

Running Head: PARSING THE “INFLUENTIAL INCREMENT”

**Parsing the “Influential Increment” in
the Language of Complexity: Uncovering the
Systemic Mechanisms of Leadership Influence**

By

James K. Hazy

hazy@adelphi.edu

Adelphi University School of Business

Working Paper Series:

SB-WP-2010-02

April 16, 2010

Abstract

This article develops theory relating the process of leadership to the social processes that sustain an organization as a complex adaptive system. It interprets current theory in a new light and describes dynamical interactions that relate mechanisms of leadership to the organizational capabilities that have succeeded in the environment. It examines how three distinct but complementary mechanisms interact to form a leadership metacapability that evolves in organizations to positively impact both performance and adaptation.

**Parsing the “Influential Increment” in the Language of Complexity:
Uncovering the Systemic Mechanisms of Leadership Influence**

Having ballooned in the 1980s and 1990s, executive compensation levels have continued to set records unabated (Morgenson, 2006). Yet it is commonly assumed in organization theory circles that leadership does not matter. Either leadership impacts organizations and their performance, often profoundly, as these salaries seem to imply; or it does not, in which case executive compensation is a reflection not of the implied importance of leadership, but rather of something else. There is controversy on this point, I believe, because the field does not really understand what those in leadership are doing to justify their paychecks. I am not referring to the specific actions taken by individuals; those have certainly been studied (Drucker, 1966, 2004; Hambrick & Brandon, 1988; Kaplan, Drath, & Kofodimos, 1987; McCall, Lombardo, & Morrison, 1988; Sperry, 1997). Rather, what is largely unexplored is how leadership and leaders affect the system, the organization, in ways that add value to the organization and its members. This article focuses attention on this important and largely unexplored area and offers preliminary ideas on the subject.

Katz and Kahn (1966) famously called leadership the “influential increment” beyond the normal directives of the organization. Using the developing language of complexity science, this article begins to parse the meaning of this “influential increment” in an effort to uncover the systemic mechanisms whereby the decisions and actions of certain individuals, called “leaders” by others, have a direct and sometimes profound impact on the complex dynamics at work within organizations.

Theoretical Foundation

The tradition that links leadership with organization theory began with the work of Chester Barnard (1938). Katz and Kahn (1966) reintroduced the notion of organizational leadership in a systems context, but little research or theory development has followed since that time. These early contributions are described below.

An Early Theory Presages Study of Leadership in Complex Systems

In his 1938 book *The Functions of the Executive*, Barnard described an integrated perspective of leadership within organizational systems. This view of leadership, which Barnard called “executive functions,” presaged more recent efforts to develop a theory of leadership within complex systems (Goldstein & Hazy, 2006). Interestingly, however, the research that followed Barnard consciously broke with his tight integration of leadership and systems theory in order to focus primarily on his contribution to systems thinking in organization theory. As an example of the prevailing perspective among organization theorists, James March was recently quoted in the *Harvard Business Review* (March & Coutu, 2006):

I doubt that “leadership” is a useful concept for serious scholarship. The idea of leadership is imposed on our interpretation of history by our human myths, or by the way we think that history is supposed to be described. As a result, the fact that people talk about leaders and attribute importance to them is neither surprising nor informative.

(p. 85)

Barnard’s (1938) impact on subsequent organization theory, however, has been nonetheless profound. As only one example of many (Hazy & Goldstein, 2006), Herbert Simon (1997) drew heavily on Barnard to develop his theory of administrative decision making:

The concepts of systems, multiple constituencies, power and politics, and organizational culture all flow quite naturally from the concept of organizations as complex interactive structures held together by a balance of inducements provided to various groups of participants and the contributions received from them—a concept that originated with Barnard. (Simon, 1997, p. 27)

This article honors these early connections with Barnard (1938). It also seeks to repair the breach in the Barnard tradition by bringing “executive functions” or “leadership” back into the discourse among organization theory researchers. To do so, this article uses complexity concepts and language—unavailable to Barnard, Katz and Kahn (1966), or others—to consider leadership to be a series of mechanisms within human systems that engage in, as Simon (1997) put it, the “complex interactive structures” that are “held together by a balance of inducements provided to various groups of participants” (p. 27). In this view, leadership balances performance and adaptation of an organization’s capabilities in response to and anticipation of changes in the environment, and it does so in a manner consistent with Katz and Kahn’s idea that leadership is an “influential increment.”

Applying what is now known about complex adaptive systems in an organizational context (Thietart & Forgues, 1995), this article takes the point of view that what is observed as leadership is best studied in the context of the functions of leadership and of those who perform those functions. This perspective lies in contrast with the traditional perspective that seeks to identify individuals “who are leaders” and then to study their traits and behaviors. Functions are not behaviors. They are elements of a complex adaptive system *in situ*, not individuals or dyads that can be studied in isolation.

As elements of a system, leadership functions have evolved as essential mechanisms that enhance the system’s survival potential in some way. In this light, it is clear that the performance of leadership functions can be effective, or it can be ineffective. In a further nod to the Barnard (1938) tradition, I define *effectiveness* as he did: to be achieving some purpose. Thus, as an initial definition, I suggest that *effective leadership achieves a purpose*.

The “Influential Increment” in Complexity Terms

Organizational leadership was defined by Katz and Kahn (1966) as the “influential increment over and above mechanical compliance with the routine directives of the organization” (p. 528). It is an organization-level process or mechanism that is necessary due to imperfections and incompleteness of organizational design, the changing internal state of the organization, changing external conditions, the problem of managing the boundary, and the challenges of human membership in organizations (Katz & Kahn, 1966).

