that in highly turbulent environments, organizations need to be able to adapt and shift their focus from
planned objectives to the newly emergent objectives that result from the
dynamically changing environment.
CHAPTER I: INTRODUCTION

Statement of the Research Question

Each year organizations devote their energies toward fulfilling the mission and vision of the organization, yet their results do not always meet their expectations. These less than satisfactory results are achieved in spite of the best efforts of the people combined with the significant application of material and financial resources. Burton and Moran (1995) suggest that the problem may be related to organizational alignment.

To be profitable to both [customer and organization] requires the providing organization to focus its resources in the most productive manner possible. This focusing process requires an alignment of the business plan, quality plan, strategic plan, research and development plan, and so on. Alignment requires that a leading purpose be established to which all the work of an organization is aligned and designed to achieve. The problem today is that every organization has so many plans that they compete with one another for the limited resources available. (p. 15)

Each part of the organization is working to achieve its individual mission, but due to the lack of clear alignment the total result is sub-optimized. The immediate solution might appear to be a better planning process that aligned all of the sub-plans, but as Mintzberg (1994) observed, the planning process has a number of pitfalls. Alignment must be viewed as part of the larger organizational system. That system has its own structure, logic, and dynamic. That is, it has its own physics. In order to better organize and align an organization, it will be necessary to understand its underlying physics.
Significance of the Problem

The standard for successful organizations in both the business and non-profit sectors continues to rise each year, as the competition becomes more global. The success of organizations and more fundamentally, their survival will depend on how effectively they can meet their missions. According to Douglas Harris in the National Research Council report on organizational linkage (1994, p.2), the United States economy experienced more than 25 years of declining productivity growth in spite of investments in information technology designed to improve individual efficiency. This is attributed to the lack of linkage between individuals and the organization. In his work on the Alignment Project, Scott Cypher (1996) notes that, “Alignment is a perplexity; it is often discussed and advocated, but how to create it escapes us”, (p. 1). Organizations continue to try different methodologies in their search for the best path to success and this search has lead the cynics to write about “Fad Surfing” (Shapiro, 1995) and consultants as “Witch Doctors” (Micklethwait & Wooldridge, 1996). This search is conducted in a vacuum that until recently had no underlying model or theory that served as a guide for what is needed, what is not needed, and in what combinations. Robert Pritchard (1994) said,

What is needed in addition is more conceptual work that will enable researchers and practitioners to understand better the nature of organizational linkages. Specifically, a sound theory of aggregation is
needed, that is, a theory for how organizational levels are related to each other and how that affects organizational productivity. (p. 185)

Over the past decade, high level models have appeared that offered some clarity, but they do not fully demonstrate the dynamic relationship of the model’s components. This lack of detail limits the degree to which the model can drive action. Cypher (1996) notes, “The effect of a single intervention at a particular level toward organizational system performance will be inaccurately assessed without knowledge of how the levels and efforts connect and align”, (p. 3). The answer lies not in isolated changes, but in the relationships that may be altered by those changes.

While the existence of a model or theory is important, I believe that the value of a dynamic model will come from the ability to build existing theory into a simulation that can be run to show the effects of changes in key components on the system as a whole. Through this mechanism, the ineffectual results of isolated change can be demonstrated and the individuals in an organization can better understand the systemic effects of isolated changes.

This situation leads me to ask, “What is the structure and the physics of organizational alignment?” By organizational alignment, I mean that the actions of the organization are such that they move the organization in a direction that will increase the probability of it achieving its purpose. By structure and physics, I mean the components that affect alignment and how they interrelate with each
other. This dissertation will develop a theoretical model that will allow individuals to understand the impact of changes in key structural components as they flow through the linkages between organization levels and systems. The model will be created as a system dynamics model and will demonstrate the relational physics of the components in the model. It is intended as a first step toward understanding the physics of alignment.
CHAPTER II: REVIEW OF THE LITERATURE

Definitions

Alignment is discussed regularly, but the usage of the term is not always consistent. To begin, we must understand the different meanings of alignment and clarify the meaning that will be used in this dissertation.

Alignment as Commitment

The concept of being aligned is often used synonymously with commitment. Organizational commitment is a concept that is well studied and which refers to an individual’s commitment to his or her employer or more generally to any specific entity. Commitment (Meyer, Allen, & Smith, 1993) is multi-dimensional and is reported to take three forms: affective, continuance, and normative. The corresponding three themes of commitment are: “commitment as an affective attachment to the organization, commitment as a perceived cost associated with leaving the organization, and commitment as an obligation to remain in the organization”, (Meyer, Allen, & Smith, 1993, p. 539). None of these should be viewed as synonymous with alignment, but affective attachment may be a component in creating alignment at the individual to organization level.

Alignment as Cultural Alignment

Another perspective on alignment is offered by Edgar Schien (1996) in his discussion of cultures within organizations.
The learning problems that I have identified can be directly related to the lack of alignment among three cultures, two of which are based on occupational communities — (1) the culture of engineering, (2) the culture of CEOs, and (3) the culture of operators — and the shared assumptions that arise in the “line units” of a given organization as it attempts to operate efficiently and safely. (p. 13)

Schien is referencing one aspect of the problem that arises from misalignment between functions or “silos.” This is another dimension of organizational alignment that requires the model to address the inter-activity of different groups within an organization.

**Alignment as Shared Understanding**

Kotter (1990) defined alignment as “A condition in which a relevant group of people share a common understanding of a vision and set of strategies, accept the validity of that direction, and are willing to work toward making it a reality” (p. 60). Kotter heavily weights communication and leadership as the means toward alignment, but his definition closely matches the thrust of this dissertation.

**Alignment as Organizational Linkage**

Another term is organizational linkage. This concept was studied by the National Research Council and explored the linkages between individual, group, and organizational productivity. It defines linkage as existing “when productivity gains at one level lead to productivity gains at another level” (National Research Council, 1994, p. 1). This concept focuses on the end result of alignment as I am using the term. An aligned organization will be linked across every dimension to
the clearly identified mission and vision of the organization. Part of the literature on organizational linkage focuses on inter-organizational linkages and linkages to the external environment (Walker, 1992; Strauss, 1982; Aveni, 1978). For the purposes of this research, I will limit the model to the internal linkages.

**Alignment as Congruence**

Nadler and Tushman (1992) use the term “congruence” and define it as “the degree to which the needs, demands, goals, and structures of one component are consistent with the needs, demands, goals, and structures of another component” (p. 51). Their concept will be reviewed in detail in the section on models. Congruence is closely related to alignment, as this dissertation uses the term, and Nadler and Tushman’s model clearly demonstrates the relational context of the components.

**Alignment as Attunement**

A final related term is the concept of “attunement” (Harrison, 1989) which refers to the linkages that occur on the more emotional level. Harrison believes that alignment without attunement can result in exploitation of the members of the organization while organizations that are attuned but not aligned will not be efficient.
Alignment as Shared Understanding Expressed Congruently

The models created in this dissertation will be based on a definition of alignment similar to Kotter’s (1990). Alignment is the state in which the members of an organization share a common sense of mission and work congruently to make that mission a reality. The shared understanding is translated into meaningful action to achieve the objectives of the organization. Before we explore the details of the model, it is important to understand what is meant by models and modeling.

Modeling

According to the American Heritage Dictionary (1994), a model is:

1. A small object, usually built to scale, that represents in detail another, often larger object. …

3. A schematic description of a system, theory, or phenomenon that accounts for its known or inferred properties and may be used for further study of its characteristics.

Organizations use models in both senses. Organizational models are created to understand how the organization works; to describe the organization, and to serve as a basis for the redesign of an organization. Models have also been used to predict future events as made famous by the Club of Rome’s world dynamics models of the early 1970’s (Meadows et al., 1970). The accuracy of these results varied and were highly contingent on the validity of the model’s assumptions.
A.P. de Geus (1994) of Shell Oil explained the difficulties with prediction when he said,

> In the living world, as in the world of inanimate objects, the observation of reality is influenced by the position of the observer. This makes it impossible to construct a model that represents reality well enough that a reliable prediction can be made from it and, anyway, it is unlikely that the manager will acknowledge the model as either complete or precise. (p. xiv)

The value of modeling, according to de Geus is the role it can play in helping managers better understand the system in which they work and help them make better decisions based on that understanding. Often this understanding comes from a type of modeling frequently referred to as “Microworlds” which allows a manager to “play” with his current situation. This type of model grows out of the tradition of business simulation but these newer models are often more non-linear.

According to de Geus (1994), models and simulations allow people to “experiment without having to fear the consequences. In the process they learn — and only then do they go and apply into practice their new and now confirmed understanding of this part of their world, accepting the responsibility for their actions” (p. xv). Essentially, models are a medium that promotes understanding and learning in a safe environment.

**Types of Systems Models**

Within the broader context of models, a sub-set exists called Systems Models. Systems Models attempt to represent the reality of the system being
modeled along with the relationships between its components. Systems Models come in a variety of forms that range from pure mathematics to pure narrative. Within each end of that spectrum, there exist models that are static, discrete, or continuous. A static model does not factor in time or change over time. It is simply a representation of the existing condition. A discrete model advances time in discrete events. For example, a discrete model might only look at results for the end of each month. A continuous model takes events as a smooth flow. A continuous model cannot be simulated on a digital computer, but it may be approximated by keeping the step increments sufficiently small.

Within most organizations, the static model is the only one that is used. Static models most frequently show up as the organization chart. This chart is a static example of the structure and reporting relationships for the individuals in the organization. Some organizations have begun process mapping, which usually results in a static model that represents the various processes within the organization, and how product or services flow from one process to another. Process mapping is a natural first step that in turn may lead to a more dynamic model.

Dynamic models are intended to explore, as Barry Richmond (1994) is fond of saying, “the physics of the business” (p. 20). This is a reference to the internal logic that the structure of an organization creates and which often
overrides the conscious direction of the organization. Richmond (1994) says, “If the organization’s vision and resulting objectives are out of line with what the physics of the business dictate, management has two choices. Change the physics. Change the vision and/or the objectives” (p. 21). Unfortunately management rarely is aware of the “physics of the business” and thus is at a loss to understand why its carefully crafted vision and strategy is failing. To that point, Mintzberg (1994, p. 376) notes, “… managers may have difficulty dealing with certain types of intricate feedback loops. In other words, under certain circumstances their informal models may not be all that good.” By creating a formal model, the feedback loops are explicitly identified and relationships that are often counter-intuitive become apparent. The objective of model design is not to accurately depict the existing system in every detail since the model would then be as complex as the reality and just as difficult to understand. Rather, models are used to highlight key factors and their interrelationships to clarify the non-intuitive aspects of complex systems. Dan Houston (1996) makes a distinction between process modeling and dynamic modeling. Dynamic modeling looks at the system and examines it as it changes state. Process modeling describes stages and does not need to address the relations in the system and their relative impact on each other. The nature of the question that this dissertation is to address will require a systems based model that is dynamic. This type of model will be capable of not
only showing the results of the relationship between components in one state, but will also demonstrate how the results change as the state changes.

Systems Models have two widely accepted formats: causal loop models and stock and flow models.

Causal Loop Models

A type of modeling that was popularized by Peter Senge (1990) in The Fifth Discipline is called causal loop modeling. As shown in Figure 1, a causal loop is a simple representation of how elements in a system interconnect. These diagrams are useful to a point, but they do not describe the relations in enough detail to fully understand a system.

For example, in Figure 1, depicting the relationship between income, performance, and pay, there is no indication of what one factor does to another. Does income increasing cause performance to increase or does increased performance cause the pay to increase?
Stock and Flow Models

Another type of model, based on J.W. Forrester’s work in systems dynamics, is called the stock and flow diagram. Figure 2 depicts a stock and flow, also called a level and rate, diagram of the same system displayed in Figure 1. This format clearly shows that the increase in income is a result of the flow of pay. In this type of model a stock is represented by a rectangle and a flow is represented by a circle, with a line on top that resembles a spigot, attached to an arrow. In Figure 2 this model shows the flow of funds as pay to income. The circle labeled “performance 1” represents a converter that is used to convert the income stock back into the pay flow. This model defines the relationship between Income and Performance mathematically and then defines the relationship between Performance and the rate of pay expressed in Pay One. The relationships are no longer ambiguous.

Figure 2. Sample Stock and Flow diagram

Daniel Kim (1997) describes the relationship between the types of models in a type of hierarchy,
One common way that people communicate something that has happened is by organizing the raw information into descriptive, verbal accounts that convey stories. Causal loop diagrams move beyond this simple reporting to describe the interconnections in a system that help explain observed behavior. On an even more technical level, accumulators (stocks) and flows depict the precise operational structures that produce the dynamics shown by causal loop diagrams. Finally, if we need to know in quantitative terms how changes in one variable effect another, computer models that represent relationships provide even greater accuracy. (p. 7)

Kim’s (1997) description shows the building complexity and technical accuracy in the different ways of describing relationships in systems. The method used depends on the goal of the modeling process. This dissertation will use the fourth level discussed by Kim and define the dynamic relationships mathematically.

Before the dynamic model is created, the essential elements of alignment must be understood.

The Generic Model of Alignment
Alignment builds from a core structure. The essential core of an organization is shown in Figure 3. Every purposeful organization, whether it be non-profit or business, fits this essential model. The organization is created because there exists an unmet need that must be fulfilled. To this end, the organization marshals physical resources and human energy in a purposeful manner to meet the need. In the simplest organization with a simple task, this is easily managed. For example, two friends come together to move a tree stump. They gather the appropriate tools and work until the task is accomplished. The purpose, human actions, and use of physical resources are all aligned to accomplish the task.

As organizations grow in size and complexity to meet increasingly

Figure 3. The essential core of a purposeful organization.

Figure 4. Elements in a Multi-tasked Organization that contribute to results.
complex tasks, the core becomes less clear and misalignment begins to enter the organization. Now the core may look like Figure 4. In this model, the organization has more than one need that must be met and thus has more than one purpose that must be accomplished. This new purpose draws upon the organization’s human and physical resources at the same time that the original purpose draws on the resources.

With each additional need and purpose, the resources of the organization are stretched thinner and the potential for misalignment increases. This potential for conflict results in turbulence in the system. To attempt to smooth the turbulence, organizations will begin to plan the workflow. In simple systems, work is apparent and is addressed with all of the physical and human resources as it arises. In more complex organizations, the different purposes are ideally allotted varying levels of importance that determines how resources are allocated. This allocation of resources is determined both strategically and tactically by the organization during its planning process.

With the addition of planning, the model now has four components: people, resources, purpose, and planning. The model is shown in Figure 5 that demonstrates the filtering function of planning. The unmet needs are inputs into the planning process that assigns priorities and allocates resources.
Conventional wisdom and experience tell us that the best plans often go awry. This suggests that planning alone is not sufficient to maintain the alignment within the organization. Other factors must be evident within the system that prevents it from following the plans as given. The answer may lie in the internal structure of the organization. The current model accounts for planning the allocation of resources to meet the needs, but it does not address the manner in which these resources are organized. Thus, the organization begins to create a formal structure that determines the manner in which the resources are organized to fulfill the purposes of the organization. This structure includes a number of critical components. It includes the processes that are used to do the work; the management and allocation of materials; and the organization and maintenance of the human resources. The organization and maintenance of the human resources
includes several key sub-components: the reward systems, the communication systems, and the organizational relationships. The model, shown in Figure 6, now has five components: people, physical resources, purpose, planning, and structure. It shows how the planning process provides direction to the structured processes of resource management, purpose, and people.

This model is now similar to the model used by Edward Lawler (1996) that focuses on strategy, people, structure, processes, and rewards. Lawler’s strategy refers to strategic planning and is represented by planning in this model. Lawler makes a point that he is looking at strategic planning in a non-traditional
way. He supports Mintzberg’s (1994) observation that, “Because planning, in the absence of an ability to control the environment, must rely on forecasting, and because forecasting amounts to extrapolation of known states, existing trends, or recurring patterns, planning typically works best under conditions of relative stability” (p. 239). Lawler recognizes that “conditions of relative stability” are the exception in today’s business environment, so he separates the strategy and planning components from each other.

Strategy, to Lawler (1996), is the means by which the leadership of the organization brings the mission and vision to life. Planning is focused on the allocation of resources, facts, and budgets. Planning can still be useful in dynamic environments when used in a contingency based manner. This approach has been used successfully by Shell Oil. Shell’s leadership group creates a number of potential scenarios that are based on potential futures. They then create plans that will be deployed for whatever contingency materializes (Mintzberg, 1994, p. 248-254).

**Basic Systems Models**

The preceding section built the logic of the organizational model. Others have followed a similar logic and developed models that represent the structure of the organization. These basic models depict the key factors in an organization and will serve as the point of departure for this dissertation’s model.
McKinsey’s 7-S Framework

McKinsey’s 7-S Framework (Peters & Waterman, 1982) identified the interdependent variables that their research revealed were essential for successful organizations to manage. The model, Figure 7, identifies “hardware” as strategy and structure. It identifies “software” as style, systems, staff, skills, and shared values. The model was a powerful antidote to the prevailing mindset of the time that only looked at strategy and structure. It elevated the “soft” elements to a conscious level and suggested that these too were within management’s circle of concern. The model identified not only the factors, but stressed that each was interdependent with the others. The emphasis on shared values as the central

![Figure 7. McKinsey’s 7-S Framework as a systems model of organizations](image-url)
element foreshadowed Collins and Porras’ (1991; 1993; 1994) work on values and visionary companies.

**Leavitt’s Diamond**

Peters and Waterman (1982) acknowledge that their model was built on the foundation of Leavitt’s Diamond (1972) which identified four key elements: structure, task, technology, and people. Leavitt’s Diamond, Figure 8, clearly shows that these elements are tied together in an interdependent fashion.

According to Leavitt, a change in any element in the model will result in change in the other elements. For example, if an organization decides to “empower” its people, the resulting change will put pressure on the organizational structure and pull it toward a different configuration. The change will also make new demands on the technology of the organization (communication, information systems, etc.)

![Figure 8. Leavitt’s Diamond model of organizational systems.](image)
forcing change in that element. These changes will impact the manner in which the tasks of the organization are performed. In addition to the impact each element has on the others, Leavitt (1972) stresses that the environment in which the organization functions also pulls and pushes on each element in the system. At the time, Leavitt expressed caution against implementing change that only addressed a single element and ignored the implications for the remaining elements in the system.

**The Business Diamond**

Leavitt’s (1972) design received new prominence in the writings of Michael Hammer and James Champy (1993) who resurrected the diamond and called it “The Business System Diamond” (p. 80). Their model, Figure 9, revived

![Figure 9. The Business Diamond by Hammer and Champy (1992, p. 80)](image-url)
the diamond shape of Leavitt’s, but incorporated the values element from McKinsey’s Seven-S framework (Peters & Waterman, 1982). Unlike the other models, Hammer and Champy’s model has the relationships following single, one-way flows.

Their model begins at the top with the processes of the business. These processes then determine the jobs and structure of the organization that in turn determines the type of management systems the organization will use. Finally, these management systems determine and shape the values and beliefs of the people in the organization that will support the business processes. This model is doctrinaire in its structure and is clearly designed to support Hammer and Champy’s (1993) process-centered reengineering approach. The emphasis on the linear, one-way flows ignores the interdependence of the model’s elements. It does not allow for the possibility that an organization’s processes are the result of its management and measurement systems. The model does not have the robust explanatory power of Leavitt’s (1972) diamond but it does have simplicity. Perhaps it is this simplicity that made this model capture the attention of so many business leaders during the early 1990’s. In a complex world, simplicity can be an aid and a hazard. Simplicity that reduces the clutter to key elements while not doing violence to the relationships between those elements is very different from simplicity which creates a false or incomplete view.
OP Model

David Hanna (1988) offered the OP Model which has six design elements that interact with four critical factors. The model is grounded in both Bertalanffy’s General System Theory and Tavistock’s Sociotechnical Systems Theory. The design elements in Hanna’s model are: tasks, structure, rewards, decision making, information, and people. The critical factors are the business situation, the business strategy, the culture, and the business results. Hanna’s model, Figure 10, examines the interrelationship between the design elements and their interaction with the critical factors for the business.