The Katz and Kahn (1966) definition of leadership can be usefully interpreted in complex-systems terms. Leadership is assumed to consist of observable mechanisms that serve specific functions. In particular, leadership is posited to be composed of three interacting mechanisms, each built of members and roles that enact routines and process knowledge to address elements of Katz and Kahn’s definition. “Imperfections and incompleteness of organizational design” and the inevitably “changing internal state of the system” (Katz and Kahn, p. 528) are addressed through (1) the mechanism that maintains a configuration of capabilities (Dosi, Nelson, & Winter, 2000; Nelson & Winter, 1982) and promotes their continual convergence toward more efficient performance (however defined). “Changing external conditions” and the implied “changing internal state of the system” (p. 528) are

addressed through (2) the mechanism that generates requisite variety (Ashby, 1962) of new structures and capabilities internal to the system and then extrapolates existing structures for possible future use (Helfat et al., 2006; Surie & Hazy, 2006; Teece, Pisano, & Shuen, 1997). Finally, the “problem of managing the boundary” and the “challenges of human membership in organizations” (p. 528) are addressed through (3) the mechanism that produces and reproduces the social structures that define the system as a “unity” (Maturana & Varela, 1998), its identity, its boundaries, and the exchange between the system and the environment (Adams, 1976; Aldrich & Herker, 1977; Hazy, Tivnan, & Schwandt, 2004; Yakura, 2002), including the rights and responsibilities of organizational membership by agents.

In sum, organizational leadership is posited to mediate the effects of change, both in the environment and internal to the system, on the internal configuration and effectiveness of organizational capabilities. It does this by processing information and knowledge and by modifying social structures (Giddens, 1984) that guide agent activity. In the evolutionary language of today’s organization science, the three mechanisms described above could be said to form an organizational metacapability. A *metacapability* is a specialized organizational capability (Dosi et al., 2000) that processes information, knowledge, symbols, and structures to dynamically organize and reconfigure other organizational capabilities. When organizational capabilities are considered to be components of a complex adaptive system of agents, it follows that a metacapability must connect individual agents with each other, with necessary resources, with knowledge, and with tasks, as required by the system (Krackhardt & Carley, 1998).

As March (1981) noted, individual interventions at critical points can leverage organizational forces so that small changes in the organization can have a huge impact on the

organization’s ability to respond to the environment. Some actors are better at this than others, and so some agents are rewarded with greater power, status, and other benefits. These people are usually studied as “leaders.” Understanding what makes these people tick—almost the exclusive domain of leadership research—is only half of the puzzle. Why they do what they do, and how these actions and decisions help the system to sustain itself and to adapt, are both important questions as well. This is the theory that is developed in the pages that follow.

A Working Definition of Leadership

Drawing upon both Barnard (1938) and Katz and Kahn (1966), a working definition of organizational leadership can be formulated. *Leadership* is the “influential increment” that moves those led—and thus the system—toward some purpose. Again using Barnard’s definitions as a guide, *effective leadership* achieves a purpose. That is, it is effective with respect to a particular purpose. Under these definitions, the notions of leadership and effective leadership apply to the individual, the group, the organization, and society: each attending to a purpose, and each supporting a different constituency.

Why Leadership Matters

March (1981) articulated a prevailing view among organizational theorists that leadership is of little consequence, that most leadership only requires “ordinary people to do ordinary things” (p. 575). A few years earlier, however, Burns had (1978) challenged this rather dismissive view of leadership. He espoused the notion that the transforming leader, as opposed to the transacting leader, can cause followers to achieve results even beyond their own expectations. This idea took research beyond the notion that leadership is ordinary (Bass, 1996; Bass & Avolio, 1994) and began a research stream that has been called at various times the “new

leadership,” “transformational leadership,” or “charismatic leadership” (Judge & Piccolo, 2004). This work argued that the individual leader matters a great deal to organizational performance, even though the mechanisms of this impact are not well understood (Sashkin, 2000). Of course, March (1981) also acknowledged the potential impact of the individual, saying that it may be possible to time the execution of routine activities “so that the force of natural organization processes amplifies the interventions” (p. 575).

The present article takes as a starting point March’s (1981) position illustrated by the quotes above. However, it challenges his conclusion that leadership is of only incidental moment. To do so, I build upon recent scholarship to argue that *it is the effectiveness of the combined operation of an ensemble of organizational capabilities that directly relates to an organization’s performance and adaptability*. As has been said, effectiveness is defined with respect to a purpose (Hazy & Goldstein, 2006). The chosen configuration and specific interactions between these capabilities do, however, have extremely complex and interdependent effects on the performance of the ensemble, complicating the achievement of purpose. Small, apparently inconsequential differences can have tremendous implications on the expressed performance at the system level. Thus, regarding the influence of leadership, this paper argues that *the effective operation and specific configuration of these organizational capabilities are influenced, at least in part, by the mechanisms of leadership*. Therefore, it is leadership that drives performance and adaptation, albeit indirectly. It does this by leveraging the “force of natural organization processes” (March, 1981, p. 575). Before I describe how this occurs, some preliminary observations are necessary.