Figure 10. Organizational Performance (OP) Model in diagnostic mode. (Hanna, 1988, p. 46)
In Hanna’s model, the business situation includes the socio-political environment and the competitive pressures. The business strategy includes the organizational goals, mission, values, and assumptions. The design elements focus on the internal workings of the organization. The culture factor is defined as the “observable work habits and practices that explain how the organization really operates” (p. 42). The business results factor is the outputs delivered by the system.

Hanna’s model is both a descriptive and a diagnostic model. In the diagnostic mode, the use of the model begins by examining the current business results with the future business situation. Then the organization’s culture is

Figure 11. OP Model in design mode (Hanna, 1988, p. 56).
viewed to see what in the culture is leading to the results. Then the design elements are explored to see how they have created the current culture. Then the strategy is examined to understand the influences that resulted in the design elements. The strategy in use is often not the strategy espoused. Finally, the business strategy is compared with the business situation and those elements that are mismatched are marked for change.

In design mode as shown in Figure 11, the model creates a strategy that matches the business situation. This strategy is then used to design an organization that fits the strategy. The design is then reviewed for potential positive and negative impact on the culture of the organization. Finally, the business results are predicted given the newly designed culture.

Hanna’s (1988) model incorporates the best of Leavitt’s (1972) model and the Seven-S framework (Peters & Waterman, 1982) to create a model that looks at the internal systems of an organization in the context of its environment. The limitation of Hanna’s model is that it does not specify the nature of the relationships and interactions in the model.

Organizational Congruence Model

Nadler and Tushman’s model focuses on organizational congruence and is grounded in Open System theory. They contend that “The effectiveness of an organization reflects the congruence of the key components” (Nadler & Tushman,
(1992), p. 45). The key components in their model, Figure 12, are the inputs (environment, resources, and history), strategy, work, informal structure, formal structure, people, and outputs (system level, unit/group level, and individual level).

Their model is similar in structure to Hanna’s. The inputs are comparable to Hanna’s business situation and this component feeds strategy in both models.

The business results in Hanna’s (1988) model correspond well with Nadler and Tushman’s outputs. The model’s differences occur primarily in their central cores. Nadler and Tushman do not separate culture as did Hanna (1988), but rather incorporate it into the informal structure and process. They consider the
informal organization to be the emergent organization or “the structures and procedures that emerge while the organization is operating” (Nadler & Tushman, 1992, p. 51). They equate this with organizational culture. The formal structure in Nadler and Tushman includes the structure and reward elements from Hanna’s (1988) model and the formal portion of decision making. The informal part of decision making is captured in the informal structure and processes. The factor called People, for Nadler and Tushman (1992), focuses on “identifying the characteristics of the employees or members … individual knowledge and skills, the different needs or preferences of individuals, and the perceptions or expectancies that they develop” (p. 49). The use of the factor, People, in both models is comparable. Work in Nadler and Tushman’s model maps directly to tasks in Hanna’s model. The element that appears to be missing from Nadler and Tushman’s model is information. Hanna recognizes the significance of communication and information flows and this element is not overtly reflected in the Nadler and Tushman model. However, in discussing the model, Nadler and Tushman (1997) clearly incorporate information into their model. They reference Jay Galbraith and contend that organizational design is the result of viewing “organizations as information processing systems” (p. 63).

Both models recognize the importance of the relationship between the components. Nadler and Tushman (1992) said, “In any system, however, the
critical question is not what are the components, but what is the nature of their interaction and how do the relationships among the components affect how they combine to produce output” (p. 51). It is that relationship which will be explored in this dissertation.

The author considered a number of models as the basis for exploring the variables that impact alignment. Most of the models owe their origin to Leavitt’s (1972) diamond and offer varying levels of expansion upon his concept. Hanna’s (1988) model and Nadler and Tushman’s (1992) model offered the most detail and explanation. The author chose to focus on Nadler and Tushman’s model primarily because the authors have continued to write about the relationships in the model and provided the greatest detail upon which to build the system dynamics model.

Chaos and Stability: A Confounding Variable

Strategic planning and most organizational models are built on the assumption of a relatively stable environment. With stability, a plan may be set and held to for the course of action. In a more chaotic environment, rigid adherence to a plan may be counter-productive. Galbraith (1997) noted:

The advantages around which the organization is designed are quickly copied or even surpassed by high-speed competitors. Therefore, to focus and align the organization is to become vulnerable. Some people have concluded that alignment is no longer a useful criterion for organizational design. … On the other hand, misalignment of strategy, structure, and processes will cause activities to conflict, units to work at cross-purposes,
and the organization to lose energy over many frictions. Instead, we need a new, aligned organizational design in which organizational structures and processes are easily reconfigured and realigned with a constantly changing strategy. (p. 88)

The face of alignment must be different under the assumption of stability than it is under the assumption of rapid change that borders on chaos. Within stability, control and alignment can be hierarchical and cascade through the organization in clear objectives and goals. Within chaos, control may best result from the flocking rules identified by Craig Reynolds (Kelly, 1994, p. 11): “do not bump into each other, keep up with your neighbors, and do not stray too far away.” The degree of control and alignment may also be contextual within an organization. In an unstable environment, tight alignment may be critical within the common areas and loose alignment appropriate within individual domains. The differences between the stable and the chaotic organization may necessitate two models or may be incorporated into a single model.

System Dynamics

This dissertation is grounded in the discipline of system dynamics. The discipline is over 40 years old and is largely the creation of Jay W. Forrester. It provides a mechanism for understanding complex systems. Forrester (1975) notes, “As one moves toward systems of greater complexity in any one of the preceding dimensions — order, inclusion of positive feedback, non-linearity, and multiple loops — he finds that system behavior changes in major qualitative ways.
The more complex systems do not merely show extensions of behavior seen in the simpler systems” (p. 140). To study complex systems in the same manner as simple systems is the root problem in reductionist thinking. Unfortunately, higher order systems are difficult if not impossible to intuitively visualize.

Traditional work in organizations was descriptive and was often represented as case studies that comprehensively represented the facets of the situation. The problem, as Forrester (1991) describes it, is:

A descriptive model of the company would have been assembled, but the human mind is not able to deal with the inherent dynamic complexity of such a situation. For those who have studied mathematics through differential equations, such a descriptive model is equivalent to a high-order nonlinear differential equation. (p. 10)

A system is considered non-linear if it,

…contains a multiplication or division of variables or if it has a coefficient which is a function of a variable. For example, the rate of a sale in a market might be expressed as the product of the number of salesmen multiplied by the sales effectiveness, where the sales effectiveness may depend on such things as the price, quality, and delivery delay of the product. But if these latter are variables, the sales rate is a nonlinear function of the variables representing the number of salesmen and the sales effectiveness. Likewise, throughout our social systems, non-linearity dominates behavior. (Forrester, 1975, p. 139).

System Dynamics, through modeling, brings the variables together in a manner that maintains the relationships between the variables and allows the system to be simulated. This simulation surfaces system behavior that may be non-intuitive but that is reflected in reality.
System Dynamics models have been applied to a number of challenges since the early seventies. Probably the most famous model was the “Limits to Growth” model created by Donella Meadows and the Club of Rome (1972). This model examined the challenges facing the planet from limited natural resources and growing population. The model fostered action in conservation, population control, and increased exploration for natural resources. System dynamics models are regularly applied in the biological and economic sciences (Hannon & Ruth, 1994) and in different aspects of the managerial sciences (Roberts, 1978; Grantham, 1993), but the author could not find a systems dynamics model that examined the elements contributing to organizational alignment or congruence.

The creation of system dynamics models is a process that has six steps: “1) describe the system; 2) convert description to level and rate equations; 3) simulate the model; 4) design alternative policies and structures; 5) educate and debate; and 6) implement changes in policies and structure” (Forrester, 1994, p. 4). This dissertation focuses on the first three steps and creates a dynamic model that encompasses the linkages between the elements that form an organization’s structure. The system was described based on Nadler and Tushman’s (1992) congruence model and then converted into rate and level (stock and flow) equations and diagrams. Nadler and Tushman’s model was chosen because over the years they have written extensively on the elements in the model to provide a
more detailed understanding of the components. With this understanding, the 
author operationally defined the relationships between the model’s components so 
that the interactions can be simulated and explored. The operational definitions 
are presumed to be functionally accurate while not mathematically exact. In 
system dynamics modeling, the precision of the variable values is less critical than 
the relationship between the variables. Traditionally, the variable’s value is 
sublimated to the ease of understanding and to ensuring that they are 
proportionately balanced with other variables. Capra (1996) recognized the 
illusion of precision in analysis when he said,

No matter how many connections we take into account in our scientific 
description of a phenomenon, we will ways be forced to leave others out. 
Therefore scientists can never deal with truth, in the sense of a precise 
correspondence between the description and the described phenomenon. 
… for systems thinkers the fact that we can obtain approximate knowledge 
about an infinite web of interconnected patterns is a source of confidence 
and strength. (p. 42)

This model will strive to illuminate the dynamic relationships between the 
components that work to align an organization, but it makes no pretense of 
creating a precise representation of reality.
CHAPTER III: METHODOLOGY

Using the systems dynamics modeling software, Ithink®, theoretical models will be created that show the interrelationship between key components that lead to organizational performance. Models will be created showing these relationships in a stable environment and in a chaotic environment. The data that will serve as the basis for these models will come from published case studies of organizations and descriptions of the components and their importance in the business, sociological, and psychological literature. The models will be designed with the intention of keeping them as simple as possible while capturing the dynamic relationship between the variables. It is anticipated that the final model will raise as many questions as it answers and will provide a wealth of opportunities for further refinement, validation, and study.

This dissertation will focus on the first three steps of Forrester’s (1994) process, 1) describe the system; 2) convert description to level and rate equations; and 3) simulate the model. Using that process, the author will create dynamic models that encompass the linkages between the elements that form an organization’s structure. The system will be described based on Nadler and Tushman’s (1992) Congruence Model and then converted into rate and level (stock and flow) equations and diagrams.
Description of the System and its Components

The components for the dynamic model will come from Nadler and Tushman’s (1992) model and will include the design elements of inputs (environment, resources, and history), strategy, the transformation process (informal organization, formal organization, people, and work), and outputs (system, unit, and individual). In order to understand the model, it is necessary to understand how Nadler and Tushman define the components.

Inputs

The Congruence model considers inputs as those elements that are “givens” and with which the model must work. These include the environment, resources, and the organization’s history. The “givens”, according to Nadler and Tushman (1997, p. 29), “cannot be changed in the short run.”

Environment

The environment refers to everything that is outside of the organization. It includes other organizations, competitors, the marketplace, governmental bodies, etc. These elements in the environment will interact with and make demands upon the organization. The environment may be a source of opportunities, constraints, and demands. The environment may be stable or it may be turbulent. It cannot be ignored.
Resources

Resources range from tangible raw material to the human, capital, technological, and information resources available to the organization. The availability of resources may be a source of strength for an organization or a constraint.

History

Today’s organization is largely the product of yesterday’s organization. The organization’s history shaped its perceptions and provided much of the organizational learning that is maintained with the organizations formal and informal systems.

Strategy

The business strategy, according to Nadler and Tushman (1997), flows from the organization’s vision. Vision is a powerful force and is the cornerstone of most organizational planning. Vision may be defined as “creating the future by taking action in the present” (Collins & Porras, 1993, p. 87) or “Shared vision is a collective dynamic urge that is the prime generative force that powers a successful organization” (Fritz, 1999, p. 203). Both definitions emphasize that vision is not a static image of an imagined or predicted future, but is a dynamic force that moves the organization in a constant direction. Vision is often used interchangeably with mission, but Collins and Porras make a distinction between
the two. The mission is defined as “a clear, definable and motivational point of focus — an achievable goal, a finish line to work towards” (Collins & Porras, 1993, p. 85). Nadler and Tushman (1997) define vision as “how [an organization] intends to compete and what kind of organization it wants to be, given the realities of the environment” (p. 29). From this vision, an organization’s strategy is developed and expressed in business decisions about resource allocation against the elements in the environment (demands, constraints, and opportunities).

Strategy includes specific and measurable objectives that steer the organization towards its goals. Strategy is critical to an organization’s success and as Nadler and Tushman (1997) comment, “No amount of organization design can prop up an ill-conceived strategy” (p. 30).

The definition of strategic objectives is more complex than Nadler and Tushman describe, but are developed in detail by Henry Mintzberg. Mintzberg (1994, pp. 24-25) identifies several types of strategy: intended strategy, deliberate strategy, unrealized strategy, emergent strategy, and realized strategy. Intended strategy is the strategy that an organization plans. The deliberate strategy is the intended strategy that is actually applied and acted upon. This intended and deliberate strategy is the essence of strategy as referenced by Nadler and Tushman (1992). The unrealized strategy is the portion of the intended strategy that is not applied. The emergent strategy is a strategy that was not planned but emerged
from a series of consistent actions taken over a period of time. The realized strategy is the combination of the deliberate and emergent strategies. Most organizations, according to Mintzberg (1994), use a combination of the two approaches. An organization that only followed an intended, deliberate strategy would have little space for learning and an organization whose strategy was totally emergent would have little sense of control. The strategic objective component of the dynamic model will need to reflect both deliberate and emergent strategies.

**Transformation Process**

The transformation process is the means by which the inputs to the model are transformed into the outputs of the model. The challenge in organizational design is to configure the components (informal organization, formal organization, people, and work) in a manner that achieves the strategic direction of the organization.

**Informal Organization**

This is often referred to as the organization’s culture. It is the unwritten guidelines and norms that guide the behavior of members of the organization. Nadler and Tushman say that it “encompasses a pattern of processes, practices, and political relationships that embodies the values, beliefs, and accepted behavioral norms of the individuals who work for the company” (p. 32). This definition is in line with Hanna, who defines culture as follows:
Culture is much like air; it is everywhere we look and touches everything that goes on in organizations. It is both a cause and an effect of organizational behavior. The more we learn about organizations, the more elements of culture we discover. There are behaviors, values, assumptions, rites, rituals, folklores, heroes, creeds, physical artifacts, and climate. All are elements of culture. Unfortunately, the definitions of culture that are the most inclusive are also the most esoteric and unwieldy to the manager. (Hanna, 1988, p.42)

Hanna reports a causative linkage between culture and the design elements of decision making, structure, rewards, tasks, information, and people. These design elements, according to Hanna (1988), “reinforce patterns of behavior. Thus, the design choices have a major impact on the organizational culture that will emerge” (p. 44). According to Collins and Porras (1996, p. 66), values are “the essential and enduring tenets of an organization.” From these perspectives, it is clear that the informal organization exerts a significant influence. Nadler and Tushman (1997) note that, “It’s not unusual for informal arrangements to actually supplant formal structures and processes that have been in place so long that they’ve lost their relevance to the realities of the current work environment” (p. 32).

**Formal Organization**

The formal organization includes the structures, processes, systems, and procedures that are developed in a planned manner to guide and support the work of the organization. The formal organization is directly related to the deliberate
strategy of the organization. This element corresponds to structure in Hanna’s (1988) model.

Structure, in Hanna’s model, refers to the organization of the organization: the reporting structures, the organizational boundaries, the roles, and the communication channels. Structure may be thought of as the skeleton of the organization. The variable for this element will represent the continuum between lateral, process-oriented structure and vertical, function-oriented structure.

People

In Nadler and Tushman’s (1997, p. 32) model, people refers to the characteristics of the people who are being asked to perform the work. These characteristics include skills, knowledge, experience expectations, behavior patterns, and demographics. In essence, congruent organizations have a good fit between the design of the organization and the characteristics of the people.

The variable People is also an element in Hanna’s (1988) model and is defined as the human element within the organization. This element includes skill sets, personal needs, and level of motivation.

This component is represented by several variables in the dynamic model.

The first variable represents the level of skills and knowledge possessed by the individuals in the organization. This is the sum of knowledge and skill sets
and is represented as a continuum from no skills to fully qualified. This variable is tied to the level of skills and knowledge required by the organization.

The second variable represents the level of correlation between a person’s individual needs and the organization’s needs. This is a combination of two variables in Hanna’s model: the correlation between a person’s individual values and the values of the organization; and the correlation between personal goals and organizational objectives.

The third variable represents the perceptions that an individual holds about the organization. It is not necessarily the true state of the organization, but it is what the individual believes the state of the organization to be. This variable ranges from a negative to a positive perception of the organization.

The preceding variables combine to indicate the motivational level of the individual. Based on Ford (1992), motivation is defined as “Motivation = Goals x Emotions x Personal Agency Beliefs” (p. 78). This variable is essentially a summary of the preceding three variables. An individual’s personal agency beliefs are the result of the capability of the individual combined with beliefs about “whether the person’s context will facilitate or support the person’s goal-attainment efforts” (Ford, 1992, p. 74). Personal Agency is the combination of the individual’s skills and knowledge mixed with the goals and objectives. The variable, Emotions, refers to the arousal pattern that allows an individual to take
action. This can be basic, as in fight or flight, or it can be more cerebral as in the response to music and thought. For the purpose of this model, emotions may be considered as the correlation between personal and organizational value systems combined with the individual’s perceptions of the organization. Motivation is not overtly represented in the model, though its presence is strongly felt through the interaction of the components that comprise motivation.

**Work**

This is the means by which the organization achieves its mission and realizes its reason for existence. The design of the organization begins with an understanding of the tasks to be accomplished and the interrelationships and flows between one task and another. This element corresponds to the process element in Hammer’s model and the Tasks element in Hanna’s (1988) model.

Tasks are defined by Hanna as the things people do. Another way of viewing tasks is that they are the points at which the strategic becomes tactical. The individual objectives that guide a person’s day-to-day actions are the tasks they perform, and for the purpose of alignment, they must be linked to the strategy of the organization. The variable for tasks represents the continuum from complete linkage to the strategy to objectives created in isolation.
Critical Features

Within the transformation process, Nadler and Tushman (1997) identified critical features that are presented in table 1. These features will be some of the factors examined in the dynamic model.
Table 1. Critical features of elements within the transformation process (Nadler and Tushman, 1997, p. 33)

<table>
<thead>
<tr>
<th>Work</th>
<th>Individual</th>
<th>Formal Organization</th>
<th>Informal Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interdependence</td>
<td>Skills &amp; Knowledge possessed</td>
<td>Grouping of functions &amp; structure of units</td>
<td>Leader behavior</td>
</tr>
<tr>
<td>Routineness</td>
<td>Individual needs and preferences</td>
<td>Coordination and control mechanisms</td>
<td>Norms, values</td>
</tr>
<tr>
<td>Skills &amp; Knowledge demands</td>
<td>Perceptions and expectations</td>
<td>Job design</td>
<td>Intra-group relations</td>
</tr>
<tr>
<td>Rewards inherent to work</td>
<td>Background factors</td>
<td>Work environment</td>
<td>Inter-group relations</td>
</tr>
<tr>
<td>Performance Constraints</td>
<td></td>
<td>HR management systems</td>
<td>Informal working arrangements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reward Systems</td>
<td>Communication and influence patterns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical location</td>
<td>Key roles</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Climate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Power &amp; Politics</td>
</tr>
</tbody>
</table>

Outputs

In Nadler and Tushman’s (1997) model, output is used in a broad sense and “describes what the organization produces, how it performs, and how effective it is” (p. 31). This effectiveness is not only the effectiveness of the organization’s economic output, but also refers to the effectiveness of individuals and groups within the organization.