The Mechanisms of Organizational Leadership

Organizational leadership is posited to be a coordinated collection of activities—or, using Weick’s (1979) term, *leadership enactments*—that affect “organizational forces” (March, 1981) by acting as catalysts to organize the decisions and actions of agents within complex adaptive systems. These catalytic activities form the mechanisms of leadership. They impact internal interactions between agents and, by extension, the interactions and interdependencies among organizational capabilities. How these interactions are expressed as ensembles determines leadership effectiveness with respect to a purpose.

Mechanisms operate together in three ways as the “influential increments” of leadership as defined by Katz and Kahn (1966). First, they organize activity to determine how an organization’s capabilities come together and evolve to facilitate system convergence toward a parametrically determined, increasingly efficient resource-processing configuration, sometimes called a *structural attractor* (Allen, 2001). This first influential increment is called *convergent leadership* because it catalyzes the convergence of the organization’s system dynamics toward a structural attractor. Second, mechanisms enable activities that explore the environment and the organization’s internal possibilities for developing new capabilities. These activities generate variety in the organization and create options available to the system as possible futures for the system (Surie & Hazy, 2006). This second influential increment is called *generative leadership* because it generates the requisite internal variety needed to match the variety in the environment (Ashby, 1962). Third, mechanisms unify the system and separate it from the environment by adjusting system parameters—such as boundaries (e.g., alliances and joint ventures) and membership benefits (e.g., compensation) and/or requirements (e.g., the employment contract)—

to sustain resource and informational differentials between the system and the environment. These parametric changes can also alter the complexity of the structural attractors toward which the system tends. Absent this “influential increment” (Katz & Kahn, 1966), forces of entropy would tend to even out these differences, level boundaries, and move the combined system-environment toward a randomized distribution of disorder. This third influential increment is called *unifying leadership* because it maintains the system’s viability as an entity and supports a unified model of the system within the environment across the organization’s parts and among its members. Each of these mechanisms is described in detail in a later section.

Leadership, Configuring Capabilities, and the Performance Landscape

The extraordinary potential to leverage individual action in the context of organizational forces results from peculiar characteristics of complex systems operating at the edge of chaos. Because of sensitivity to initial conditions (Gleick, 1987; Marion, 1999), small differences in the choices of even a small number of agents can have a large effect (Kauffman, 1993). Individual acts have this disproportionate effect because the complex interdependencies within the configuration of organizational capabilities determine how an ensemble of capabilities comes together to express organizational fitness in the environment. The specific characteristics of this impact depend upon how interdependent the choices are, a condition that is sometimes represented as a rugged *performance landscape* (Levinthal, 1997; Rivkin & Siggelkow, 2003). (The performance landscape is described in the next section.) If the performance landscape is rugged due to interdependencies among the choices taken, then a small choice might move the system radically along the landscape—either for good or for ill. In this situation, a single agent

can be said to leverage “organization forces” and thus impact the organization’s large-scale characteristics, including its performance.

The theoretical framework described in detail in the next section suggests that leadership impacts performance through organizational capabilities. Once organizational capabilities are developed and configured, leadership activities moderate their impact on performance by enacting (Weick, 1979) a model of the system’s evolving performance landscape (Gavetti & Levinthal, 2000). Agents acting out the mechanisms of leadership use this model to define purpose and aspirations for themselves and for other agents. These agents, in turn, impact the system because their actions and choices impact the configuration and implementation of capabilities.

The Leadership of Organizations

Consider an *organization* to be a complex system of human actors within the environment (Carley & Svoboda, 1996; Kauffman, 1993; Marion, 1999; Prigogine & Stengers, 1984; Thietart & Forgues, 1995). The organization, once formed, interacts with its environment as an open system (Katz & Kahn, 1966; Schwandt & Marquardt, 2000; von Bertalanffy, 1950), maintaining its energy by gathering resources, producing outputs, and exchanging information with the environment (Katz & Kahn, 1966).

The Organization and Its Capabilities

Inside the system, the organization’s agents develop, maintain, and reconfigure *organizational capabilities* (Dosi et al., 2000): collections of routines and integrating knowledge that are assembled in a particular configuration to perform a specific function. Organizational capabilities are in general “knowledge-based, firm specific, [and] socially complex, and they

generally cannot be simply acquired in factor markets” (Maritan, 2001, p. 514). Capabilities are effective enough to have survived organization-level evolutionary processes (Aldrich, 1999; Hannan & Freeman, 1989; Nelson & Winter, 1982). The configuration of organizational capabilities changes over time through the operation of what have been called *dynamic capabilities* (Teece et al., 1997). Organizational capabilities develop and evolve in two ways: (1) through incremental improvement in their exploitation and (2) through exploration that favors finding and developing new capabilities and/or the redeployment of capabilities in new ways (March, 1991).

The Organization in the Environment

The organization as an open system (Katz & Kahn, 1966; Schwandt & Marquardt, 2000; von Bertalanffy, 1950) interacts with its environment to import the energy, resources, and knowledge (Schreiber & Carley, 2006) that it needs to sustain itself, its members, and its other stakeholders. Thus, as a system, the organization depends upon its continued access to resources and knowledge. An open question is whether it is reasonable to assume that organizational systems exhibit resource-seeking or “nourishment-seeking” behavior. Clearly their members do, and they depend upon the organizational system for resources. For the present analysis it is enough to assume that individual members are seeking nourishment and that they depend upon the organization for at least some of the resources they need.

Many types of resources are gathered. Most are consumed to maintain the social structure of the organization and the needs of its members. This gathering of resources is assumed to occur outside the organization boundary in markets where the organization’s outputs and available

resources are exchanged for other necessary resources.¹ These interactions may result in *economic rents*, defined as value that accrues when the resources imported by the system have greater value than what were needed to create the outputs that were used in the exchange (Makadok, 2001). Although sustained rents are difficult to maintain, proponents of the resource-based view (RBV) of the firm argue that when an organization has differential access to resources, including non-imitable internal resources such as proprietary knowledge, then competition is less effective at eliminating excess rents. As a result, organizations can be sustained over the longer term (Barney, 1991; Makadok, 2001; Penrose, 1959). The analysis herein follows this tradition, arguing that boundaries can be established and maintained through the operations of leadership mechanisms and, further, that the permeability of these boundaries to certain proprietary knowledge and resources can be adjusted by the actions of leadership. This mechanism of leadership enables the system to maintain competitive advantage and sustain itself.

¹ An important element of this framework is the assertion that an organizational boundary separating the system from its environment can be identified and described. Some theorists applying complexity science to social science have raised questions about this assertion (Griffin, 2002; Maturana & Varela, 1998; Stacey, 1995), arguing that the boundary is merely metaphorical. Theoretical support for emergent boundaries in complex social systems has been demonstrated computationally. Boundaries emerge in organized systems of agents as a means of regulating the flow of new information into the organized system of tasks. These emergent boundaries help to balance information flow against the productivity loss associated with agent exploration activity (Axtell, 1999; Hazy, Tivnan, & Schwandt, 2003; Hazy et al., 2004). As a result, there is analytical and theoretical support for the assumptions made here.

The markets and the ways in which organizations participate in them co-evolve (Lewin, Long, & Carroll, 1999). The technologies used to combine markets change over time (Hazy, Torras, & Ashley, 2008). As the environment changes, the outputs (i.e., products and services) produced by one organization are often promoted to the market. In this way, the nature of the environment, the available markets, and the resources required all change over time. Old markets may decline and new ones may emerge and grow. The organization must continually exploit existing markets but also explore to find or to enact, and then to exploit, new market opportunities.

Measuring an Organization’s Potential for Sustainability

The existence of economic rent for a system means that resources accumulate within the organization for future use and for fueling of growth. In this way, the production of economic rent over time is a measurement of current and prospective fitness or performance. In the absence of distribution to stakeholders, economic rent accumulates within the system in what has been called *organizational slack* (Cyert & March, 1963; Nohria & Gulati, 1996; Singh, 1986). These accumulated resources become an important hedge against changes in the future.

For a given set of environmental conditions, the organization’s capabilities may be configured in many ways. Each possible configuration would, if implemented, map to a level of economic rent, that is, to a level of “performance” over time. For this reason, when possible configurations are considered, the expected economic rent for each possible configuration is called *performance rent*. Each configuration can be considered a vector of choices over time: choices to perform a task, to access a resource, to interact with others, etc. (Krackhardt & Carley, 1998). Each unique configuration of choices implies a specific level of performance for a given

metric, such as the appropriation of rent. The complete set of all possible choice vectors—that is, all possible configurations and the implied performance for each—forms a multi-dimensional graph called the firm’s *performance landscape* (Westhoff, Yarbrough, & Yarbrough, 1996; Levinthal, 2001).

Configuring and Reconfiguring Organizational Capabilities

Organizational capabilities (Nelson & Winter, 1982), described earlier, relate to the performance of certain organizational functions. *Dynamic capabilities* were defined by Teece et al. (1997) as the presence within an organization of a dynamic process that acts to acquire and/or deploy resources and assets, tangible or intangible, in order to perform a task or activity to produce or improve results (Maritan, 2001; Nelson & Winter, 1982; Teece et al.). Organizations must have the capacity to dynamically reconfigure their capabilities. *Dynamic capabilities* renew an organization’s competencies and reconfigure its capabilities to achieve congruence with the changing environment. Innovation, strategic alliances, and mergers and acquisitions (M&A) are all examples of dynamic capabilities that help firms to adapt to changing markets. Dynamic capabilities are posited to accomplish this by adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competencies to match the requirements of the changing environment (Teece et al., 1997; Eisenhardt & Martin, 2000; Zander & Kogut, 1995).

In the analysis that follows, organizational capabilities and dynamic capabilities are considered to be complementary. Together they make up the dynamic mechanisms of organizational evolution. Organizational capabilities include routines, knowledge, and technology that perform organizational functions; and dynamic capabilities form the mechanisms

of recombination and change. Both of these are actualized by individual choices and actions taken by the organization’s members. The complexity of the interactions between these choices and actions devolves into the dynamics whereby individual action can leverage organizational forces (March, 1981) to large-scale effect. In other words, the complexity inherent in the expression of ensembles of interacting capabilities enables the mechanisms of leadership.

The Mechanisms of Organizational Leadership

Organizational capabilities consist of shared, interconnected organizational routines executed by the organization’s members, or agents, to enable the organization to gather more resources than is perceived to be possible individually (Nelson & Winter, 1982). In the traditional telling, leadership is absent. Nelsen and Winter did talk about “coordinating capabilities” but did not address the question of leadership. However, researchers as far back as Barnard (1938) have talked about meta-level social structures that enable collective action. Over time these structures become increasingly complex and specialized (Simon, 1962, 1997). What is missing, and is addressed in this article, is the connection to leadership.