Nadler and Tushman evaluate the performance of the organization according to three criteria:

1. How successfully has the organization met its strategic objectives?
2. How well has it used its resources to meet the objectives? This includes the development of new resources to prevent the overuse of existing resources.

3. How well does the organization seize new opportunities and ward off threats from the environment?

**Variable Value Ranges**

The system dynamics model uses the Nadler and Tushman (1992) model as the starting point and focuses on the variables shown in Table 2. The ranges for the variables are a deliberate simplification to facilitate the understanding of the model. For example, the variable communication only examines the clarity of the communication while it could easily have focused on the frequency of communication, mode of communication, or any of a hundred other potential dimensions of communication.

These variables were modeled in the Ithink® software and an “executive flight simulator” was created which allowed participants to vary the values of the variables and note the impact of those changes on the outputs of the model. This simulator creates visual control panels with knobs and sliders that allow the user to set level of variables to be run. For example, the user can set the value of Leadership from a value of zero indicating the Leadership skills of someone like
Barney Fife, to a value of one indicating the Leadership skills of someone like Gandhi or Patton.

Table 2. System Dynamics Model variables and ranges

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inputs</strong></td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>stable ⇒ turbulent</td>
</tr>
<tr>
<td>Resources</td>
<td>easily obtained ⇒ constrained</td>
</tr>
<tr>
<td>History</td>
<td>start-up ⇒ traditional</td>
</tr>
<tr>
<td><strong>Strategy</strong></td>
<td></td>
</tr>
<tr>
<td>Intended</td>
<td>realized ⇒ unrealized</td>
</tr>
<tr>
<td>Emergent</td>
<td>realized ⇒ unrealized</td>
</tr>
<tr>
<td><strong>Transformation Process</strong></td>
<td></td>
</tr>
<tr>
<td><em>Informal Organization</em></td>
<td>negative ⇒ positive contribution</td>
</tr>
<tr>
<td>Leadership</td>
<td>weak ⇒ strong</td>
</tr>
<tr>
<td>Norms/Values</td>
<td>vague ⇒ strong</td>
</tr>
<tr>
<td>Intra-group relations</td>
<td>disruptive ⇒ cohesive</td>
</tr>
<tr>
<td>Inter-group relations</td>
<td>disruptive ⇒ cohesive</td>
</tr>
<tr>
<td>Communication</td>
<td>unclear ⇒ clear</td>
</tr>
<tr>
<td>Role Clarity</td>
<td>unclear ⇒ clear</td>
</tr>
<tr>
<td>Climate</td>
<td>formal ⇒ informal</td>
</tr>
<tr>
<td>Politics</td>
<td>low trust ⇒ high</td>
</tr>
<tr>
<td><strong>Formal Organization</strong></td>
<td></td>
</tr>
<tr>
<td>Structure</td>
<td>negative ⇒ positive contribution</td>
</tr>
<tr>
<td>Control</td>
<td>process, product, function, geographic</td>
</tr>
<tr>
<td>Job design</td>
<td>centralized ⇒ decentralized</td>
</tr>
<tr>
<td>Reward System</td>
<td>poor fit ⇒ good fit</td>
</tr>
<tr>
<td></td>
<td>individual ⇒ team</td>
</tr>
<tr>
<td><strong>People</strong></td>
<td></td>
</tr>
<tr>
<td>Skills &amp; Knowledge</td>
<td>negative ⇒ positive contribution</td>
</tr>
<tr>
<td>Personal needs</td>
<td>low ⇒ high</td>
</tr>
<tr>
<td>Perceptions</td>
<td>conflict ⇒ congruent</td>
</tr>
<tr>
<td></td>
<td>negative ⇒ positive</td>
</tr>
<tr>
<td><strong>Work</strong></td>
<td></td>
</tr>
<tr>
<td>Interdependence</td>
<td>negative ⇒ positive contribution</td>
</tr>
<tr>
<td>Routineness</td>
<td>low ⇒ high</td>
</tr>
<tr>
<td>Skill demands</td>
<td>low ⇒ high</td>
</tr>
<tr>
<td>Intrinsic reward</td>
<td>low ⇒ high</td>
</tr>
<tr>
<td>Performance constraint</td>
<td>low ⇒ high</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td></td>
</tr>
<tr>
<td>Strategic objectives met</td>
<td>% Intended objectives realized</td>
</tr>
<tr>
<td>New opportunities seized</td>
<td>% Emergent objectives realized</td>
</tr>
</tbody>
</table>
Model Validation

The model was subjected to the accepted tests for systems dynamics models. According to Shreckengost (1984), “there are no fully valid models because all models are something less than the object, or system, being modeled” (p.1). Rather, Shreckengost emphasizes that a model’s value depends on the purpose for which it is created and that, “Validity, or usefulness, lies in the subjective view of the user. We think of models as valid when they can be used with confidence” (p. 1). Confidence then becomes the way in which models are assessed. Forrester and Senge (1980) support this perspective when they say, “Validity as meaning confidence in a model’s usefulness is inherently a relative concept. One must always choose between competing models. Often a model with known deficiencies may be chosen, if it inspires greater confidence than its alternatives” (p. 211).

Shreckengost, after Forrester and Senge, focuses on two major test areas: structure and behavior. Tvedt (1996) agrees with the two test areas and based on Richardson (Richardson & Pugh, 1981) he adds three sub-dimensions: verification, validation, and evaluation. The details of these dimensions correspond with Shreckengost’s sub-groupings under both major test areas. Tvedt’s breakdown is shown in Figure 13.
According to Shreckengost, “Every element in a model should have a real-world counterpart, and every important factor in the real system should be reflected in the model” (p. 2). Elements that must be considered in the structure include the model parameters, the model’s boundaries, and extreme conditions.

The model’s parameters are the actual values used in the model. If valid historical data exists, it may be used to check the parameters. Unfortunately, this is rarely the case for “soft” variables. In the absence of historical data, these

<table>
<thead>
<tr>
<th>Verification (tests focusing inward on the model)</th>
<th>Focusing on Structure</th>
<th>Focusing on Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Dimensional consistency</td>
<td>• Parameter (in)sensitivity</td>
<td></td>
</tr>
<tr>
<td>• Extreme conditions in equations</td>
<td>- behavior</td>
<td></td>
</tr>
<tr>
<td>• Boundary adequacy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- important variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- policy levers</td>
<td>- characteristics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- policy conclusions</td>
<td></td>
</tr>
<tr>
<td>Validation (tests comparing the model with information about the real system)</td>
<td>• Structural (in)sensitivity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- behavior</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- characteristics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- policy conclusions</td>
<td></td>
</tr>
<tr>
<td>• Face validity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- rates and levels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- information feedback</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- delays</td>
<td>• Replication of reference modes (boundary adequacy for behavior)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- problem behavior</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- past policies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- anticipated behavior</td>
<td></td>
</tr>
<tr>
<td>• Parameter values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- conceptual fit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- numeric fit</td>
<td>• Extreme condition simulations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Surprise behavior</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Case study</td>
<td></td>
</tr>
<tr>
<td>Evaluation (tests concerning the usefulness of the model, with respect to the user)</td>
<td>• Appropriateness of model characteristics for audience</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- size</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- simplicity/complexity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- aggregation/detail</td>
<td>• Counter-intuitive behavior</td>
</tr>
<tr>
<td></td>
<td>exhibited by model</td>
<td></td>
</tr>
<tr>
<td></td>
<td>made intuitive by model-based analyses</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Generation of insights</td>
<td></td>
</tr>
</tbody>
</table>

Figure 13. Tvedt’s (1996, p. 49) Tests for Confidence based on Richardson & Pugh
values must be checked against “expert” knowledge for reasonableness and consistency.

The model’s boundaries set the context in which the model may be applied. In Shreckengost’s study, the boundary was heroin usage in New York City. The model could not be extended to the national level. However, he notes that, “In practice, boundaries tend to shift as the developers’ and users’ understanding of the problem evolves with the model’s development” (Shreckengost, 1984, p. 3).

Extreme conditions refer to shifts in the model’s parameters that are outside of the norms that were used during the model’s creation. In Shreckengost’s study, heroin users were related to the supply of heroin which varied between 3 and 7 tons during the model’s development. If the model did not account for extreme conditions, it might still show heroin users when the supply was 0. A model should be designed to behave logically when values exceed the design parameters.

**Behavior Tests**

Behavior tests normally take six forms: behavior replication test, anomalous behavior test, behavior sensitivity test, behavior prediction test, family member test, and behavioral boundary test.
The behavior replication test compares the behavior of the model with the observed behavior of the system. If historical data is available, the model should be capable of generating similar data. In the absence of historical data, experts in the system judge the model’s behavior.

The anomalous behavior test examines results that do not match the reasonable expectations from the model. When this occurs, the structure, parameters, and boundaries are checked. If they appear correct, then the comparative data is examined for inaccuracies.

The behavior sensitivity test looks at the sensitivity of the model to changes in parameter values. According to Shreckengost (1984), “The criterion in the sensitivity test is that any sensitivity exhibited by the model should not only be plausible, but also consistent with observed, or likely, behavior in the real system” (p. 6).

The behavior prediction test checks the model’s ability to predict behavior given a variety of alterations in the parameter’s values. The basis for this measurement is expert judgment, experience, and intuition applied to the results generated by the model.

The family member test examines the model’s results when applied to environments similar to the one modeled. For example, a convenience store
model should be applied to other convenience stores as a general predictor of behavior.

The behavior boundary test verifies that the boundaries of the model are still appropriate in light of extreme conditions, predictive behavior, and generic application. This test is part of an iterative cycle that continually checks and improves the model.

Procedures

A system dynamics model of the alignment process was developed using the Ithink® software version 5.0. The model was created following the first three steps of Forrester’s (1994) process, 1) describe the system; 2) convert description to level and rate equations; and 3) simulate the model.

After the model was completed, a panel of experts was identified to test the model according to the methods identified by Shreckengost (1984). The experts consisted of managers within a Fortune 50 company to check internal validity. The family member test was not relevant for this model, so it was omitted. Consultants from Price-Waterhouse were asked to check for the possible extension of the model beyond the identified boundaries.

Biographical sketches were provided for each expert to identify the qualifications that make them an expert. These experts were asked to complete a form soliciting feedback on the performance of the model. The form consisted of
questions that specifically relate to components in the model and the performance of those components. The feedback is directly related to the performance of the model and was not subjected to any form of analysis, but was the foundation for the discussion section. A sample of the feedback form is included in Appendix A.
CHAPTER IV: THE MODEL

The model (Figure 14) has six major areas: strategy, inputs, work sub-systems, formal organization, informal organization and people. These areas interrelate with each other as depicted in Figure 14. These areas correspond with the components in Nadler and Tushman's model. Each major area is composed of

Figure 14. Major sections of the System Dynamics Model of Alignment
Inputs

The inputs to the model include the turbulence factor and the resources factor. The Turbulence factor corresponds to the environment factor in Nadler and Tushman's (1992) model and is a roll-up of all of the environmental influences into a single variable that indicates the degree to which the environment is changing. The Resources factor is a variable that represents the demands on the organization. Both variables are user defined (Figure 15).

Figure 15. Input screen for user to set values for Environment variables

Turbulence

Turbulence is a variable value that is set by the user when the model is run. It directly impacts the following variables: Emergent Strategy, Skill Change, and Routineness. Turbulence has a variable range from 0 to 1 in increments of .1.
A value of 0 represents total stability and a value of 1 indicates extreme change bordering on chaos. The default setting is 0.

**Resources**

The Resources variable represents the demand on the resources of the organization. These include physical, capital, and human resources.

![Figure 16](image_url)

**Figure 16.** Graphic input display for Resources as a function of Total Objectives

The variable is set-up as a graphic function (Figure 16) with 1 representing the normal demand on the total availability of resources and 2 representing the demand level that over strains the resources. Either absolute state is unrealistic. The graph may be altered during the simulation. The setting is a function of the
total number of objectives facing the organization. Total objectives is defined as follows:

$$\text{Total Objectives} = \begin{cases} \frac{\text{Planned Objectives}}{\text{Months Left}} + \text{Emergent Strategy}, & \text{if Months Left} > 0 \\ \text{Emergent Strategy} & \text{else} \end{cases}$$

Total Objectives combines the objectives to be met in a particular month. It combines the Planned Objectives that are part of the annual strategy and the emergent objectives that arise as the result of change.

The default graph for Resources assumes adequate resources for the planned strategy, but the additional Emergent Strategy will begin to place a strain on the organization. This assumption is based on the fact that most organizations plan their staffing levels in accordance with their strategic planning process.

**Strategy**

The strategy section of the model includes the primary flow. It represents both the planned strategy of the organization and the emergent strategies that result from changes in the environment. It has two primary flows, one representing the planned strategy and the second representing the emergent.

![Figure 17](image.png)

**Figure 17.** The Planned strategy flow as represented in the model.
The planned flow (Figure 17) begins with a stock representing the Planned Objectives for the year. In most organizations, this is a set number that is determined during the annual planning process. These objectives are communicated to the organization. This communication is represented by the flow symbol which corresponds to the communication process. The objectives are then acted upon within the conveyor (III) and converted to Realized Objectives. This is represented by the bottom flow in Figure 18.

The top flow is a similar structure that represents the flow of Emergent Objectives. The key difference is that the Emergent Objectives are not preset but are the result of the degree of change indicated by the Turbulence factor. The degree to which the organization is able to respond to the emergent strategies is

Figure 18. The primary flows for planned and emergent strategies.
influenced by the variables Organizational Climate and Leadership. These relationships will be reviewed in detail below.

Realization of Emergent Strategy

In the model, the Emergent Strategy is realized through variable flow called E_Out. This flow is defined by the following equation:

\[
\text{TRANSIT TIME} = \begin{cases} 
\text{if } (\text{Organizational\_Climate} > 0.75) \text{ then Work\_Factor else} \\
(\text{Work\_Factor} + (1-\text{Organizational\_Climate}) + (1-\text{Leadership}))
\end{cases}
\]

This variable determines the time in which objectives can be achieved and is the result of the work factor and the nature of the environment. The model factors in whether or not the organization has a centralized environment and the relative levels of Inter-group and Intra-group cohesiveness to arrive at a measure of organizational climate. It assumes that it will take longer to respond to emergent objectives when the organizational climate score is low due to non-cohesive group dynamics and centralized control. This time may increase if the leadership of the organization is weak. Explicitly, it states that if the organization's degree of informality is greater than 75% then it will be able to respond to emergent strategies naturally. If it is more formal, then its ability to respond will be the result of the natural response tempered by the level of formality and the degree of leadership. Strong leadership will not make up for the organizational climate, but weak leadership will aggravate the situation.
Planned Objectives

Planned Objectives are the result of the strategic planning process within an organization. The variable is initialized with a value of 100. This may be considered as 100% of the planned objectives.

Clear Communications

Clear Communications is the variable representing the communications to the organization. This variable could easily become a separate model. It is simplified to represent the clarity of communication as tempered by leadership. Its formula is as follows:

\[
\text{Clear\_comm} = \left(100 \ast \text{mean(Comm\_Factor,Leadership)}\right)/12
\]

Informal Organization

Figure 19. User input dialog for the Informal Organization variables that include Communication and Leadership.
The Comm_Factor is a variable that is set by the user (Figure 19) and has a range from 0 to 1 in .1 increments. A value of 0 represents a total breakdown in communications and a value of 1 represents perfectly clear communication. A value of 0 would only be expected in extreme cases such as differences in language. It is averaged with the Leadership Factor to determine the degree of communication. The Leadership factor is determined by the following formula:

$$\text{Leadership} = \text{Leaders}_{-}\text{Ability} - (1 - \text{Politics\_&\_Trust})$$

The Leader's Ability is set by the user (Figure 19) and has a range of 0 to 1 in .1 increments. A value of 0 represents an individual with no leadership abilities and a value of 1 represents a strong leader. As noted in the formula, the Leadership variable is the Leader's Ability minus the attenuating effects of trust in the organization. That is, if trust is high, Leadership will be solely based on the Leader's Ability while if trust is low, the distrustful atmosphere will erode the Leader's ability to lead.

**Work**

The conveyor called Work represents the processes within the organization that are used to convert the objectives of the organization into the outputs required by the clients. Work is initialized with a value of \( \frac{100}{12} \) which is the full achievement of one month's Planned Objectives.
As shown in Figure 20, Work has two different outflows. The primary flow is called output and represents the successfully completed work that becomes Realized Objectives. The second flow is called Lost Opportunity and represents the work that was not achieved due to work related issues. The variable Work Factor determines the amount of work that is accomplished. It is a complex variable with a number of influencing conditions. It will be reviewed in detail under the Work Sub-systems section.

Figure 20. Design of variables impacting work.
Work Sub-Systems

The Work Sub-systems section is focused on the elements that impact the performance of the tasks the organization sets.

**Work Factor**

The key component is Work Factor that determines the flow of both the planned and emergent strategies. Work Factor is in turn influenced by variables within and outside the Work Sub-systems section. Work factor is defined as follows:

$$\text{Work\_Factor} = \frac{(((3 + (1-\text{perf}\_factor} + (1-\text{Personal\_Factor}) + (1-\text{Reward\_Congruence})) / 3) + \text{Resources}) / 2$$

![Figure 21. Variables in the Work Sub-system section](image-url)
Work Factor, assumes a value of 1 and then adds to that value based on other factors such as Perf_factor, Personal_factor, Resources, and Reward_Congruence to determine the Work Factor. The resultant total determines the relative effectiveness of the system and is reflected in the time it takes for objectives to move through the system. If all the factors are optimal, the process will retain a value of 1 and all objectives will be achieved within the allotted time frame. If not, the value will be greater than 1 and the system will be inefficient. As you can see in the formula, Perf_factor, Personal_factor, and Reward_Congruence are weighted equally and Resources is weighted equal to the mean of those three variables. The assumption is that if an organization has inadequate resources, the best systems and people cannot fully overcome the gap.

Performance Factor

The Perf_Factor variable is internal to the section as shown in Figure 21. The variables Personal_Factor, Resources, and Reward Congruence are external. Perf_Factor is a graphic function (Figure 22) that is tied to the skill gap. As the skill gap increases, the performance function goes down in a matched and stepped manner. The variables that are external to the Work Sub-system will be discussed in their own section.
Skill Gap

Skill Gap is the variable that drives the setting for the Performance Factor. Skill Gap is a derived variable that is the result of the user defined variables Skill Levels and Skill Demands (Figure 23). The formula for the variable is:

\[ \text{Skill\_Gap} = ((\text{Skill\_Demands} + \text{Skill\_Change}) - (\text{Skill\_Levels} + \text{Skill\_Development})) \]

Note that there are two additional variables that impact Skill Gap. These are Skill Change and Skill Development.

Skill Change

Skill Change is determined by the following formula:

\[ \text{Skill\_Change} = \text{if}(\text{Turbulence} > 0) \text{ then PULSE}(0.1, 2, 1/\text{Turbulence}) \text{ else } 0 \]
This variable assumes that the need for changes in skill sets is related to the amount of change in the environment. The higher the rate of change, the more...