To understand the mechanisms of organizational leadership, it is useful to begin with traditional research at the individual level. When individuals are surveyed about their perceptions of leaders, the behaviors that are identified as indicating “leadership” fall into two distinct categories: *transactional*, in particular contingent reward behaviors; and *transformational*, often associated with charisma, inspiration, intellectual stimulation, and change (Bass, 1985; Judge & Piccolo, 2004; Sashkin & Sashkin, 2003; Tejeda, Scandura, & Pillai, 2001). Understanding these qualitatively different behaviors and how they may impact organizational capabilities is a helpful first step in uncovering the system-level leadership mechanisms at work within organizations.

Convergent leadership. To look for clues to organization-level effects of leadership behaviors, a meta-analysis of empirical studies (Judge & Piccolo, 2004) found that transactional leadership activities relate to positive performance when they organize follower behaviors by making individual rewards contingent upon decisions and actions that are aligned with organizational objectives. These organizational objectives derive from models-in-use developed and maintained by the agents within the system (Argyris & Schon, 1978). These models, whether aligned or not, or correct or not, serve to guide the actions and decisions of agents who are converging the system toward a state implied by the model-in-use. To do so, agents decompose these models into goals and objectives. Actions and interactions between agents are guided toward these objectives when the leadership mechanism assigns rewards contingent on their accomplishment. Stated differently, structure is initiated and direction is provided as described in the Ohio State studies (Bass, 1990). This system-level mechanism is called *convergent leadership*. It is the “influential increment” that evolves and uses models to guide and coordinate action and decisions, and thus the system, toward what is perceived to be an end-state level of ongoing performance.

Generative leadership. What is often called transformational leadership comprises behaviors that inspire, motivate, and stimulate individuals to act in return for intrinsic rewards (Bass, 1985; Bennis & Nanus, 1985; Conger, 1989; Judge & Piccolo, 2004; Kouzes & Posner, 1987). Attribution of transformational leadership relates to individual practices such as intellectual stimulation, individualized consideration, and idealized inspiration (Bass, 1985). In these situations, individual agents are stimulated to act and to interact because their internal

motives are activated. From this unbridled interaction, new information may be gathered, new knowledge may be formed, and previously unknown possibilities may emerge for the system.

Leadership that increases information flow and interaction rates facilitates the generation of internal variety within the system (Ashby, 1962; Surie & Hazy, 2006). This catalyzing of cross-functional communication, learning, and exploration of the environment in turn generates new ideas and possibilities for the overall system. Leadership activities of this type also facilitate the recombination of existing capabilities into variations of structure for the organization that might prove useful in the future. As catalysts to the organization’s dynamic capabilities (Helfat et al., 2006; Teece et al., 1997), these activities increase the variety of possibilities available to the organization as it responds to changes in the environment.

The system-level leadership mechanism that generates variety is called *generative leadership* (Surie & Hazy, 2006). It is the “influential increment” in the system that catalyzes the variation and recombination within organizational capabilities to make system-wide adaptation possible.

Unifying leadership. Leadership activities by individual agents also find, recruit, inculcate and retain the organization’s members; determine the rights and responsibilities of various categories of membership; and enforce rules, rights, and values by, for example, excluding those who do not meet certain thresholds of participation. Although unifying leadership is not specifically described in much leadership theory, the leadership activities also identify and reinforce boundaries, defining the resources that are claimed by the system and identifying others in the environment (Drucker, 2004). These boundary conditions may change as circumstances warrant. Leadership activities within the system actualize this change by

defining what is included and what is abandoned, and by determining who remain members and thereby have claims to system resources (Hazy & Tivnan, 2004) and who do not.

This system-level mechanism is called *unifying leadership* because it manages membership and boundaries internal and external to the system. It defines and maintains unity within the system (Maturana & Varela, 1998) in the face of tension between convergent and generative leadership activities within the organization, and it makes sense of these tensions for the organization’s members (Weick, 1995) to find meaning. It is the “influential increment” that creates and dissolves boundaries, determines the boundary’s permeability to information (Hazy et al., 2004), and establishes and enforces the rights and responsibilities of system membership.

The three constructs described above form the conceptual framework that explicitly considers organizations as complex adaptive systems. The constructs, and the relationships between them, are shown in Figure 1. They are also described in more detail below.

Insert Figure 1 about here

The Leadership and Capabilities Model

The relationships described above situate an organization and its capabilities within a changing environment. They describe how the organization and its members struggle to sustain the system’s stakeholders and also position it to survive in the longer term. In other words, the organization is described as a complex adaptive system. March (1991) highlighted the tension between the short-term and long-term needs of organizational systems. He argued that organizational members must divide attention judiciously between exploration of new possibilities and exploitation of old certainties. Each is important to the dynamics of the

organization as a complex system; and as will be shown, each relates to a particular mechanism of leadership.

In the analysis below, the theoretical constructs described in the last section and the interactions between them are organized into a model of leadership in complex systems. Because this analysis frames these leadership mechanisms theoretically as a metacapability that organizes other organizational capabilities, including dynamic capabilities, it is called the Leadership and Capabilities Model (LCM). Below, the underlying resource-processing dynamics of exploitation and exploration and the leadership mechanisms that must be in place to operationalize them are discussed separately.

Gathering Value Through Exploitation

Organizations that have been around for a while have had time for their members to gather knowledge about and accumulate resources from the environment. As time passes they evolve structures that exploit the organization’s opportunities (Allen, 2001). In short, they have had time to develop organizational capabilities (Dosi et al., 2000). For business organizations, these capabilities include the ability to execute effectively in many functional areas, such as inventory management, manufacturing, logistics, financial management, and marketing. In non-governmental organizations (NGOs), capabilities might include recruiting, fund raising, and domain expertise. In governments they include policy development and budgeting. In order to coordinate and organize interactions within these capabilities, the people who are involved have developed simplified, often incomplete and disconnected cognitive models of the processes that make up the capabilities. These models are used to evaluate performance, propose changes,

evaluate alternatives, and make decisions. It is important to remember, however, that these are models of reality, not reality itself.

Exploitation and the value-gathering loop. As described earlier, in exploitation, current capabilities are exercised to gather performance rent and acquire necessary resources from the environment. Over time, the capabilities become more effective at doing this through a dynamic process, an adaptive walk of incremental improvement. Gradually, the capability within the system converges toward a locally determined peak in performance, a model of the environment that serves as a dynamical structural attractor for the system (Allen, 2001).

Resources allocated to exploitation—whether financial, physical, or human—serve not only to produce the output of the organizational system and to exchange it in the market, but also to improve the efficiency and throughput of the capabilities. Quality programs, transaction cost reductions, and similar programs are examples of programs that use a particular model of the system in its environment to catalyze activities in an effort to converge the system dynamics toward the end state implied by the model. These programs are specifically intended to enable incremental improvement by testing specific changes to the structure of capabilities, evaluating the result, and retaining configurations that appear to improve efficiency while abandoning those that do not. These conscious-management programs, conceived and implemented through acts of leadership, are catalysts of convergence as the system moves toward an attractor state.

As shown in Figure 2, when considered as a complex system, the exploitation process can be modeled dynamically as a positive feedback loop. Because exploitation leads to the gathering of positive cash flows critical to value creation, this feedback loop is called the *value-gathering* loop. As more resources are gathered and aggregate as slack, they are available for use in

catalytic management programs as incremental changes are tested. With strong leadership, those that are successful are incorporated into the capability, and those that are not successful are dropped. As improvements are identified, more and more energy, resources, knowledge, and variety can be absorbed from the environment. The system approaches a local performance peak, a structural attractor (Allen, 2001). Eventually, a point is reached where any incremental change would degrade rather than improve performance. Strong leadership recognizes these points and adjusts resource flows accordingly. For this to happen, one or more agents must recognize the condition based upon the model-in-use and then enact routines to adjust resource and information flows in the system.

Complacency and market demand limit exploitation. The local peak that is the end point of an adaptive walk may be an actual structural constraint of the system and its current configuration of capabilities. However, it may also be an artifact of the human actors’ modeling processes. It is possible that the incomplete nature of model-in-use creates a *perceived* limit to performance that is not an *actual* limit in the system. Rather, the organization’s members may not fully understand the system, or they may be blind to other possibilities. Because choices are governed by the model-in-use rather than the actual system, they may act as though peak performance is achieved, when in fact better performance is possible. Thus, agents reacting to incomplete or incorrect models may enact leadership routines that are inappropriate to the system state or the conditions in the environment. This would be ineffective leadership.

With ineffective leadership, the organization’s members may fail to allocate resources toward the various opportunities offered by the environment and the organization’s current structure. This is *complacency*, a situation where the system’s performance is perceived to be

good enough, or as good as it can be, when in reality further improvement is possible. As changes occur in the environment, it becomes more and more likely that the system is not actually in a configuration of relative peak performance, but rather that its structure has drifted to an ineffective state. Ineffective leadership would maintain the inadequate model-in-use even in the face of changes in circumstances. Thus, as Figure 2 shows, complacency is a balancing feedback loop that regulates the system’s exploitation potential. An effective leadership metacapability must contain the mechanisms that guard against complacency.

The environment also limits the growth potential of the system. The upper bound in the carrying capacity of the market serves to limit demand. Likewise, competition limits the share of available resources gathered by the system. As demand declines, rents decline and eventually the internal resources available to the system decline. Assets are sold and employees are laid off. Thus, markets and competition balance the positive feedback loop that would otherwise fuel continuous growth in the system. Effective leadership must be sensitive to these conditions and enact routines appropriate to the system and environmental conditions.

Insert Figure 2 about here

Convergent Leadership and Exploitation

Leadership is the “influential increment” necessary to adjust to incompleteness of design and changes in the system. Agents must recognize changes and enact meta-routines—routines that organize other routines—to accommodate the changes. As such, leadership is a catalyst in the convergence of the system to a local performance peak, or a structural attractor state. Effective leadership allows the system to continually pursue its systemic performance peak as

conditions change, rather than permitting the system to wander aimlessly or to become stranded on a false peak perceived to be locally optimal due to inaccurate models-in-use. Based upon the variables included in the model-in-use, feedback from the system is gathered and evaluated. The performance of both the system and the model, as a predictor of the system, are evaluated so that corrections can be made to both. Gaps are identified, either between the system and its performance objectives (as modeled), or between the model-in-use and reality as it is then understood. Convergent leadership catalyzes agent activity in an adaptive walk within each capability. It is the mechanism that operates among the interacting structures, promotes incremental variations that the model predicts will improve performance, and then tests for perceived performance improvements. If it validates the changes, it incorporates them into the capabilities interaction structure as a step in the adaptive walk.

The convergent leadership mechanism may involve tuning parameters in the model-in-use so that it better predicts actual performance, or it may involve influencing interactions within the system itself (as inferred from the model-in-use) in an effort to achieve predicted performance gains in the form of a local performance peak.