**Work**

Interdependence

Skill Demands

This represents the degree to which the work is interdependent. 
0 = Independent 
1 = Requires teamwork

Skill demands are the level of skills required by the work. 
0 = Low skill level 
1 = Highest skill level

The interdependence setting for the work needs to be congruent with the setting in the rewards section. The skill demands should correlate well with the skill level setting in the people section.

**People**

Skill Levels

Personal needs

Skill levels represents the current level of the individuals performing the work. 
0 = Low skill level 
1 = Highest skill level

This represents a measure of the congruence between the individual's needs and the organization's. 
0 = Total Conflict 
1 = Total Congruence

The settings for those factors affect the degree of work performance. The skill level setting will correlate with the skill demand setting in the work section. The congruence of individual and organizational objectives is a factor in the personal motivation equation.

Figure 23. User setting dialog for Skill Demands and Skill Levels
often the organization will be taxed to raise its skill levels. This variable
determines the setting of the Turbulence variable, a user defined variable, and
then creates a change in the level of skill sets required. If the setting for
Turbulence is greater than 0, then the program will increase the level of skills
demanded by a factor of .1 beginning in the second month and continuing on an
interval of 1/Turbulence. Otherwise, if the Turbulence setting indicates a stable
environment the skill demands will not be increased.

**Skill Development**

Skill Development refers to the organization's ability to retrain and is
influenced by value of Skill Change and the Leadership within the organization.
The formula is:

\[
\text{Skill\ Development} = \text{DELAY}(\text{Skill\ Change}, 1-\text{Leadership}, 0)
\]

As the need for skills changes, the organization will attempt to provide training in
those skills. This function assumes that there is at least a one month delay
between recognizing the need for new skills and having the training completed. If
the leadership is strong in the organization, these changes will be recognized
earlier and the delay will be minimized. Just as Skill change increases the Skill
Demands, Skill Development increases the Skill Levels.
Accomplishment

Skill Gap also influences another chain of variables that begins with one called Accomplishment. This variable is a measure of the individual's sense of accomplishment. It is a graphical function that is tied to the Skill Gap.

Accomplishment = GRAPH(abs(Skill_Gap))

This variable assumes that people get a sense of satisfaction when their skill sets match the demands of the job. If they are lacking in skills, they have a sense that they are performing below expectations and are less satisfied. If their skills are too high for the job, then they begin to feel boredom and are less satisfied.
The graph looks at the value of Skill Gap in absolute terms. If the Skill Gap is non-existent, then the assumption is that the individual may not feel fully challenged, so the intrinsic reward is lessened.

**Intrinsic Reward**

Intrinsic reward is a derived variable that is the average of Accomplishment and Routineness. The formula is as follows:

\[
\text{Intrinsic Reward} = \frac{(\text{Accomplishment} + \text{Routineness})}{2}
\]

Intrinsic reward is the natural reward that comes from a challenging job that is within one's capabilities.

Figure 25. Relationship between Routineness and Turbulence
Routineness

This variable represents the individual's response to the level of routine in a job. The formula for Routineness assumes that people like a balance between change and stability. If the level of turbulence is at the middle value, the person is most satisfied with the level of routine. As the amount of change increases, the person becomes more challenged by the change and less satisfied. As the amount of change decreases, the person becomes more bored with the routine and is less satisfied. The variable is a graphic function tied to the user set value of Turbulence.

\[ \text{Routineness} = \text{GRAPH(Turbulence)} \]

Like the relationship between Skill Gap and Accomplishment, the graphic relationship values are set at arbitrary levels, but the levels represent the conceptual relationship between comfortable predictability and the need for stimulating change.

Intrinsic Reward takes these two relationships and uses them as a factor in Personal Factor. Personal Factor is a variable that is part of the People section and will be reviewed in more detail in that section.
People

This section of the model focuses on the human aspects of the model and determines the value of the variable called Personal Factor.

The value for this variable results from the following equation:

\[
\text{Personal\_Factor} = \text{GRAPH}(\text{if Leadership}>0.5 \text{ then } ((\text{Personal\_needs} + \text{Intrinsic\_Reward} + \text{Role\_Clarity} + \text{Group\_impact})/4 + 0.1) \text{ else } (\text{Personal\_needs} + \text{Intrinsic\_Reward} + \text{Role\_Clarity} + \text{Group\_impact})/4)
\]

The Personal Factor is a measure that combines the degree of congruence between an individual’s values and the company's needs, as represented in Personal_Needs. It is affected by the impact of exceptional leadership and the intrinsic reward or lack thereof that may arise from having skill sets that are significantly above or below those required to perform the task at hand. Finally, the individual’s role clarity and the impact of group interactions influence Personal Factor. Thus,
Personal Factor is a graphic function of the average impact of Personal Needs, Intrinsic Reward, Role Clarity, and Group Impact. If the Leadership is strong, then the average is increased by a factor of .1.

**Personal Needs**

As shown in Figure 23, the value of Personal Needs is user determined at the time the model is executed. The setting for Personal Needs assumes a value that ranges from 0 to 1, with 0 representing complete conflict between the needs of the individual and the needs of the organization to a value of 1 representing total congruence. While this value is critical, the on-going intrinsic rewards of the situation, the degree of positive interaction with the group, and the perceived clarity of the individual’s role in the organization influence Personal Needs. The relationship between these factors and the Personal Factor is defined by the graphical relationship shown in Figure 27.

**Figure 27.** Graphical relationship defining Personal Factor
Role Clarity

Role Clarity is defined by the following equation:

\[ \text{Role Clarity} = \begin{cases} \text{Leadership < 0.3} & \text{then 0.3 else Leadership} \\ \end{cases} \]

Its value is set based on the degree of Leadership within the organization. If the level of Leadership falls below 0.3, the formula assumes that an individual will probably be clear on at least a third of the role. If the value of Leadership is higher, then the degree of role clarity is a direct reflection of the Leadership value.

Role Clarity influences both the Personal Factor and the Intra-group relations. The impact on Intra-group relations will be explored in that section.

Intra-group Relations

Intra-group Relations is defined by the following equation:

\[ \text{Intra-group Relations} = \begin{cases} \text{if(Activity Grouping = 1) then Role Clarity else} \\ \text{(.5+Role Clarity)/2} \\ \end{cases} \]

This variable is a reflection of the degree of cohesiveness within the group. The assumptions are as follows:

1. If the organization is organized around functional activities then individuals with similar skill sets and mindsets will be working together which should increase cohesiveness.

2. If it is organized around a different structure, such as output or user, then the value is set at 0.5 which is an arbitrary weight reflecting a presumed loss of cohesion that may arise from a more cross-functional team.

The other factor considered to impact group cohesion is the clarity of the roles of the individuals in the group. The assumption is that increased role clarity reduces
a number of sources of interpersonal conflict, which will increase Intra-group cohesion.

**Inter-group Relations**

Inter-group relations is a variable that is set by the user at run time. It is part of the definition of the informal organization and is shown in Figure 19. The variable is set on a scale from zero to one as shown in Figure 28. A value of zero indicates that the group is dysfunctional and not working well together while a value of one would indicate a perfectly functioning team with no internal friction.

**Group Impact**

Group Impact is a variable that reflects the combined effect of Intra-group relations and Inter-group relations in light of the activity grouping of the organization.

\[
\text{Group\_impact} = \begin{cases} 
(2^*\text{Intra-group\_Relations}) + \text{Inter-group\_relations})/3 & \text{if } (\text{Activity\_Grouping}=1) \\
(2^*\text{Inter-group\_relations}) + \text{Intra-group\_Relations})/3 & \text{else} \end{cases}
\]
It assumes that Intra-group relations will be more critical in an activity based organization since the members of the functional group perform the work through interactions within the functional group. In the other potential groupings, output or user, the work is performed more cross-functionally necessitating more Inter-group actions.

**Activity grouping**

Activity grouping is another variable whose value is set at run time. It represents the primary direction of the organizational structure following the constructs proposed by Nadler and Tushman (1997). The variable is set through

![Figure 29](#)  
Figure 29. Switch box for setting the primary organizational structure.
the dialog shown in Figure 29. This variable interacts with the Intra-group Relations and Group Impact variables in the manner discussed above. As discussed in the Work section, the People Factor is a critical determinant of the work outputs. However it is the result of a series of complex interactions between Group Dynamics, Internal Role Clarity, the influence of Leadership, and Inner Needs. The relationships defined in this model are intended to provide an initial glimpse at these interactions but recognizes that the complexity of any one of these interactions could constitute a model by itself.

Formal Organization

Formal Organization, in this model and according to Nadler and Tushman (1997), refers to those elements within an organizational design and structure that are consciously and deliberately implemented.

Figure 12. Elements in the Formal Organization component of the model.
Figure 30 displays the variables utilized in the model. The organizational structure is addressed in the grouping variables and was discussed under the People section. The additional variables are Centralized Control and Reward Congruence. Formal Organization variables are set in the dialog shown in Figure 31.

![Figure 31. Dialog for setting Formal Organization variables.](image-url)
Centralized Control

Centralized Control is a user set variable determined at run time. If the organization is highly centralized then the value is set to 1. If it is more decentralized, then the value is set to 0. The model assumes a greater time lag in responding to change in a centralized environment due to the necessity of clearing decisions through a central point. This variable is a formal determination, but its impact is greatest in the informal organization. This relationship will be discussed in the Informal Organization section.

Reward Congruence

Reward Congruence is a variable that is determined by the interaction of two user set values: Reward System and Interdependence. The Reward System is set according to the degree to which it is team-based versus individual based. There is no inherently better design to use, but the strongest relationship results from a high degree of congruence between the basis of the reward system and the Interdependence of the organization. The Interdependence value is set in the dialog shown in the Work section of Figure 23.

Just as an entity has a formal organization, it has an informal organization. This Informal Organization will be discussed in the next section.
Informal Organization

The Informal Organization consists of organizational constructs that are not consciously planned but which naturally emerge as an organization goes about its existence. The key variables in the model are shown in Figure 32.

As discussed in the section under Clear Communication, Leadership is determined by the interaction between the Leader’s Ability and the Politics & Trust variables. The latter are user set variables whose dialog box is shown in Figure 19.

Organizational Climate

Organizational Climate is a calculated variable that is based on the interaction between three variables: Intra-group Relations, Inter-group Relations, and Centralized Control. It is defined by the following equation:

\[ \text{Organizational\_Climate} = \text{MEAN} ((1 - \text{Centralized\_Control}) + \text{Inter-group\_relations} + \text{Intra-group\_Relations}) \]
Organizational Climate is a reflection of the degree of informality within an organization. The assumptions are that: centralized control will tend to be more formal than decentralized control; Strong Inter-group relations will allow for a more informal climate; Strong Intra-group relations will allow for a more informal climate. The variable is set as the average of these values. The closer the value of Organizational Climate is to one, the more informal the organization. The impact of Organizational Climate on the design was discussed in the section on Realization of Emergent Strategy.

The final two variables listed in the Informal Organization section are Comm_Factor and Role Clarity. These were both reviewed in detail in earlier sections and are displayed in this section to underscore their presence in the informal organization.

Behavior of the Model

All of the variables reviewed are part of an interactive simulation model and impact the behavior of the model. The possible combinations are too extensive to discuss all of them in detail, but this section will review some of the key behaviors.

The Perfect Organization

The first iteration will examine the extreme setting of all variables performing to the ideal setting. This organization has strong leadership, excellent
communication, a high degree of trust, etc. The organization is assumed to be
decentralized and activity based with a stable environment.

Table 3. Value settings for "Ideal" Organization.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Informal</strong></td>
<td></td>
</tr>
<tr>
<td>Comm Factor</td>
<td>1</td>
</tr>
<tr>
<td>Leader's Ability</td>
<td>1</td>
</tr>
<tr>
<td>Politics &amp; Trust</td>
<td>1</td>
</tr>
<tr>
<td>Inter-group Relations</td>
<td>1</td>
</tr>
<tr>
<td><strong>Formal Organization</strong></td>
<td></td>
</tr>
<tr>
<td>Centralized Control</td>
<td>Off</td>
</tr>
<tr>
<td>Reward System</td>
<td>1</td>
</tr>
<tr>
<td>Organization Structure</td>
<td>Act</td>
</tr>
<tr>
<td><strong>People</strong></td>
<td></td>
</tr>
<tr>
<td>Skill Levels</td>
<td>1</td>
</tr>
<tr>
<td>Personal Needs</td>
<td>1</td>
</tr>
<tr>
<td><strong>Work</strong></td>
<td></td>
</tr>
<tr>
<td>Interdependence</td>
<td>1</td>
</tr>
<tr>
<td>Skill Demand</td>
<td>.5</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td></td>
</tr>
<tr>
<td>Turbulence</td>
<td>0</td>
</tr>
<tr>
<td>Resources</td>
<td>Graph</td>
</tr>
</tbody>
</table>

The value settings are shown in Table 3. The results of this run are shown in Figure 33.
environment. It should be noted that these values are only considered “perfect” in a stable environment. Rigid adherence to predetermined strategies can be deadly in a volatile environment since such adherence precludes the ability to adapt and learn from the changes experienced. Next, the variables will be set to indicate an organization whose leader's abilities are less than optimum.

The Leadership Challenged Organization

The values for an organization whose leader's abilities are lacking are left the same for all variables other than Leader's Ability. To amplify the effect, this variable is set at the extreme level of zero. The settings are shown in Table 4.

Table 4. Variable settings for the Leadership challenged organization.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal</td>
<td></td>
</tr>
<tr>
<td>Comm Factor</td>
<td>1</td>
</tr>
<tr>
<td>Leader's Ability</td>
<td>0</td>
</tr>
<tr>
<td>Politics &amp; Trust</td>
<td>1</td>
</tr>
<tr>
<td>Inter-group Relations</td>
<td>1</td>
</tr>
<tr>
<td>Formal Organization</td>
<td></td>
</tr>
<tr>
<td>Centralized Control</td>
<td>Off</td>
</tr>
<tr>
<td>Reward System</td>
<td>1</td>
</tr>
<tr>
<td>Organization Structure</td>
<td>Act</td>
</tr>
<tr>
<td>People</td>
<td></td>
</tr>
<tr>
<td>Skill Levels</td>
<td>1</td>
</tr>
<tr>
<td>Personal Needs</td>
<td>1</td>
</tr>
<tr>
<td>Work</td>
<td></td>
</tr>
<tr>
<td>Interdependence</td>
<td>1</td>
</tr>
<tr>
<td>Skill Demand</td>
<td>.5</td>
</tr>
<tr>
<td>Environment</td>
<td></td>
</tr>
<tr>
<td>Turbulence</td>
<td>0</td>
</tr>
<tr>
<td>Resources</td>
<td>Graph</td>
</tr>
</tbody>
</table>
The results of this setup are shown in Figure 34. The lack of leadership resulted in an organization that only achieved 46.5% of its planned strategy. Again, the Emergent strategy is not a factor in a stable environment. The significant impact of a low Leadership score is apparent if one thinks of all of the equations that had leadership as a factor.

Leadership is defined based on the value of Leader's Ability as it is tempered by the political climate in the organization. Communication, the transit time for E_Out, Role Clarity, and Skill Development are all dependent on the value of leadership.

\[
\text{Leadership} = \text{Leaders} \_\text{Ability} - (1 - \text{Politics} \_\& \_\text{Trust})
\]

**Figure 34.** Results in a "Leadership Challenged" organization.
Clear_comm = (100*(mean(Comm_Factor,Leadership)))/12

Unclear_Comm = (100*(1-MEAN(Comm_Factor,Leadership)))/12

TRANSIT TIME for E_OUT= If (Organizational_Climate>.75) then Work_Factor else (Work_Factor+(1-O Organizational_Climate)+(1-Leadership))

Role_Clarity = if (Leadership<.3) then .3 else Leadership

Skill_Development = DELAY(Skill_Change,1-Leadership,0)

When the Leader's Ability is zero, the value of Leadership will be either zero or a negative number depending on the level of Trust. This low score is averaged with the Comm_factor and effectively cut the level of effective communication in half. It also influences the level of Role Clarity since the model assumes that a significant degree of clarity results from effective leadership.

Communication as a Challenge

Next to Leadership, Communication may be viewed as the most significant factor in the model. If the direction of the organization is not communicated to the workforce, then the probability of success is reduced. When all other factors are left at the optimal value and communication is set to zero, the results, Figure 35, are similar to the results with Leader's Ability set to zero. The level of success is 50%. The model's parameters are set as shown in Table 5.
Table 5. Variable setting for poor communication.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal</td>
<td></td>
</tr>
<tr>
<td>Comm Factor</td>
<td>0</td>
</tr>
<tr>
<td>Leader's Ability</td>
<td>1</td>
</tr>
<tr>
<td>Politics &amp; Trust</td>
<td>1</td>
</tr>
<tr>
<td>Inter-group Relations</td>
<td>1</td>
</tr>
<tr>
<td>Formal Organization</td>
<td></td>
</tr>
<tr>
<td>Centralized Control</td>
<td>Off</td>
</tr>
<tr>
<td>Reward System</td>
<td>1</td>
</tr>
<tr>
<td>Organization Structure</td>
<td>Act</td>
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<tr>
<td>People</td>
<td></td>
</tr>
<tr>
<td>Skill Levels</td>
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</tr>
<tr>
<td>Personal Needs</td>
<td>1</td>
</tr>
<tr>
<td>Work</td>
<td></td>
</tr>
<tr>
<td>Interdependence</td>
<td>1</td>
</tr>
<tr>
<td>Skill Demand</td>
<td>.5</td>
</tr>
<tr>
<td>Environment</td>
<td></td>
</tr>
<tr>
<td>Turbulence</td>
<td>0</td>
</tr>
<tr>
<td>Resources</td>
<td>Graph</td>
</tr>
</tbody>
</table>

The results are primarily derived from the impact of communication on the following two equations:

\[
\text{Clear}\_\text{comm} = (100\times(\text{mean(Comm}\_\text{Factor},\text{Leadership)})))/12
\]

\[
\text{Unclear}\_\text{Comm} = (100\times(1-\text{MEAN(Comm}\_\text{Factor},\text{Leadership)})))/12
\]

As may be seen, the impact of Comm_Factor is equivalent to the impact of Leadership. The results from the model are slightly better than when the Leader's Ability was low since the Comm-Factor does not impact as many different areas.
Low Trust Organization

A "low trust" organization creates a situation that can hamper a Leader's effectiveness. When the simulation is run with all settings at optimal, but with the trust level set low, the results are identical to that achieved when the Leader's Ability was set to zero. This is the result of the following equation:

\[ \text{Leadership} = \text{Leaders\_Ability} - (1 - \text{Politics\_&\_Trust}) \]

With Trust set at zero, the Leader's Ability is drawn to zero. This follows the logic that if every statement a leader makes is thought to be a lie and every planned action is thought to be incompetent, then the Leader will be unable to move the organization in a common direction. This situation is unlikely to appear except in the rare case of a strong leader inheriting a distrustful organization. In

\[ \text{Figure 35. Results when the Communication Factor is at zero.} \]
that case, the Leader's ability to move the organization will rise proportionate to
the increasing levels of trust. The settings for this simulation are shown in Table
6.