The catalytic role of convergent leadership has two aspects. On the one hand, it must observe and gather feedback, synthesize the knowledge, and then articulate and evolve the model-in-use for the performance of particular capabilities and for combinations of them. On the other, it must translate the model into reality by initiating and evolving structure, making resource allocation decisions, establishing reward structure, and then modeling these to catalyze the actual interactions within the system so that they converge to the structural attractor states being modeled. Many aspects of leader behavior identified in research can be better understood

in this context. Initiating structure, for example, identified in the Ohio State studies (Bass, 1990), involves creating a model of the system and organizing agents within that structure. Contingent reward leadership establishes objectives and promises rewards contingent on performance. These catalysts align agent actions and decisions to enable convergence to a desired structural state. These are routines included in the convergent leadership mechanism.

Convergent leadership involves cognition, communication, and action. It is necessary to develop and articulate the model and then to distribute signals to catalyze substantive interactions that establish structures, distribute rewards, focus attention, and synchronize interactions (Hazy, 2006a). *Convergent leadership enacts routines that signal agents and thereby applies continuous pressure on members to engage them in the activity and to align their efforts towards the model-in-use.* This is captured in Figure 3 as leadership influence signal α . In addition, *convergent leadership enacts routines that distribute signals to influence resource allocation among various exploitation processes to support the adaptive walk and ultimate convergence of the system to a local performance peak.* The impacts of the resource allocation are shown as leadership influence signal β . Whereas convergent leadership operates by executing meta-routines toward some purpose, *effective convergent leadership achieves said purpose—it moves the organization towards a more effective model of organizational performance.*

Identifying Value Potential Through Exploration

Of course, organizations are constantly changing, and they exist in a constantly changing environment. Capabilities that were built to be highly effective at one point in time may become obsolete in the face of new ways of doing things or new technologies. Sources of resources in the environment may also dry up or require different methods of exploitation. The sad story of the

buggy-whip manufacturers who could not adapt when automobiles were invented is just one example of this. To ensure sustainability over time, the organization must also explore the environment and its own structure for new sources of resources and new ways to exploit them. This process consumes stored resources to create internal variety with little or no guarantee there will ever be a benefit. However, because of change in the environment, without exploration, virtually any organization will eventually disintegrate.

Exploration and the value-identifying loop. In exploration, the organization’s members use some of the organization’s slack resources (Cyert & March, 1963) to search for new information beyond and across various boundaries within and around the organization (Hazy, Tivnan, & Schwandt, 2003; Levinthal & March, 1981; March, 1991; March & Olsen, 1988/1975). The organization’s members might experiment with new technologies, paradigms, strategies, and knowledge, for example, in an effort to find and recombine aspects of the business in new and innovative ways (Hazy et al., 2003; Levinthal & March, 1981; March, 1991; March & Olsen, 1988/1975; Teece et al., 1997). In searching the external environment, the organization may find new sources of resources in the market. With proper tuning and careful reconfiguration of its capabilities, the system might be able to exploit these new sources of energy. The objective of search is to continually match the organization with the opportunities in the environment, what Ashby (1962) called “requisite variety.” This requires finding new sources of energy and resources and establishing the organization in these new niches (Christensen, 1997; Levinthal & Siggelkow, 2001; Lewin et al., 1999; Lewin & Volberda, 1999).

As shown in Figure 3, the dynamic process of exploration can be modeled as a positive feedback loop—the value-identifying feedback loop—within the organizational system. When

exploration and nurturing are successful, resources can become available to the organizational system as new sources of rent are discovered and the capabilities are configured and built so that the new resources can be appropriated. During this process, the organization positions itself to have differential access to these new resources (Barney, 1991; Penrose, 1959; Peteraf, 1993) and knowledge (Makadok, 2001; Zander & Kogut, 1995). By laying claim to these sources of energy, through political, legal, or technological means, the system appropriates them for its use and the use of its members.

Organizational slack can be used for exploration and experimentation. It can also be invested to build or acquire new capabilities, for example through M&A activity, or to reconfigure current capabilities to begin the process of exploiting newly discovered opportunities in the environment. These are dynamic capabilities. Investment may lead to additional performance rent and ultimately to more organizational slack. As long as this new ongoing opportunity in the market remains significantly larger than the organization’s capability to extract rents, the system engages in a virtuous positive business development feedback loop, the value-identifying loop.

Choice of search strategy and fatigue as limits to exploration. By its nature, exploration can often be for naught. Two risks related to this reality serve to limit the identification of value-creating programs. First, choices might be taken that limit the search areas. Second, because of low probability of success and long time lags, the organization may become fatigued at the prospect of continued exploration, lose heart, and discontinue its efforts.

In the first instance, by channeling exploration activity to areas considered to have higher potential than others, an organization can conserve its limited resources. At the same time, however, possibilities not explored might be missed.

In the second instance, long time delays and the difficulty of identifying and nurturing new businesses may tax leadership’s ability to maintain commitment. In this case, there are considerable uncertainty and potentially long time delays between actions of exploration and returns to the system. Because of these time delays, the system must be primed, meaning that some allocation of resources must precede the production of rents. Exploration is rarely self-financing and therefore depends critically on the availability of slack resources within the system, or alternatively on access to resources outside the system, from capital markets, for example. Some level of success somewhere in the ecology must precede exploration.

Further, discovery of a potential opportunity is not enough for an organization to begin to exploit it. Time is also needed to develop the opportunity, to configure capabilities to exploit it, and then to improve those capabilities to a performance level that can sustain exploitation in competitive environments. Priming and nurturing are needed to prepare capabilities for outright competition in the environment. Fatigue may cause the system to abandon promising activities or overcommit to projects that develop more slowly than expected. These limiting loops are shown in Figure 3.