Table 6. Variable settings for the low trust organization.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Informal</strong></td>
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</tr>
<tr>
<td>Comm Factor</td>
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</tr>
<tr>
<td>Leader's Ability</td>
<td>1</td>
</tr>
<tr>
<td>Politics &amp; Trust</td>
<td>0</td>
</tr>
<tr>
<td>Inter-group Relations</td>
<td>1</td>
</tr>
<tr>
<td><strong>Formal Organization</strong></td>
<td></td>
</tr>
<tr>
<td>Centralized Control</td>
<td>Off</td>
</tr>
<tr>
<td>Reward System</td>
<td>1</td>
</tr>
<tr>
<td>Organization Structure</td>
<td>Act</td>
</tr>
<tr>
<td><strong>People</strong></td>
<td></td>
</tr>
<tr>
<td>Skill Levels</td>
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</tr>
<tr>
<td>Personal Needs</td>
<td>1</td>
</tr>
<tr>
<td><strong>Work</strong></td>
<td></td>
</tr>
<tr>
<td>Interdependence</td>
<td>1</td>
</tr>
<tr>
<td>Skill Demand</td>
<td>.5</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td></td>
</tr>
<tr>
<td>Turbulence</td>
<td>0</td>
</tr>
<tr>
<td>Resources</td>
<td>Graph</td>
</tr>
</tbody>
</table>

The results are shown in Figure 36.
Change, Turbulence, and Chaos

The single variable that probably has the most significant impact on the results of the model is the environmental variable that I called, Turbulence. This variable is an indicator of the level of change in the environment of the organization. The name of the variable is a reference to the concept of turbulence in fluid dynamics. In a perfectly aligned fluid system, the liquid is flowing in a laminar manner with absolutely no turbulence. The molecules are perfectly aligned and more fluid is able to flow through a pipe when the flow is laminar. Laminar flow, in general, occurs at low velocities between close boundaries (Barnhart, 1986, p. 350). This is analogous to a tightly aligned organization in a

**Figure 36.** Results of the Trust level set to zero.
stable environment with little or slowly moving change. Turbulence is the
introduction of rapid and constant change. In fluid dynamics, a turbulent flow is
characterized by constant changes in direction and velocity (Barnhart, 1986, p.
691). These changes make the fluid swirl and churn, resulting in less fluid
moving through the pipe. A highly chaotic environment creates this turbulence
for organizations and interferes with the carefully laid strategic plan. In the
model, Turbulence has two primary points of impact. The first point of impact, is
that it determines the degree of emergent strategy through the equation:

\[ \text{Emergent\_Strategy} = \text{Turbulence} \times 8.33333333 \]

The constant, 8.33333333 is \( \frac{1}{12} \) of 100 which is the amount of completed
objectives for one month. Thus, the higher the value of Turbulence, the higher the
value for Emergent Strategy.

Turbulence impacts another variable, Skill Change. The model assumes
that more change in the environment will result in the need for more change in the
skills required to perform the work at hand. This relationship is reflected in the
following equation:

\[ \text{Skill\_Change} = \text{if(Turbulence>0) then PULSE(1,2,1/Turbulence) else 0} \]

This variable will cause the level of skills needed to increase by one-tenth
beginning on the second cycle and repeat at intervals of the inverse of the level of
turbulence. In other words, the higher the level of turbulence the more often the simulation will increase the level of skills needed.

With this understanding, the simulation is set with the level of Turbulence at its maximum value. The variable settings are shown in Table 7.

**Table 7. Turbulence set for maximum change.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Informal</td>
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<td>Leader's Ability</td>
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</tr>
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<td>Politics &amp; Trust</td>
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<td>Inter-group Relations</td>
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<td>Formal Organization</td>
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<td>Reward System</td>
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<td>Organization Structure</td>
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<td>Personal Needs</td>
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<td>Skill Demand</td>
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<td>Environment</td>
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<tr>
<td>Turbulence</td>
<td>1</td>
</tr>
<tr>
<td>Resources</td>
<td>Graph</td>
</tr>
</tbody>
</table>

With those settings, the results are shown in Figure 37. These results show that only 28.2% of the planned strategy was achieved, but 45% of the emergent strategy was achieved. The oscillating nature of the emergent strategy curve is noteworthy and is indicative of the recovery period required for skill set building. High levels of turbulence make planning virtually irrelevant and give rise to the
need to surf the metaphorical waves of change. Strategy is no longer planned, but largely emergent.

**Feedback from External Review**

In the development of a system dynamics model, it is necessary to validate the model for its usefulness in providing an understanding of the environment that is being modeled. In some cases, the model can be tested using historical data and then the results of the model are compared to the historic results to determine validity. In cases, like this dissertation, where historical data is not available, the preferred approach is to have the model evaluated by a panel of experts to
determine how well the model captures their experience of the system in question. If significant gaps are found, the experts’ feedback is used to modify the model and the model is re-circulated with the changes incorporated. The creation of the model thus becomes an iterative cycle that is virtually identical that found in the Delphi technique.

Several reviewers having experience as employees within a Fortune 50 corporation or experience as organizational consultants were sent copies of the model referenced in this dissertation on CD-ROM for review. The reviewers examined a Powerpoint presentation (Appendix B) before executing the model and then were asked to complete an evaluation (Appendix A) after running a series of simulations.

**Match to Experience**

The first criterion in the evaluation was a simple question that asked, “In general, did the model's results match your experience?” The question was seeking the reviewer's basic impression of how well the model's actions matched those in the real world. All of the reviewers responded that the model did match their experience.

The follow-up question asked which areas may not have performed as expected. There was no common response to this question. One reviewer found that the areas of Skill Sets and Inter-group Relations did not match his
expectations; another had trouble modifying the Resource utilization component and was not sure of its interaction; and another was surprised about how Realized Emergent Strategies can exceed Realized Planned Strategies in extremely turbulent conditions.

The concern surrounding Skill Sets and Skill Demands centered on the mutual relationship between the two variables. The reviewer found that the model met his expectations when Skill Demands were higher than Skill Sets, resulting in a degraded performance. However, the model did not meet his expectations when Skill Sets were higher than Skill Demands. Under that condition, he would expect the performance to improve to a point and then either stop or degrade as the degree of over qualification increased. The expectation was that a change in either variable of ±.1 would result in optimization and any change beyond .1 would result in a drop-off in performance.

General Comments

The reviewers were asked to provide general comments on the model. The value that most saw was that the model makes an attempt to operationally define very fuzzy relationships. Mr. Foreman, an engineer with training in applied physics, commented, “This is a very scientific mathematical approach to a very unpredictable process. I would like to see the inputs into the model be measurable
metrics from an organization — but that is the next step. This was an excellent first step.”

Another reviewer found the interface to be valuable since it clearly segregated the model’s parameters and provided simple, easily interpreted results with both numeric and graphical output.

More than one had questions about the Resources variable. One suggested that it could be a derived variable from the Skill Sets, Skill Demands, and Environmental Turbulence variables. The author suspects that this variable may have generated these responses because it was the only user modifiable variable that was modified graphically instead of by knobs or sliders with pre-set values. This makes it more difficult to intuitively understand the impact of that variable and makes it more difficult to modify.

John Earley, a Principle Management Consultant with Price-Waterhouse, commented on the model as a tool for understanding,

I could see this tool being used in a number of ways:

- As a management cause and effect tool to analyze business issues and determine root cause and action requirements.
- It would also be valuable as [a] self-assessment tool to allow businesses to benchmark themselves against world class (in this instance world class characteristics would need to be defined).
- As a training tool for management and business schools to study the impact of the different business levers on results. In this area, some differentiation in the levers between what is internal and external
would be useful to facilitate discussion on what can and cannot be influenced by management action.

His comments reflect the intent of the model as well as possible applications.

**Thoughts Regarding the Interaction of Model Elements**

The interaction between the elements in the model is the model's reason for being. Mr. Foreman noted, “Realization of planned goals is highly dependent on the overall health of the organization. In business, we often forget this simple fact. This model quantifies just how sensitive results are on minor shifts of the input variables.”

Lee Maginniss, a Price-Waterhouse Consultant, focused his attention on the correlation between the Environmental Turbulence and Informal Organization parameters. He noted, “As chaos increased, the importance of having clear communications, strong trust in management and strong leaders increased. This was exactly what I expected.”

Thom Williams, a reviewer with a strong analytical background, would like to have conducted a fractional factorial analysis on the model. He examined the model at extreme settings and created Table 8. The minus signs in each column represent the variables set at its extreme negative value. The plus signs in each column represent the variables set at the positive extreme. Under each column, he recorded the results from Planned Strategies, Emergent Strategies, and the Unrealized Strategies. These values underscore the impact of Turbulence on
the organization and the impacts of Communication and Leadership. His short analysis set all of the values within a parameter group to their extremes instead of treating each variable one at a time. It is a useful approach since it highlights the interrelationship between the major elements in the model without the impact of the lower level variables. His table clearly shows the tremendous impact of the Informal Organization on the organization's ability to achieve its objectives.
Table 8. Reviewers Extreme Conditions Analysis of the Model.

<table>
<thead>
<tr>
<th>Environment</th>
<th>Turbulence</th>
<th>Resources</th>
<th>Work</th>
<th>Interdependence</th>
<th>Skill Demands</th>
<th>People</th>
<th>Skill Levels</th>
<th>Personal Needs</th>
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<td>-</td>
<td>+</td>
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<td>-</td>
<td>+</td>
<td>Unrealized Strategy 107.9 44.2 1.3 22.1 2.0 102.2</td>
</tr>
</tbody>
</table>

That result is expected since a key assumption in the model was that objectives that are not communicated can not be achieved. When Communication is set to zero, the model will deliver zero results.

John Earley also developed a matrix to identify the various settings and results of the model. Table 9 shows the variable values identified in the analysis, Table 10 shows corrections to certain values, and Table 11 carries the reviewer’s commentary on the results.
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Work</th>
<th>Environment</th>
<th>People</th>
<th>Formal Organization</th>
<th>Informal Organization</th>
<th>Actual result</th>
<th>Expected result</th>
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</table>
Table 10. Table 9 with corrections underlined and in bold text.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Work</th>
<th>Environment</th>
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<td>1.4</td>
<td>0.7</td>
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<td>Chaos</td>
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<td>Chaos</td>
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<td>25</td>
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<td>1</td>
<td>Chaos</td>
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<td>26</td>
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<td>Chaos</td>
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<td>D</td>
</tr>
</tbody>
</table>
Table 11. Price-Waterhouse consultant commentary on results of model.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Team reward system moves some focus away from pure task driven culture which would impact ability to deliver objectives (see comment Scenario 3 on emergent strategy)</td>
</tr>
<tr>
<td>2</td>
<td>Centralized organization can respond to change at a more strategic level and with unity which should improve response to emergent requirements better than decentralized organization</td>
</tr>
<tr>
<td>3</td>
<td>This represents the optimum environment output objectives. I would expect morale issues (skilled workforce / mundane tasks) which may impact the realization of objectives. Why would emergent strategy not be realized with this flexibility to change?</td>
</tr>
<tr>
<td>4</td>
<td>This is a worst case scenario. A dysfunctional organization, badly led with a complex job and environment. I would expect total chaos and very little achievement. The actual result is probably worse than reality, something would get done.</td>
</tr>
<tr>
<td>5</td>
<td>This is a very task focused but inflexible organization. Great at doing repetitive tasks even if complex but no way of handling change. As expected, lack of interaction between functional groups has little if any impact on results</td>
</tr>
<tr>
<td>6</td>
<td>A very flexible organization very reactive to change but unlikely to plan well and execute to the plan. I was a little surprised that the planned strategy execution was so high.</td>
</tr>
<tr>
<td>7</td>
<td>This represents a good overall organization structure and management but a chronic skill gap and overload. The overload situation should cause panic in the staff and nothing gets done. The actual results appear optimistic with this profile</td>
</tr>
<tr>
<td>8</td>
<td>Staff are carrying the management in this example. This should work in a stable environment even with complex work, but breaks down when change happens. Actual may be influenced by work complexity? Try next scenario</td>
</tr>
<tr>
<td>9</td>
<td>As above but simpler work should improve results. Very surprising actual result. Indicates that the model places high emphasis on management skills rather than staff competency. (see also Scenarios 7 &amp; 8)</td>
</tr>
<tr>
<td>10</td>
<td>Probably the ideal organization with good skills and balanced motivation around delivery but operating in a complex environment. This is to test if anyone could cope. (These situations exist so I would hope so!) (next 2 scenarios try to determine cause of failure)</td>
</tr>
<tr>
<td>11</td>
<td>Decreasing workload helps</td>
</tr>
<tr>
<td>12</td>
<td>Stable environment has a very surprising result. I would expect stability to improve result as less management time is spent on fighting rather than watching out and reacting to real changes.</td>
</tr>
<tr>
<td>13</td>
<td>Probably the typical business with a mix of good and bad but generally OK. Not a world class business but a long term survivor. The actual results were surprisingly low, with these results the business would fail. Also surprising to see emergent higher</td>
</tr>
<tr>
<td>14</td>
<td>This and subsequent scenarios test the sensitivity to factors on the results. Rating 0-5 represents actual vs expected sensitivity to the factor. (1=less than expected 3 = as expected 5 = more sensitive than expected.) Scenario 11 = base.</td>
</tr>
<tr>
<td>15</td>
<td>See scenario 12</td>
</tr>
<tr>
<td>16</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>This represents unskilled people working in a complex environment. I would have expected a larger reduction in planned achievement and an almost zero achievement in emergent as the people will have enough trouble working on the planned stuff.</td>
</tr>
<tr>
<td>18</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>I would have expected a functional organization to be less efficient than this particularly in a complex environment. Perhaps the good management saved the day? The lack of impact on emergent strategies is very surprising.</td>
</tr>
<tr>
<td>22</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>I would not have expected one deficiency in one management area to have such a significant impact on the outcome, particularly the planned strategy which should be more controlled.</td>
</tr>
<tr>
<td>24</td>
<td>See scenario 24</td>
</tr>
<tr>
<td>25</td>
<td>See scenario 24</td>
</tr>
<tr>
<td>26</td>
<td></td>
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</tbody>
</table>

John Earley, a Principle Consultant with Price-Waterhouse, provided detailed feedback on the model as summarized in Tables 9, 10, and 11. While Mr.
Earley found the model to be, “a good predictor of behaviors or outcomes in a work place provided realistic entries are made on the variables under evaluation,” he was surprised by the actions of certain variable combinations. In several of the “surprising” categories, the recorded results were different than those generated by the model. It is assumed that the figures were recorded in error or a variable’s value was different than supposed by the reviewer. Scenario 6 surprised the reviewer because the execution to plan was so high (99%) compared to what he expected (50%). The corrected value should have been 19% that was actually lower than the reviewer’s expected 50%. The reviewer and the author were unable to discuss the underlying physics of the model prior to the review. The reviewer did not know that the model was designed to reduce the percentage of planned objectives achieved in a chaotic environment to allow the organization to focus on emerging objectives. He was also surprised that emergent objectives were not achieved in Scenario 3 with a highly flexible organization. The model is designed to only generate emergent objectives in a dynamic environment. Scenario 3 was set with a very stable environment that would have failed to generate emergent objectives. The reviewer was surprised that Scenarios 8, 9, and 23 did not achieve higher results. In all of these scenarios, the communication factor was set to 0 and the model assumes that objectives that are not communicated can not be achieved. This position may be too extreme since
individuals within an organization would have some sense of what must be done in spite of the absence of communication or conflicting communication.

In a number of the scenarios, Mr. Earley was looking for both the planned and the emergent objective results to be high. Unknown to Mr. Earley, the model assumed that limited resources within an organization constrain its ability to achieve both the originally planned objectives and the emergent objectives. In addition, the model assumed that a number of the planned objectives would be supplanted by the emergent objectives.

Model Validation

As discussed earlier, there are two major tests for the validity of a systems dynamic model: structure and behavior. The model’s structure is reviewed for extreme conditions and the adequacy of the model’s boundaries. The model’s behavior is considered across several dimensions, including the sensitivity of parameters, behavior reproduction, and behavior anomaly.

Model Structure

Boundary adequacy refers to the appropriateness of the model’s level of aggregation and the degree to which it includes all of the relevant structures. None of the expert reviewers found the model to miss relevant structural pieces. This is not surprising since it was created after Nadler and Tushman’s (1992, 1997) well researched model.
While the reviewers universally found the model’s structure to be adequate, the author has some reservations about the degree of aggregation in the communications section. The communications variable is set as a variable ranging from perfectly clear communication to the complete absence of communication. As the variable reaches the lower extreme setting, it carries tremendous weight and effectively pulls the results of the model toward zero. While it can be argued that an organization with no communication would achieve nothing, the reality is probably more positive due to emergent communication between entities in the organization. This will be explored in more detail in Chapter Five.

The other variable that may be too highly aggregated is the impact of environmental turbulence. This variable is not as impactful as communication, but it is the other primary variable that may skew the model’s results in a certain direction. It represents the degree of change in the organization’s environment, but does not make distinctions about the nature of the change. Those distinctions could impact how and where the level of change impacts the model. This will also be discussed more in Chapter Five.

Model Behavior

The model’s behavior may be considered in light of the sensitivity of the parameters. In general, the model showed appropriate sensitivity to changes in
parameter values. The assumption of this test is that changes in the values of different parameters will have plausible results in the model. This was explored in some detail in Mr. Earley’s tables. The primary exceptions, as discussed in the previous section, may be the impact of extreme settings in Communication and Turbulence.

The next consideration is behavior reproduction. This test essentially asks whether the model accurately depicts the behavior observed in the system. The reviewers all indicated that they found the model to match their experience of the world.

The final behavioral test is for behavior anomaly. This test looks for inaccurate behaviors that arise when certain parameters are eliminated or added. This test is used extensively during the creation of the model in an attempt to build it accurately. The finished model did not show evidence of anomalous behavior.

**Summary of Model Validity**

With the exception of the aggregation concerns with Communication and Turbulence, the model meets the primary tests for validity of a systems dynamic model. It is not created with the intention that it be used in a predictive manner though with some enhancements it could grow into that type of model. Rather, the intent of this model is to provide a structure for understanding the dynamic
relationships between factors in an organization. In this regard, the model provides a significant first step.

The author intended for the model to be reviewed by ten reviewers, but despite repeated calls, he only received five returns. All of the reviewers found the model to generally match their experience of behavior in the world. The missing responses did not represent individuals who would be expected to have a radically different perspective as a result of their jobs or organizational roles. Therefore, after reviewing the comments and seeing the commonality of the responses, the author does not believe that the additional responses would have made a noteworthy difference.
CHAPTER V: DISCUSSION

The Organizational Alignment Model is a first step toward understanding the complex and interactive relations that make a successful organization. The values used in the model are not intended to represent an exact correlation to the variable relationship of any particular organization, but rather to represent the generic nature of these variable relationships. These relationships have been discussed and modeled by Hanna (1988), Nadler and Tushman (1992, 1997), Hammer (1994), Leavitt (1972), and others, but the existing models have not made an attempt to operationally define those relationships. As a result, it has been difficult to apply the understanding in organizations as fully as the models warrant. This dissertation is an initial attempt at that operational definition. As Lord Kelvin said,

I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely in thought advanced to the stage of Science, whatever the matter may be. (Hopp & Spearman, 1996, P. 186)

Lord Kelvin’s comment will undoubtedly prick the post-empiricist sensibilities of some readers, but the author understands his comment to refer to the level of thought required to translate relationships into mathematical terms. It is not saying that relationships can be reduced to mathematics, but that the attempt to do so forces one to a different and deeper level of thought. It is the author's hope that
this dissertation provides a framework to further explore the congruence and alignment of organizations.

Nadler and Tushman’s Model

The systems dynamic model in this dissertation explored the relationship between the components of Nadler and Tushman’s (1992) model and operationally defined those relationships. Mathematically defining those relationships helped to clarify, for the author, the significance of certain relationships. At the same time, it raised questions that will require more extensive models to answer. In this discussion, the author will review those relationships and offer suggestions for future exploration.

Inputs

Nadler and Tushman’s model had a number of input variables: history, resources, and environment. This dissertation ignored the history variable since the impact of that variable was viewed as being more specific to each organization’s history and thus less generalizable. Later models, focusing on particular organizations, may benefit from exploring the history in greater detail. There will most likely be differences in organizations that began as family businesses and those that began with unrelated business partners. The stage of an organization’s history may also be a factor as it makes the transition from a sole proprietorship with a strong leader to a corporation with a board of directors.
These differences would undoubtedly impact a number of the variables in the model such as leadership, communications, and organizational structure.

Nadler and Tushman’s (1997) model sets the environment as a variable and they view the variable as including societal, marketplace, legal, technological, and economic impacts. Each of these factors could be modeled with operationally defined relationships. For the purpose of the dissertation, these components were aggregated in the variable, Turbulence. Turbulence was designed to represent all of the changes that arise from the environmental factors and that in turn place a strain on the organization and its alignment. Strategic planning and organizational design are much easier in a low-change static environment. The lack of change allows the organization to pick a course of action and follow it to its conclusion. Change becomes akin to a series of detours on the organization’s strategic path that force it to make mid-course corrections. Turbulence was a major factor in the model as it is in life. In the absence of turbulence, the only objectives to be achieved are the planned objectives and the organization makes progress toward those objectives in accord with the internal strength of the organization. When the environment becomes highly turbulent, many of the planned objectives become irrelevant and are replaced by the new emerging objectives. The model simulated this process well, but future iterations of the model could be improved by creating a sub-model that break the Turbulence factor into its various components:
societal, marketplace, legal, technological, and economic impacts. Each component would be likely to impact different parts of the model to greater or lesser degrees. The legal and regulatory environment might be changing rapidly, but have little impact on the planned objectives while small changes in the marketplace might have a significant impact on the organization. This sub-model could quickly become as large as the model used in this dissertation. The obvious danger is that the model would become as complex as reality and lose its usefulness as a clarifying device.

As it exists in the model, Turbulence is one of two variables that most impact the results of the model. In the case of Turbulence, the impact comes from the emergence of new objectives and the impact on the organization’s need for retooling its skill sets in response to the changing demands.

The emerging objectives that arise in the face of a turbulent environment provide an interesting challenge for the organization. The organization has carefully marshaled its resources to achieve a predetermined set of strategic objectives that are codified in the Strategic Plan. When the environment changes, the organization must first recognize that a change has occurred; then analyze the nature of the change to understand its impact; then adjust or eliminate planned objectives and add newly emergent objectives to the plan; and finally it must train and direct its workforce to achieve the new set of objectives. The challenge is to
create a cohesive, fully aligned organization that is capable of reinventing itself on the fly. As Galbraith (1997) noted:

… to focus and align the organization is to become vulnerable. … On the other hand, misalignment of strategy, structure, and processes will cause activities to conflict, units to work at cross-purposes, and the organization to lose energy over many frictions. Instead, we need a new, aligned organizational design in which organizational structures and processes are easily reconfigured and realigned with a constantly changing strategy. (p. 88)

Some aspects of this flexible organization are highlighted in the model. As change increases, the leadership must be strong to enable quick decisions and redirection of the organization’s resources. The training function must also be able to offer a “quick changeover” in people’s skills. Toyota’s guru, Shigeo Shingo (1985), created a system for the quick changeover of mechanical processes that he called, SMED or Single Minute Exchange of Die. A similar approach is needed in the personnel realm to allow for the rapid conversion of human skill sets to adjust to changes in demand for skill sets in organizations. Such an approach would seek standardization of skills where appropriate; provide “on-the-job” training to potential candidates before they are actually in a position; and organize training to be delivered in a concise, just-in-time fashion.

The model introduces a highly optimistic time lag of one month to recognize and deploy new training. In the author’s experience, this time lag is more likely to be in the 3 to 6 month range. A later iteration of the model may be
devised to expand the simulation period beyond 12 months to allow for variables such as this to be decompressed. The unreality of the time frame may be balanced by the fact that the model induces a 10% change in the skill set needs each month at an interval that is inversely proportionate to the turbulence factor. This is likely to be a higher than expected degree of change. The results of the initial settings seem to create an appropriately realistic model, but further research using a specific organization and real data should prove to be enlightening.

Work

Work, in Nadler and Tushman’s (1997) model, is the actual business of the enterprise. It is the day-to-day actions that accomplish the objectives of the organization and move it into the future. In most organizational improvement studies, this is the primary focus. For the purpose of this dissertation, this area was kept generic and was designed to reflect the combined results of clearly communicated objectives that are executed by relatively skilled people with variable motivation. The actual Work Factor is a derived factor that is the result of such things as the skill gap between the demands of the work and the current skill levels of the employees; the congruence between the individual’s objectives and the organization’s objectives; and the reward systems. In the model, the objectives are achieved if the communication level is high and the person has the skill sets and motivation to perform the work. This relationship is definitely
found in the workplace. The level of achievement increases with the elevating skill sets until the skill sets become significantly higher than those required by the work. At that point, the work performance begins to diminish as boredom emerges. A couple of reviewers noted this relationship and felt that the model should have been even more sensitive to the boredom factor. This is an example of the type of relationship that will need to be revised with the application of specific data from future studies.

**People**

Nadler and Tushman (1997) identified the key sub-components of the people factor in their discussion of their model. The model presented in this dissertation further defined potential relationships between those components.

**Personal Needs**

The first component to be defined was the congruence between the individual’s personal needs and the needs of the organization. This may be thought of as the degree of match between the personal mission and the organizational mission. In any organization each person performs this individualized computation and the resulting level of commitment to the work will be the result of that ratio. As reviewed in Chapter Four, this component’s impact on the model is not taken in isolation, but is combined with the impact of the intrinsic rewards of the situation, role clarity, and the degree of positive
interaction with group members. In later versions of the model, this factor could be expanded and become a derived factor created from a motivational sub-model.

**Role Clarity**

Role Clarity was a derived function tied to Leadership. It could easily be argued that the function should have been derived from the communication factor. The author chose to base it on Leadership as a result of his experience in organizations. Role clarity is more often the result of communication combined with careful mentoring. The author has witnessed the same organizational communication addressed with very different degrees of success and the only variance was the leader involved in the communication. Future iterations of the model might include a new derived function that would be determined from both Communication and Leadership.

**Intra-group Relationships**

Intra-group Relationships served as a modifier to Role Clarity in the model. If the group were considered to be cohesive, then the Role Clarity would retain its value. If the group were not cohesive, then Role Clarity would be modified in a negative manner to simulate the role confusion that may arise in dysfunctional group settings. As with other sections of the model, Intra-group Relationships could easily become a sub-model. The sub-model might include elements such as relative levels of individual competency, personal styles,
learning styles, organizational approach for the group, or gender/ethnic
distribution within the group. Depending on the construction of these
components, other parts of the model would be impacted such as Skill-Sets, Skill-
Development, and Personal Needs. While such additions would further clarify the
relationships within the model, they might add too much complexity to the model
and hinder its use as a tool for understanding the organization. It may be better to
make clarifying sub-models as separate entities that may be run to clarify the
understanding about the dynamic within the sub-model without having to
understand its connection to the larger model. That approach would result in a
better understanding of the sub-model, but might result in a loss of the larger
holistic understanding that comes from understanding how the changes impact the
larger model. This is the constant dilemma for model designers — balancing the
level of detail with the viewer’s ability to understand the relationships within the
model.

Inter-group Relationships

In the model, this variable’s value was set by the user and was intended to
indicate the degree of cohesion between different groups in an organization. In
hierarchical organizations with functional structures the Inter-group cohesion can
become a critical factor in achieving organizational objectives. The business
literature of the nineties was filled with articles (Lunn, 1997; Donath, 1998;
Lessard & Zaheer, 1996; Barabba, 1996; Brooks, 1995) addressing the issue of “silos” within organizations and which viewed their existence as a likely cause of organizational dysfunction. This area could also be developed into a sub-model that would examine the factors that create a “siloed” environment and the impact of that environment on other variables within the organization. The impact on the organization is also likely to be a function of the organization’s structure and intent. If the organization is structured by functional area with little interdependence, then a silo structure will be likely to have few ill effects. However, if the organization requires the close interaction of a number of functions to deliver a product, then the silos may prove to be counter-productive to the organization achieving its intended objectives.

Impact of Leadership

Leadership in the model, as in real organizations, is a pervasive factor. It directly impacts the organization’s ability to cope with change, the clarity of roles within the organization, and the organizational communication. The late eighties and nineties could easily be called the “Leadership Decade” in organizational thought and emphasis. Everyone from Warren Bennis (1989) to Stephen Covey (1991) to Collins and Porras (1994) emphasized the transition from a focus on managers and managerial expertise to leaders and leadership characteristics. The author worked for Johnson and Johnson, a Fortune 50 company, whose major
strategy for the next century is developing leaders and leadership within the company. This model recognizes the importance of leadership, but it does not attempt to model the characteristics of leadership. This very complex area certainly warrants a model of its own. A leadership model would appropriately simplify the other model components to allow for a better understanding of each change in a leadership characteristic. This model simplified Leadership into a user-defined variable that simply indicated whether the leadership was strong or weak. It would make sense to break out several characteristics of leaders such as clear communicator, organized planner and visionary thinker. These characteristics could be used to derive the communications function instead of having it set by the user. Future versions of the model can be structured to emphasize the areas that the user wishes to understand and explore.

**Formal Organization**

The Formal Organization, to Nadler and Tushman (1997), is the combination of structures, systems, processes, and procedures designed to organize the work of the organization. In this model, the emphasis was placed on two elements, the structure and the reward systems of the organization.

**Structure**

The structure effectively looked at two dimensions of organizational structure: the first, whether or not the organization is highly centralized and the
second, whether the organization is structured by activity, output, or user
groupings. The question of centralization was primarily a factor in the
organization’s ability to respond quickly to change. The grouping was primarily a
factor in the Intra-group variable in this model. A future model could explore
these settings in greater detail and their impact on different types of products and
material flow. The nature of the organization’s relationship with its customers
and the type of products delivered will tend to make one type of grouping more
advantageous than another. That exploration was considered to be beyond the
scope of this model.

Reward Systems

The model had a user defined setting that set the degree to which the
reward system was team based or individual based. This corresponded to a
similar user setting that determined the nature of the work as team or individual
based. As discussed in Chapter Four, the model makes no assumptions about one
structure being better than the other, but it looks for congruence between the
reward system and the work structure.

Rewards are another area that could easily justify its own model. This
model did not consider whether or not rewards are effective or detrimental (Kohn,
1993) and it did not explore different applications of rewards such as incentive
payments, pay for performance, or profit sharing plans. It also did not explore the
time dimension in rewards such as annual bonuses versus daily incentive payments. These aspects of the reward system were beyond the scope of this model but clearly warrant further exploration in a reward-centered model.

**Informal Organization**

The Informal Organization, according to Nadler and Tushman (1997), refers to the culture of the organization and the unwritten procedures, policies, values, political climate, and beliefs held by the organization. It often carries more weight than the Formal Organization’s policies and procedures. The model grouped the Leadership, Communication Factor, and Politics & Trust variables in this area.

**Politics and Trust**

As discussed in an earlier section, the Leadership variable is a user set value, but it is modified by the political climate of the organization as set in the user defined variable, Politics & Trust. The user sets the value in a continuum ranging from an organization with no trust, like the Borgia Court, to the idyllic organization with total and complete trust. A future iteration could create a sub-model that would expand this variable by developing some of the components of trust like character and competence and linking them to organizational factors like promotional policies and developmental opportunities. These linkages would allow a model to derive the Politics & Trust factor.
Communications

Communications is the most significant variable in the model. The author assumed that an organization could only achieve those objectives of which it is aware. Communication is the medium by which an organization becomes aware of objectives. Consequently, variations in the values for Communications had the strongest impact on the results achieved in the model. The Communication Factor was adjusted by the Leadership value in the model with the final result being an average of the two. The actual value for Communications was user set and ranged from no communication to perfect communication. It did not allow for any of the possible differences in communication. This area, more than any other, warrants expansion into its own sub-model. Components of the sub-model could include: frequency of communication, modality of communication, level of communication detail, educational level of senders and receivers, formal and informal communication, and emotional context of the communication.

It may be argued that at the extreme values this variable carries too much weight. For example, some would say that in the complete absence of communication work would still be done and objectives would still be met. While this may be true in an existing organization due to the residual effects of prior communication, the author is not convinced that it would occur in a start-up
organization in which no one is clear about the mission or objectives to be achieved.

Some level of emergent communication between entities in an organization will occur but that communication may not align with the objectives of the company. For example, employees may decide that a quality product is the most important thing for the company to produce so they spend too much time producing each product and create quality products that no one can afford. A direction definitely emerged, but it was not consistent with the company's objectives to produce quality products at an affordable price.

Communication and Leadership are the starting points for organizational success and the model appropriately portrays that relationship.

Output

The output portion of the model is the area of greatest opportunity for future study. The model was created to explore the theoretical framework and potential relationships between the components in Nadler and Tushman's (1997) model. Since it was not based on any particular company and did not track the flow of real work, it did not result in real outputs. The simulated outputs in the model are based on generic objectives being achieved. A future study could take the constructs in the model and overlay them on the actual work of an organization to tie the model results to the actual results achieved in the world.
That type of model would become company specific and would become much more detailed. The results reported would be more based in reality, but the understanding that comes from seeing how the model’s variables interact would not necessarily be improved.

Application of the Model

This dissertation began with a question regarding the physics of alignment in organizations. Even before the author began his doctoral program, he was concerned with the inability of organizations to align themselves to achieve their objectives. He believed that the root of the issue lay in the absence of a clearly developed and communicated mission that was understood and accepted by the members of the organization. In the course of working through his course work and in developing this dissertation, he has come to recognize that in rapidly changing environments alignment may be as much of a hindrance as an aid in achieving organizational objectives.

Creating the system dynamics version of Nadler and Tushman’s (1997) model forced the author to delve into the specifics of the relationships between components in the model. Reviewers who have used the model found that it also helped them explore the changes in results when modifications are made to the values of the variables. This is the primary value of any model. It provides an opportunity to understand the world in a different way. Even when the behavior
of the model is contrary to initial thoughts, it fosters an opportunity to rethink and explore the reasons for the variance.

As the author created the model and thought about the planned and emergent objectives, it became apparent that an organization has bounded resources and the restraints imposed by that bounding limit its ability to respond to all objectives. Even when an organization tries to expand its resource pool, the time lags involved will limit its responsiveness.

The more tightly linked the components are in an organization, the more energy that will be involved in breaking and reforming those links in new directions. This may be thought of in light of Lewin’s (Spier, 1973) Force Field Analysis model of freezing and unfreezing. Thus, flexibility and agility may be more important attributes than strongly linked alignment in turbulent environments.

The model allows the user to simulate the impact of a number of different components and see the potential impacts. As the number of variable changes grows, it becomes more difficult to imagine their relative impact on the model. As one of the reviewers commented, “Realization of planned goals is highly dependent on the overall health of the organization. In business, we often forget this simple fact. This model quantifies just how sensitive results are on minor shifts of the input variables.” Use of the model forces a more holistic
consideration of making change in an organization. The user begins to realize that change in one area impacts many other areas and the total impact of the change may be greater or lesser than initially imagined.

The model provides the starting framework for understanding the physics of organizational alignment. It not only states that the components in the model are related, but it defines those relationships in specific equations. The author is the first to admit that the current equations do not precisely portray the results of any specific organization, but they begin to define the relationships present in most organizations and serve as a departure point for dialogue and exploration. It is the author’s dearest wish that future students take the model and further develop the potential for more detailed sub-models as well as clarifying and improving the mathematical relationships defined in the model.

The author also hopes that the methodology provided by the system dynamics approach will take root in the field of organizational development. It provides a set of tools that will allow scholars and students to bring more precision to their thoughts about organizations. At the same time, this precision is created in a holistic way that is not reductionist but rather allows the process to be examined as a system.

New technologies like the Itthink® software allow the researcher to create “flight simulators” which facilitate intuitive understandings of organizational
issues. High Performance Systems, Inc., the company who created the Ithink® software, provide consulting services to companies in which they gather a group of executives into a room for two to three days and jointly create a model of an organizational issue. The consultant facilitates the technical details of creating the model while the participants determine the components and define the relationships. The common understanding that arises from this process often leads to emergent insights. Suddenly, the group is not looking at single point strategies, but rather is focused on developing strategies that address the systemic issues that underlie the presenting problem. As the model is created, they are able to run simulations of different solutions and understand the ramifications of one over the other. The model is not the answer, but it facilitates the understanding that creates the answers.

The model presented in this dissertation does not solve the problem of organizational alignment. It does not even take a stand on whether alignment is a positive or negative event. Rather, it provides a starting point for understanding some of the factors that impact organizational alignment and their relationship with each other. Through that understanding, the author hopes that organizations can begin to make decisions that will ultimately improve the effectiveness of the organization.
Suggestions for Future Research

As discussed in earlier sections, this model could be enhanced through the development of a series of sub-models exploring critical variables like Communications, Leadership, and Turbulence in greater detail. Any one of those could warrant a dissertation if it were fully developed and operationalized.

The additional definition brought by those sub-models would facilitate the second major area for future research — the application of historical data from a specific organization to the model. This application would inevitably lead to a more robust model that could eventually result in a model with predictive capabilities. An example of this type of application is the model John Sterman of MIT created of the People Express airline. Sterman’s model was based on details revealed in public speeches by the CEO of People Express, Don Burr. Sterman’s model not only predicts the remarkable success experienced by People Express in its early years, but it also predicted the total collapse of the airline based on the company’s stated policies (Forrester, 1991).

As discussed in Chapter III, this dissertation focused on the first three steps of Forrester’s (1994) system dynamics process. The remaining three steps, “4) design alternative policies and structures; 5) educate and debate; and 6) implement changes in policies and structure” (p. 4), transfer the use of the model from understanding to action. These steps are appropriate for individual
organizations as each assesses its environment. For example, an organization in a highly dynamic arena may want to invest less energy in developing strategic plans and more into building organizational flexibility. As alternative approaches are devised, it will be necessary to enhance the model and potential sub-models to explore and debate those new alternatives. Finally, as consensus is reached regarding the systemic impact of the alternatives, changes can be implemented in the organizations. The primary distinction between Forrester’s (1994) approach and most change efforts is the careful attention to the interactive effects of modifying elements in the system. Now that software tools are readily available to facilitate the system dynamics approach to understanding systems, it is the author’s hope that this type of analysis will become more common in organizations.

Conclusions

This dissertation began with the author’s question about how organizations can achieve alignment. The question was driven by the author’s frustration in realizing the expected benefits from mission and vision work within organizations. That frustration lead to a quest for an understanding of alignment. That quest, in turn, resulted in the creation of a model that in essence provides a laboratory for experimenting with the variables that contribute to organizational alignment. The laboratory did not lead to a clear answer regarding the
achievement of alignment, but rather it led to a much more valuable realization that alignment may not always be desirable. This understanding grew out of the careful definition of relationships one-by-one. Each definition required careful thought regarding how two or more variables interact with each other. As each relationship was defined and added to the model, a complete model was created that could be simulated. This experimentation led the author to the realization that the conditions in which organizational alignment is appropriate are as rare as the conditions necessary for the creation of alignment. The reality for most organizations today is an environment of rapid change in which cycles that were once counted in decades are now counted in months. Carefully planned and communicated strategies are often obsolete before the cycle of communication is complete. Alignment thus becomes a concept that can no longer be viewed as a desired and continuous state, but rather is a concept that is experienced in rapidly changing moments. The traditional image of infantry soldiers marching in a perfectly straight line must be replaced with the image of birds flying in a formation that is constantly moving and adjusting to the variants in the air and the obstacles in its path. Recognition of this as a reality may change the emphasis of an organization from command and control designed to force alignment to achieve predetermined objectives to an emphasis on building the ability to adapt to dynamic change. Corporate vision then becomes setting a general direction
similar to the southward bound migration of the birds instead of paving a highway that forces the organization to commit to a specific path. Such a change will require a greater tolerance for ambiguity, stronger leadership and weaker control, and highly adaptive individuals within the organization. From the model, an understanding emerged that alignment still exists, but it is the alignment exhibited by flocking rules instead of linear control.

The creation of and experimentation with system dynamics models facilitates this type of emergent understanding. For the author, the pursuit of an answer led to the development of a better question. As so often happens, it is the question more than the answer that expands our horizon.
REFERENCES


APPENDIX A

Evaluation Sheets

Evaluating the Model

As an evaluator of the model, you are asked to experiment with the settings of the different elements and compare the models results with your experience of those elements in the organization. I would like for you to record these impressions in the form portion of the Acrobat file and then print the page or on the attached form. I would also like for you to fill in the information about yourself as an evaluator.
## Evaluator Profile

<table>
<thead>
<tr>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title:</td>
</tr>
<tr>
<td>Years Professional Experience:</td>
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<td>Functional Areas:</td>
</tr>
<tr>
<td>Special Awards:</td>
</tr>
<tr>
<td>Other Pertinent Information:</td>
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Model Evaluation

In general, did the model’s results match your experience? Yes ☐ No ☐

What areas did not perform as expected?

- Leadership ☐ Communication ☐ Skill Sets ☐
- Interdependence ☐ Rewards ☐ Personal Needs ☐
- Turbulence ☐ Trust ☐ Resources ☐
- Skill demands ☐ Inter-group Relations ☐

Explain the difference:

Comments about the program and model:

Thoughts on the interaction of these elements in organizations:
APPENDIX B

Introduction to the Model’s Flight Simulator

Dynamics of Organizational Alignment

Information about the Program
Run the Program
Background of evaluator
Evaluation of Program relations
Thank you

This program represents the core of my dissertation for my Ph.D. in Human and Organizational Systems. By taking the time to validate the relations portrayed in the program, you are both helping me complete my degree and taking a step to a better understanding of the interactions between work processes, people, and both the formal and informal organization.

Brent deMoville
HOD Doctoral Candidate
Purpose of the Program

- To begin to define the relationship between the organizational factors that impact performance
- To allow managers to experiment with the impact of altering these factors in isolation and in conjunction with other factors
The basis of the model to be reviewed is the Congruence Model. It was created by Nadler & Tushman.¹


Elements in the model

Nadler and Tushman’s model focuses on organizational congruence and is grounded in Open System theory. They contend that “The effectiveness of an organization reflects the congruence of the key components” (Nadler & Tushman, 1992, p. 45).

The key components in their model are the inputs (environment, resources, and history), strategy, work, informal structure, formal structure, people, and outputs (system level, unit/group level, and individual level).
Environment

The environment refers to everything that is outside of the organization. It includes other organizations, competitors, the marketplace, governmental bodies, etc. These elements in the environment will interact with and make demands upon the organization. The environment may be a source of opportunities, constraints, and demands. The environment may be stable or it may be turbulent. It cannot be ignored.
Resources

Resources range from tangible raw material to the human, capital, technological, and information resources available to the organization. The availability of resources may be a source of strength for an organization or a constraint.
History

Today’s organization is largely the product of yesterday’s organization. The organization’s history shaped its perceptions and provided much of the organizational learning that is maintained with the organizations formal and informal systems.

My model does not include this element due to the wide variety of values this variable might assume.
Strategy

The business strategy, according to Nadler and Tushman, flows from the organization’s vision.

Nadler and Tushman (1997) define vision as “how [an organization] intends to compete and what kind of organization it wants to be, given the realities of the environment” (p. 29). From this vision, an organization’s strategy is developed and expressed in business decisions about resource allocation against the elements in the environment (demands, constraints, and opportunities).

Strategy includes specific and measurable objectives that steer the organization towards its goals. Strategy is critical to an organization’s success and as Nadler and Tushman comment, “No amount of organization design can prop up an ill-conceived strategy.”
Strategy according to Mintzberg

The definition of strategic objectives used in this program is more complex than Nadler and Tushman describe, but is developed in detail by Henry Mintzberg. Mintzberg (1994, pp. 24-25) identifies several types of strategy:

- Intended strategy is the strategy that an organization plans.
- The deliberate strategy is the intended strategy that is actually applied and acted upon. This intended and deliberate strategy are the essence of strategy as it is referenced by Nadler and Tushman.
- The unrealized strategy is the portion of the intended strategy that is not applied.
- The emergent strategy is a strategy that was not planned but emerged from a series of consistent actions taken over a period of time.
- The realized strategy is the combination of the deliberate and emergent strategies.
Strategy in the Model

- Based on Mintzberg and includes intended and emergent elements
- Measures the “flow” of strategy as objectives realized
- Assumes an ideal organization achieves 100% of its intended objectives and as many emergent objectives as resources allow
Transformation

The transformation process is the means by which the inputs to the model are transformed into the outputs of the model. The challenge in organizational design is to configure the components (informal organization, formal organization, people, and work) in a manner that achieves the strategic direction of the organization. This model allows you to experiment with those elements.
In Nadler and Tushman’s (1997) model, output is used in a broad sense and “describes what the organization produces, how it performs, and how effective it is” (p. 31).

Nadler and Tushman evaluate the performance of the organization according to three criteria:

1. How successfully has the organization met its strategic objectives?

2. How well has it used its resources to meet the objectives? This includes the development of new resources to prevent the overuse of existing resources.

3. How well does the organization seize new opportunities and ward off threats from the environment?
Outputs in the Model

- The model uses realized objectives as the “output” of the organization.
- The elements in the transformation process interact to impact the degree of realization of both intended and emergent strategies.
Validation Process

To compare the results generated by the simulation with your experience of the world.

The model does not claim to represent all of the facets of the world, but rather to illustrate the relationship between certain key factors. This model, like all models, is by necessity a simpler and therefore less accurate representation of the world. However, it is through this simplification that we can begin to see the basic dynamics.
The Program

Click anywhere in the graphic to launch the program
APPENDIX C

Expert Reviewers and Qualifications

<table>
<thead>
<tr>
<th>Name</th>
<th>Qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Earley</td>
<td>Principle Management Consultant, Price-Waterhouse</td>
</tr>
<tr>
<td></td>
<td>• 17 Years professional experience in Operations Management and Process Improvement</td>
</tr>
<tr>
<td></td>
<td>• Worked for Rolls-Royce and British Airways</td>
</tr>
<tr>
<td>Gastón Barúa</td>
<td>Operations Director</td>
</tr>
<tr>
<td></td>
<td>• 10 years experience as a Manager of a Fortune 50 company</td>
</tr>
<tr>
<td></td>
<td>• Experience in Project Management, Materials Management, Industrial Engineering, and Manufacturing</td>
</tr>
<tr>
<td>Lee Maginniss</td>
<td>Management Consultant, Price-Waterhouse</td>
</tr>
<tr>
<td></td>
<td>• 7 years professional experience</td>
</tr>
<tr>
<td></td>
<td>• Corporate Leaders Fellow, ASU</td>
</tr>
<tr>
<td></td>
<td>• Experienced developer of Ithink® models</td>
</tr>
<tr>
<td>Thom Williams</td>
<td>Senior Quality Assurance Engineer</td>
</tr>
<tr>
<td></td>
<td>• Experienced in Quality Engineering, Quality Systems, and Regulatory Compliance</td>
</tr>
<tr>
<td></td>
<td>• Possesses the following certifications: CRE, CQE, CQM, &amp; CQA</td>
</tr>
<tr>
<td></td>
<td>• 1998 Examiner for the Texas Quality Award</td>
</tr>
<tr>
<td>Jeff Foreman</td>
<td>Technical Services Engineer</td>
</tr>
<tr>
<td></td>
<td>• Over 5 years professional experience</td>
</tr>
<tr>
<td></td>
<td>• Process engineering</td>
</tr>
<tr>
<td></td>
<td>• Certified Reliability Engineer (CRE)</td>
</tr>
<tr>
<td></td>
<td>• Graduate of Black Belt® Six-Sigma Process Excellence Training</td>
</tr>
</tbody>
</table>

An additional five reviewers received the model, but did not complete the feedback forms.
## Evaluator Profile

<table>
<thead>
<tr>
<th>Name:</th>
<th>Jeff Foreman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title:</td>
<td>Technical Services Engineer (Process Engineer)</td>
</tr>
<tr>
<td>Years Professional Experience:</td>
<td>5 ½</td>
</tr>
<tr>
<td>Functional Areas:</td>
<td>Process engineer supporting medical packaging departments and implementation of process excellence/Six Sigma methodology.</td>
</tr>
<tr>
<td>Special Awards:</td>
<td>Certified Reliability Engineer, 2 Ethicon Silver Awards, Completed Process Excellence/Six Sigma Black Belt Training</td>
</tr>
<tr>
<td>Other Pertinent Information:</td>
<td>B.S. Applied Physics</td>
</tr>
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</table>
# Model Evaluation

In general, did the model’s results match your experience?  
Yes ☑  No ☐

What areas did not perform as expected?

<table>
<thead>
<tr>
<th>Area</th>
<th>Leadership</th>
<th>Communication</th>
<th>Skill Sets</th>
<th>Interdependence</th>
<th>Rewards</th>
<th>Personal Needs</th>
<th>Turbulence</th>
<th>Trust</th>
<th>Resources</th>
<th>Skill demands</th>
<th>Intergroup Relations</th>
</tr>
</thead>
</table>

Explain the difference:

Model performed generally as I expected, however, I was surprised to see the number of emergent goals realized far exceed the planned goals on some runs of the model.

Comments about the program and model:

This is a very scientific and mathematical approach to a very unpredictable process. I would like to see the inputs into the model be measurable metrics from an organization - but that is the next step. This was an excellent first step.

Thoughts on the interaction of these elements in organizations:

Realization of planned goals is highly dependent on the overall health of the organization. In business, we often forget this simple fact. This model quantifies just how sensitive results are on minor shifts of the input variables. This is a useful planning tool for any large organization.
### Evaluator Profile

<table>
<thead>
<tr>
<th>Name:</th>
<th>Lee Maginniss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title:</td>
<td>Management Consultant</td>
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<td>Price-Waterhouse</td>
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<tr>
<td>Special Awards:</td>
<td>Corporate Leaders Fellow,</td>
</tr>
<tr>
<td></td>
<td>Arizona State University</td>
</tr>
<tr>
<td>Other Pertinent Information:</td>
<td>Have experience developing decision-support models using Ithink.</td>
</tr>
</tbody>
</table>
Model Evaluation

In general, did the model’s results match your experience? Yes ☑ No ☐

What areas did not perform as expected?

- Leadership ☐ Communication ☐ Skill Sets ☑
- Interdependence ☐ Rewards ☐ Personal Needs ☐
- Turbulence ☐ Trust ☐ Resources ☐
- Skill demands ☑ Intergroup Relations ☐

Explain the difference:

I was particularly interested in the interaction between Skill Demands and Skill Sets. As expected, attainment of organization objectives decreased when the Skill Demands were greater than the Skill Sets (e.g., Skill Sets = 0.6, Skill Demands = 0.8). Objective attainment continued to decline as this differential grew, suggesting that if people lack the skill sets needed to deliver on these objectives, performance will slip.

Based on my experiences, I also expected the converse to be true; if people are overqualified for the work they are required to perform, objectives will be missed as well. As I set the Skill Sets variable higher than the Skill Demands variable (e.g., Skill Sets = 0.8, Skill Demands = 0.5), the attainment of organizational objectives actually increased. My expectation was that keeping Skill Sets and Skill Demands within +/- 0.1 of each other would optimize organizational performance, and any delta beyond 0.1 would result in a drop-off in organizational performance.

Comments about the program and model:

The model’s user interface was tremendous. I especially liked the clear segregation of model parameters, allowing the user to rapidly perform various “what-if” scenarios.

The model results were simple, easy to interpret (both graphical and numeric display) and readily accessible. This enabled quick “what-if” analyses, which is probably the biggest factor in developing successful learning/decision-support tools such as this one.

The selection of model parameters was excellent. I did not feel as though there were any additional parameters that should have been included. In fact, at times I wanted to eliminate the “strain on resources” variable which defined the strain on organizational resources over time. It seemed as though this would be a by-product of the Skill Sets, Skill Demands and Environmental Turbulence variables. If the user could model these variables over time, perhaps the “strain on resources” could have been derived.

Thoughts on the interaction of these elements in organizations:

I was particularly interested in the correlation between the environmental turbulence and
informal organization parameters. As chaos increased, the importance of having clear communications, strong trust in management and strong leaders increased. This was exactly what I expected.

My goal when modifying model parameters was to achieve 80% of my current organizational objectives and 20% of the emerging objectives. The closest I was able to achieve was 74% and 19%, respectively. Based on the relationships defined in the model, environment turbulence had the single biggest impact on the attainment of a balance between current and emerging objectives.
## Evaluator Profile

<table>
<thead>
<tr>
<th>Name:</th>
<th>Thom Williams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title:</td>
<td>Senior Quality Assurance Engineer</td>
</tr>
<tr>
<td>Years Professional Experience:</td>
<td>US Army 89-92, Baxter 92-95, Ethicon 95-present</td>
</tr>
</tbody>
</table>
| Functional Areas:          | Quality Engineering  
Quality Systems  
Regulatory Compliance |
| Special Awards:            | Bronze Star - US Army  
Gold Award - Ethicon, Inc. |
| Other Pertinent Information: | Certified by American Society for Quality as  
Certified Reliability Engineer  
Certified Quality Manager  
Certified Quality Engineer  
Certified Quality Auditor  
Examiner for the 1993 Texas Quality Award |
Model Evaluation

In general, did the model’s results match your experience?   Yes ☑   No ☐

What areas did not perform as expected?

<table>
<thead>
<tr>
<th>Category</th>
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<td>Turbulence</td>
<td>☐</td>
<td>Trust</td>
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<td>Resources</td>
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<tr>
<td>Skill demands</td>
<td>☐</td>
<td>Intergroup Relations</td>
<td>☐</td>
<td></td>
</tr>
</tbody>
</table>

Explain the difference:

Ability to vary the Resource field within the Environment category is confusing – my varied mix of the model did not include varying this field.

Comments about the program and model:

Witty selections for Leader’s Ability and Politics and Trust.

The effects of the informal organizational environment are quite significant, but I think they are perhaps the most intangible of the other areas.

Thoughts on the interaction of these elements in organizations:

With more time, it might be interesting to run a fractional factorial with this model.

See table.
### Environment

|                  | Turbulence | Resources |             |             |             |             |             |
|------------------|------------|-----------|-------------|-------------|-------------|-------------|
|                  | + 0        | -         | - 2         | +           | +           | +           | +           |

### Work

|                  | Interdependence |                     |             |             |             |             |             |
|------------------|-----------------|---------------------|-------------|-------------|-------------|-------------|
|                  | + 0             | -                   | +           | - 5         | +           | +           | +           |

### People

|                  | Skill levels   |                     |             |             |             |             |             |
|------------------|----------------|---------------------|-------------|-------------|-------------|-------------|
|                  | + 1            | -                   | +           | +           | - 3         | +           | +           |

### Formal Organization

|                  | Centralization |                     |             |             |             |             |             |
|------------------|----------------|---------------------|-------------|-------------|-------------|-------------|
|                  | + on           | -                   | +           | +           | +           | - 4         | +           |

### Informal Organization

|                  | Communication |                     |             |             |             |             |             |
|------------------|---------------|---------------------|-------------|-------------|-------------|-------------|
|                  | + 1           | -                   | +           | +           | +           | +           | - 1         |
## Evaluator Profile

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<tr>
<th>Name:</th>
<th>John Earley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title:</td>
<td>Principle Management Consultant</td>
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<tr>
<td>Years Professional Experience:</td>
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</table>
| Functional Areas: | Operations management  
Process improvement |
| Special Awards: | |
| Other Pertinent Information: | |
Model Evaluation

In general, did the model’s results match your experience?  Yes ☑  No ☐

What areas did not perform as expected?

- Leadership
- Communication
- Skill Sets
- Interdependence
- Rewards
- Personal Needs
- Turbulence
- Trust
- Resources
- Skill demands
- Intergroup Relations

Explain the difference:

Please see attached spreadsheet for analysis of results

Comments about the program and model:

This model has been well thought out and assembled. It behaves in a manner which is representative of true life. I could see this tool being used in a number of ways:

- As a management cause & effect tool to analyze business issues and determine root causes and action requirements. It would also be valuable as self assessment tool to allow businesses to benchmark themselves against world class (in this instance world class characteristics would need to be defined)
- As a training tool for management & business schools to study the impact of the different business levers on results. In this area some differentiation in the levers between what is internal and external would be useful to facilitate discussion on what can and cannot be influenced by management action.

Thoughts on the interaction of these elements in organizations:

See attached spreadsheet
<table>
<thead>
<tr>
<th>Scenario</th>
<th>Wcrk</th>
<th>Environment</th>
<th>People</th>
<th>Formal Organization</th>
<th>Informal Organization</th>
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<th>Expected result</th>
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<tr>
<td>1</td>
<td>Team reward system moves some focus away from pure task driven culture which would impact ability to deliver objectives (see comment Scenario 3 on emergent strategy)</td>
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<td>2</td>
<td>Centralized organization can respond to change at a more strategic level and with unity which should improve response to emergent requirements better than decentralized organization</td>
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<td>3</td>
<td>This represents the optimum environment output objectives. I would expect morale issues (skilled workforce / mundane tasks) which may impact realization of objectives. Why would emergent strategy not be realized with this flexibility to change?</td>
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<td>4</td>
<td>This is a worst case scenario. A dysfunctional organization, badly led with a complex job and environment. I would expect total chaos and very little achievement. The actual result is probably worse than reality, something would get done.</td>
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<td>5</td>
<td>This is a very task focused but inflexible organization. Great at doing repetitive tasks even if complex but no way of handling change. As expected, lack of interaction between functional groups has little if any impact on results</td>
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<td>6</td>
<td>A very flexible organization very reactive to change but unlikely to plan well and execute to the plan. I was a little surprised that the planned strategy execution was so high.</td>
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<td>7</td>
<td>This represents a good overall organization structure and management but a chronic skill gap and overload. The overload situation should cause panic in the staff and nothing gets done. The actual results appear optimistic with this profile</td>
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<td>8</td>
<td>Staff are carrying the management in this example. This should work in a stable environment even with complex work, but breaks down when change happens. Actual may be influenced by work complexity? Try next scenario</td>
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<td>9</td>
<td>As above but simpler work should improve results. Very surprising actual result. Indicates that the model places high emphasis on management skills rather than staff competency. (see also Scenarios 7 &amp; 8)</td>
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<td>10</td>
<td>Probably the ideal organization with good skills and balanced motivation around delivery but operating in a complex environment. This is to test if anyone could cope. (These situations exist so I would hope so!) (next 2 scenarios try to determine cause of failure)</td>
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<td>11</td>
<td>Decreasing workload helps</td>
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<td>12</td>
<td>Stable environment has a very surprising result. I would expect stability to improve result as less management time is spent fire fighting rather than watching out and reacting to real changes.</td>
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<td>13</td>
<td>Probably the typical business with a mix of good and bad but generally OK. Not a world class business but a long term survivor. The actual results were surprisingly low, with these results the business would fail. Also surprising to see emergent higher</td>
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<td>14</td>
<td>This and subsequent scenarios test the sensitivity to factors on the results. Rating 0-5 represents actual vs expected sensitivity to the factor. (1=less than expected 3 = as expected 5 = more sensitive than expected.) Scenario 11 = base.</td>
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<td>See scenario 12</td>
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<td>17</td>
<td>This represents unskilled people working in a complex environment. I would have expected a larger reduction in planned achievement and an almost zero achievement in emergent as the people will have enough trouble working on the planned stuff.</td>
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<td>20</td>
<td>I would have expected a functional organization to be less efficient than this particularly in a complex environment. Perhaps the good management saved the day? The lack of impact on emergent strategies is very surprising.</td>
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<td>I would not have expected one deficiency in one management area to have such a significant impact on the outcome, particularly the planned strategy which should be more controlled.</td>
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<td>See scenario 24</td>
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<td>See scenario 24</td>
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Evaluator Profile

<table>
<thead>
<tr>
<th>Name:</th>
<th>Gaston Barua</th>
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<tbody>
<tr>
<td>Title:</td>
<td>Plant Project Manager</td>
</tr>
<tr>
<td>Years Professional Experience:</td>
<td>14.5 years</td>
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</table>

**Functional Areas:**
- Experience in the following areas:
  - Project Management
  - Materials Management
  - Industrial Engineering
  - Technical Services
  - Manufacturing

**Special Awards:**
- New Product Introduction - *Harvard University, School of Business 1995*
- Project Management for Executives - *AT&T Training Institute 1994*
- Ergonomics Designs for the Workplace - *University of Michigan 1993*
- Simulation Modeling - *AT&T Istel 1992*
- Continuous Flow Manufacturing - *IBM 1992*
- Certified Job Analyst - *AMA 1991*
- ETHICON, Inc. President’s Award Recipient -1994

**Other Pertinent Information:**
- Master in Global Management Candidate for 1999 - *University of Phoenix*
Model Evaluation

In general, did the model’s results match your experience? Yes ☑ No ☐

What areas did not perform as expected?

- Leadership
- Interdependence
- Turbulence
- Skill demands
- Communication
- Rewards
- Trust
- Intergroup Relations
- Skill Sets
- Personal Needs
- Resources

Explain the difference:
When “interdependence” was high I was expecting “trust” to be as high or be of higher value than the first variable. Given the complexity through skill demand and the high reward in the model, I would have tough that trust would play a more important role as a behavior modifier for the success of the project.

Comments about the program and model:
The model mimics normal human behaviors and interactions. When adjusted for running the models, the variables responded as I have expected (except as noted above). The degree of interaction between the different variables in the model seems to be directionally adequate. That is, the level of interaction between a variable an another is reciprocal in nature (two way vs. one way only). This makes the model more realistic since in reality any of the variable listed above has a reciprocity effect on another. In my mind, they follow real environment conditions to a high degree since in one way or another these variables are very dependent of one another.
I also noted that duration had an effect on these variable; again making the model more real; i.e. the longer you has to sustain intergroup relations the longer and more intricate communications should be.
In conclusion, I would suggest that the model is in fact a good predictor of behaviors or outcomes in a work place provided realistic entries are made on the variables under evaluation.

Thoughts on the interaction of these elements in organizations:
I have cover some of my thoughts above. But additionally, in an organization it is important to chose the right kind of rewards to affect the other behaviors effectively. That is; the more challenging the job, the higher the risk; therefore the more important to pay attention to the types of reward and the magnitude of them to compensate accordingly for personal needs.
APPENDIX E

The Model

This system dynamic model is based on the principles embodied in the Congruence Model created by Nadler and Tushman. It attempts to define the interactions and relationships identified in their model. It is the author’s hope that these relationships will be further defined and refined over time as more research is applied to the issue of...
APPENDIX F

The Equations

Emergent_Objectives(t) = Emergent_Objectives(t - dt) + (Emergent_Strategy - Comm) * dt

INIT Emergent_Objectives = 0
Emergent_Strategy = Turbulence*8.33333333
Comm = (100*(mean(Comm_Factor,Leadership)))/12

DOCUMENT: Objectives that are clearly communicated flow into the work flow. The rate of the flow is based on one month of the annual supply of objectives. The amount that actually flows depends on the quality of the communication (comm_factor) and leadership value. If the communication is clear then the full rate flows. Good leadership can compensate for poor communication and bad leadership can hamper good communication.

Emergent_Strat_Realized(t) = Emergent_Strat_Realized(t - dt) + (E_Out) * dt

INIT Emergent_Strat_Realized = 0
E_Out = CONVEYOR OUTFLOW

TRANSIT TIME = if (Organizational_Climate>.75) then Work_Factor else (Work_Factor+(1-Organizational_Climate)+(1-Leadership))

DOCUMENT: This variable determines the time in which objectives can be achieved and is the result of the work factor and the nature of the environment.

The model factors in whether or not the organization has a centralized environment and the relative levels of Inter-group and Intra-group cohesiveness to arrive at a measure of organizational climate.

It assumes that it will take longer to respond to emergent objectives when the organizational climate score is low due to non-cohesive group dynamics and centralized control.

This time may worsen if the leadership of the organization is weak.

E_Work(t) = E_Work(t - dt) + (Comm - E_Out) * dt

INIT E_Work = 0

TRANSIT TIME = varies

INFLOW LIMIT = INF

CAPACITY = 9
Comm = (100*(mean(Comm_Factor,Leadership)))/12

DOCUMENT: Objectives that are clearly communicated flow into the work flow. The rate of the flow is based on one month of the annual supply of objectives. The amount that actually flows depends on the quality of the communication (comm_factor) and leadership value. If the communication is clear then the full rate flows. Good leadership can compensate for poor communication and bad leadership can hamper good communication.
E_out = CONVEYOR OUTFLOW

TRANSIT TIME = if (Organizational_Climate>.75) then Work_Factor
else (Work_Factor+(1-Organizational_Climate)+(1-Leadership))

DOCUMENT: This variable determines the time in which objectives can be
achieved and is the result of the work factor and the nature of the
environment.

The model factors in whether or not the organization has a centralized
environment and the relative levels of Inter-group and Intra-group
cohesiveness to arrive at a measure of organizational climate.

It assumes that it will take longer to respond to emergent objectives
when the organizational climate score is low due to non-cohesive group
dynamics and centralized control.

This time may worsen if the leadership of the organization is weak.

Lost_Comm(t) = Lost_Comm(t - dt) + (Unclear_Comm) * dt

INIT Lost_Comm = 0
Unclear_Comm = (100*(1-MEAN(Comm_Factor,Leadership)))/12
DOCUMENT: This is the flow for the objectives that were not clearly
communicated and thus were not achieved. These objectives are lost.

Lost_work(t) = Lost_work(t - dt) + (Lost_Opportunity) * dt

INIT Lost_work = 0
Lost_Opportunity = LEAKAGE OUTFLOW

LEAKAGE FRACTION = Work_Factor-1

NO-LEAK ZONE = 0%
DOCUMENT: This represents the lost opportunity when communicated
objectives cannot be achieved due to productivity factors.

Planned_Objectives(t) = Planned_Objectives(t - dt) + (- Clear_comm -
Unclear_Comm) * dt

INIT Planned_Objectives = 100

DOCUMENT: This stock represents the planned objectives for the year. As
the objectives are accomplished they are removed from the list to be
achieved.

Clear_comm = (100*(mean(Comm_Factor,Leadership)))/12
DOCUMENT: Objectives that are clearly communicated flow into the work
flow. The rate of the flow is based on one month of the annual supply of
objectives. The amount that actually flows depends on the quality of the
communication (comm_factor) and leadership value. If the communication
is clear then the full rate flows. Good leadership can compensate for
poor communication and bad leadership can hamper good communication.

Unclear Komm = (100*(1-MEAN(Comm_Factor,Leadership)))/12
DOCUMENT: This is the flow for the objectives that were not clearly
communicated and thus were not achieved. These objectives are lost.

Planned_Strategy_Realized(t) = Planned_Strategy_Realized(t - dt) +
(Output - Startup_Correction) * dt

INIT Planned_Strategy_Realized = 0
Output = CONVEYOR OUTFLOW

TRANSIT TIME = Work_Factor
Startup_Correction = PULSE(Correction_Factor,0,20)
Work(t) = Work(t – dt) + (Clear_comm - Output - Lost_Opportunity) * dt

INIT Work = 8.33333333333333333333333

TRANSIT TIME = varies
INFLOW LIMIT = INF

CAPACITY = 9
Clear_comm = (100*(mean(Comm_Factor,Leadership)))/12
DOCUMENT: Objectives that are clearly communicated flow into the work flow. The rate of the flow is based on one month of the annual supply of objectives. The amount that actually flows depends on the quality of the communication (comm_factor) and leadership value. If the communication is clear then the full rate flows. Good leadership can compensate for poor communication and bad leadership can hamper good communication.

Output = CONVEYOR OUTFLOW

TRANSIT TIME = Work_Factor
Lost_Opportunity = LEAKAGE OUTFLOW

LEAKAGE FRACTION = Work_Factor-1

NO-LEAK ZONE = 0%
DOCUMENT: This represents the lost opportunity when communicated objectives cannot be achieved due to productivity factors.

Activity_Grouping = 1
DOCUMENT: This variable is part of a chained set of switches which sets the structural grouping of the organization. Based on Nadler and Tushman, there are 3 potential grouping strategies:

By activity
By Output
By User

Centralized_Control = 0
DOCUMENT: This variable is tied to a switch which the user sets. If the organization is highly centralized then the value is set to 1. If it is more decentralized, then the value is set to 0.

The model assumes a greater time lag in responding to change in a centralized environment.

Comm_Factor = 1
DOCUMENT: This variable determines the clarity of the communication.

0=Totally unclear
1=Perfect, clear communication

Realistic values are likely to be between .3 and .9.

Correction_Factor = 8.33333333333333333333333-Clear_comm
Group_impact = if (Activity_Grouping=1) then ((2*Intra-group_Relations)+Inter-group_relations)/3 else ((2*Inter-group_relations)+Intra-group_Relations)/3
Interdependence = 0
DOCUMENT: This variable sets the degree to which the work is interdependent.

0= Work is essentially independent and may be performed in isolation
1= Work is totally integrated with the work of others and requires close cooperation

Inter-group_relations = 1
DOCUMENT: This is a measure of the Inter-group relationships.

1 = strong Inter-group relations [cohesive]
0= weak Inter-group relations [disruptive]

This is set by the user at run time.

Intra-group_Relations = if(Activity_Grouping=1) then Role_Clarity else (.5+Role_Clarity)/2
DOCUMENT: This variable is a reflection of the degree of cohesiveness within the group. The assumptions are as follows:

If the organization is organized around functional activities then individuals with similar skill sets and mindsets will be working together which should increase cohesiveness. If it is organized around a different structure then the value is set at .5 which is an arbitrary weight reflecting a presumed loss of cohesion.

The other factors considered to impact group cohesion are the clarity of the roles of the individuals in the group. The assumption is that increased role clarity reduces a number of sources of interpersonal conflict which will increase Intra-group cohesion.

Intrinsic_Reward = (Accomplishment+Routineness)/2
DOCUMENT: Intrinsic reward is the natural reward that comes from a challenging job which is within one's capabilities.

Leadership = Leaders_Ability-(1-Politics&_Trust)
DOCUMENT: This variable represents the degree of leadership shown by the management team.

0= No leadership
1= Gandhi, Patton, and Jefferson roled into one

Leaders_Ability = 1
Months_Left = 12-time
DOCUMENT: This determines the remaining portion of the year for use in the total objectives calculation.

It is the total of twelve months minus the current month.

Organizational_Climate = MEAN((1-Centralized_Control) +Inter-group_relations +Intra-group_Relations)
DOCUMENT: Organizational climate is a reflection of the degree of formality within an organization. The assumptions are that:

-- centralized control will tend to be more formal than decentralized control
-- Strong Inter-group relations will allow for a more informal climate
-- Strong Intra-group relations will allow for a more informal climate
The variable is set as the average of these values.

Output_Grouping = 0

DOCUMENT: This variable is part of a chained set of switches which sets the structural grouping of the organization. Based on Nadler and Tushman, there are 3 potential grouping strategies:

By activity
By Output
By User

Performance = (Planned_Strategy_Realized-(Planned_Objectives/12)*time)

Personal_needs = .5

DOCUMENT: Personal needs represents the degree of congruence between the needs of the individual in the organization and the needs of the organization.

0= total conflict in needs
1= total congruence in needs

Someone who is able to achieve their personal needs as a direct result of the organization's work will be rated a 1. Someone who is being forced to work as a slave to an organization would be a 0. The most realistic values will be between .3 and .7.

Politics_&_Trust = 1

Reward_System = 1

DOCUMENT: This is a user set variable that reflects the degree to which the formal reward system is individual based or team based.

0=Totally individual based
1= Totally team based

Role_Clarity = if (Leadership<.3) then .3 else Leadership

Skill_Change = if(Turbulence>0) then PULSE(.1,2,1/Turbulence) else 0

DOCUMENT: This variable assumes that the need for changes in skill sets is related to the amount of change in the environment. The higher the rate of change, the more often the organization will be taxed to raise its skill levels.

Skill_Demands = .5

DOCUMENT: This variable sets the base skill level required for the work.

Skill_Development = DELAY(Skill_Change,1-Leadership,0)

DOCUMENT: As the need for skills changes, the organization will attempt to provide training in those skills. This function assumes that there is at least a one month delay between recognizing the need for new skills and having the training completed. If the leadership is strong in the organization, these changes will be recognized earlier and the delay will be minimized.

Skill_Gap = ((Skill_Demands+Skill_Change)-(Skill_Levels+Skill_Development))

DOCUMENT: This variable determines the gap between the skill demands of the work and the skill level of the individuals.

Skill_Levels = .5

DOCUMENT: This variable sets the base knowledge level of the individuals performing the work.
Total_Objectives = if Months_Left>0 then (Planned_Objectives/Months_Left)+Emergent_Strategy else Emergent_Strategy

DOCUMENT: Total objectives combines the objectives to be met in a particular month. It combines the planned objectives that are part of the annual strategy and the emergent objectives that arise as the result of change.

Turbulence = .5

DOCUMENT: This represents the degree of change in the environment.

0=Stable Environment
1=Chaos

Unrealized = Lost_Comm+Lost_work

DOCUMENT: This variable is part of a chained set of switches which sets the structural grouping of the organization. Based on Nadler and Tushman, there are 3 potential grouping strategies:

By activity
By Output
By User

Work_Factor = (((3+(1-perf_factor)+(1-Personal_Factor)+(1-Reward_Congruence))/3) +Resources)/2

DOCUMENT: This variable assumes a value of 1 and then adds to that value based on other factors such as perf_factor, personal_factor, resources, and reward_congruence. The resultant total determines the relative effectiveness of the system and is reflected in the time it takes for objectives to move through the system. If all the factors are optimal, the process will retain a value of 1 and all objectives will be achieved within the allotted time frame.

Accomplishment = GRAPH(abs(Skill_Gap))

(0.00, 0.4), (0.1, 0.5), (0.2, 0.6), (0.3, 0.7), (0.4, 0.795), (0.5, 1.00), (0.6, 1.00), (0.7, 0.9), (0.8, 0.6), (0.9, 0.4), (1, 0.2)

DOCUMENT: This variable assumes that a person gets a sense of satisfaction when their skill sets match the demands of the job. If they are lacking in skills, they have a sense that they are performing below expectations and are less satisfied. If their skills are too high for the job, then they begin to feel boredom and are less satisfied.

perf_factor = GRAPH(Skill_Gap)

(0.00, 1.00), (0.1, 0.9), (0.2, 0.8), (0.3, 0.7), (0.4, 0.6), (0.5, 0.5), (0.6, 0.4), (0.7, 0.3), (0.8, 0.2), (0.9, 0.1), (1, 0.1)

DOCUMENT: The performance factor is portrayed as a graphic function which decreases the performance as the skill gap increases.

Personal_Factor = GRAPH(if Leadership>.5 then ((Personal_needs+Intrinsic_Reward+Role_Clarify+Group_impact)/4 +.1) else (Personal_needs+Intrinsic_Reward+Role_Clarify+Group_impact)/4)

(0.00, 0.00), (0.1, 0.1), (0.2, 0.2), (0.3, 0.3), (0.4, 0.4), (0.5, 0.5), (0.6, 0.6), (0.7, 0.7), (0.8, 0.8), (0.9, 0.9), (1, 1.00), (1.10, 1.00)

DOCUMENT: The personal factor is a measure that combines the degree of congruence between an individual’s values and the company’s needs, as represented in personal_needs, with the impact of exceptional leadership and the intrinsic reward or lack thereof that may arise from having skill sets that are significantly above or below those required to perform the task at hand.

It also considers the impact of role clarity and Intra-group relations
Resources = GRAPH(Total_Objectives)
(0.00, 1.00), (1.00, 1.00), (2.00, 1.00), (3.00, 1.00), (4.00, 1.00),
(5.00, 1.00), (6.00, 1.00), (7.00, 1.00), (8.00, 1.00), (9.00, 1.00),
(10.0, 1.20), (11.0, 1.40), (12.0, 1.60), (13.0, 1.70), (14.0, 1.80),
(15.0, 1.90), (16.0, 2.00), (17.0, 2.00)

DOCUMENT: Resources represents the demand on the resources of the organization. These include physical, capital, and human resources. The variable is set-up as a graphic function with 1 representing the normal demand on the total availability of resources and 2 representing the demand level that over strains the resources. Either absolute state is unrealistic. The graph may be altered during the simulation. The default graph assumes adequate resources for the planned strategy, but the additional emergent strategy will begin to place a strain on the organization.

Reward_Congruence = GRAPH(ABS(Interdependence-Reward_System))
(0.00, 1.00), (0.1, 0.9), (0.2, 0.8), (0.3, 0.7), (0.4, 0.6), (0.5, 0.5),
(0.6, 0.4), (0.7, 0.3), (0.8, 0.2), (0.9, 0.1), (1, 0.00)

DOCUMENT: This variable compares the absolute value of the difference between the reward system and the nature of the work. This relationship is expressed graphically as reward-congruence. For example, if an organization's work is totally interdependent and team based but the reward system is totally based on individual performance then it would be viewed as totally incongruent.

1=Totally congruent
0=Totally incongruent

Routineness = GRAPH(Turbulence)
(0.00, 0.2), (0.1, 0.2), (0.2, 0.6), (0.3, 0.6), (0.4, 0.8), (0.5, 1.00),
(0.6, 1.00), (0.7, 0.8), (0.8, 0.6), (0.9, 0.4), (1, 0.2)

DOCUMENT: This variable represents the individual's response to the level of routine in a job. It assumes that people like a balance between change and stability. If the level of turbulence is at the middle value, the person is most satisfied with the level of routine. As the amount of change increases, the person becomes more challenged by the change and less satisfied. As the amount of change decreases, the person becomes more bored with the routine and is less satisfied.