Insert Figure 3 about here

Generative Leadership and Exploration

The generative leadership mechanism in organizations is a catalyst for exploration and dynamic capabilities development. It consumes slack and acts as an internal source of energy, focus, and resources in order to accelerate learning and increase internal variety. As potential opportunities take shape in the environment, the generative leadership mechanism brackets experiences to clarify what is relevant to the organization, makes sense of the situation in the context of the organization’s purpose, and then creates a model of the opportunity that can be shared among the organization’s members (Surie & Hazy, 2006). This mechanism is not a person but an ecology, a series of events (Lichtenstein et al., 2006). Although the emergent models can be quite non-specific, they serve to focus collective attention and align information gathering and exploration activities in the system (Surie & Hazy, 2006).

Generative leadership also acts as a catalyst to promote iterative prototyping. These iterations help the organization to accumulate knowledge about the opportunity and about the ability of the organization’s capabilities to provide a solution. The model of the opportunity is continually updated, as the state of the environment is observed with greater and greater clarity. And finally, as the nature of the actual environmental opportunity becomes clearer, generative leadership can catalyze and reinforce activities that partition the solution to accelerate the innovation process through modularity (Surie & Hazy, 2006).

Generative leadership provides this catalyst by applying continuous pressure on appropriate members of the organization to search out new information, bring the information back, and exchange information and knowledge with other members for the common benefit. This type of leadership influence is shown in Figure 4 as leadership signal γ and is necessary to

ensure a continuous supply of variations in routines, capabilities, and new information about potential sources of future resources.

The new opportunities that are identified may or may not be useful in providing continued access to resources. The ability to convert opportunity to success depends upon reconfiguring, acquiring, and building new organizational capabilities. These organizational skills are sometimes called dynamic capabilities (Teece et al., 1997). Besides applying pressure to individuals, groups, or capabilities, the generative leadership mechanism also includes routines that support decision making about resource allocation to guide the acquisition and reconfiguration of capabilities. It thereby facilitates the building of new capabilities—for example, new business models or new products—once opportunities are identified. This type of leadership influence is shown in Figure 4 as leadership signal δ and is often associated with innovation. *Effective generative leadership* achieves its purpose: the generation of sufficient viable options to enable many realistic possible futures for the organization.

Creating Value by Balancing Exploitation and Exploration

The tension between the forces of exploitation and those of exploration are a constant of experience in organizational life. Because the organization is not homogeneous, this tension can be manifested differently and at different levels and at various points in the system. New possibilities emerge from exploration, and these demand resources. Thus they are in conflict with established capabilities that may be losing their luster.

When the tension becomes destructive, it can be released in one of two ways. The system can change its boundaries, internal and/or external, in order to limit or contain the effects of differences. Organizations form separate business units or subsidiaries to nurture new businesses

(Davila, Epstein, & Shelton, 2006; Rivkin & Siggelkow, 2003), form alliances and/or joint ventures (Powell, Koput, & Smith-Doerr, 1996; Zander & Kogut, 1995), or acquire or sell businesses or assets (Makadok, 2001) as ways to accommodate tension in the system. This approach involves actions and decisions that orchestrate a change or evolution in design (Burton & Obel, 2002; Rivkin & Siggelkow, 2003; Siggelkow & Rivkin, 2005). In alternation or in parallel, the members can reshape their collective identity to absorb and accommodate differences and potentially allocate available resources in new and different ways (Gioia, Schultz, & Corley, 2000). This approach involves actions and decisions that reshape the values, purpose, and mission of the organization—system-level structures that are reinforced within the organization—to define the benefits, rights, and responsibilities of its members. It involves a change in culture (Denison, 1990; Schein, 1992) for sure, but also potentially a change in strategy and direction for many members of the collective enterprise (Burgelman & Doz, 2001; Mintzberg, Ahlstrand, & Lampel, 1998).

When an organization is considered to be a complex dynamical system, the above factors (boundaries, culture, values, strategy, etc.) are parameters that, when adjusted, can cause the dynamics of the system—or at least the dynamics inherent in the model-in-use that describes the system—to bifurcate into what amounts to a more complex structural attractor, one with many more potential future states. For example, decisions and actions could be taken to form a joint venture in an effort to increase the flow of information across parts of the organization’s boundary (Zander & Kogut, 1995). A parameter that measures this type of information flow across boundaries is boundary permeability (Hazy et al., 2004). By tuning the boundary permeability parameter, the system might bifurcate into one with additional possible futures, a

more complex structural attractor. Likewise, changing the relative priorities of various models-in-use within the organization would change resource flows within the system. Adjusting a parameter that measures this can also bifurcate system dynamics and broaden the structural attractor states (Allen, 2001) to which the organization is converging. With a larger range of possible futures, the influential actors within the organization can more effectively influence changes in the organization’s direction.

A boundary of sorts also occurs at the individual or member interface. This boundary of membership passes through each autonomous agent as he or she decides whether to accept or to reject the signals being reinforced by the organization (Hazy, 2006a, 2006c). Thus, tuning the parameters that define, reshape, and reinforce the definition of membership for the organization also has the potential to bifurcate the system’s dynamics. Many of these cultural elements have been well studied (Denison, 1990; Schein, 1992), but they have not been integrated into an overarching theory of organizational leadership. Other human relations aspects of organizations, for example, requiring global experience, also represent possible parameters to be adjusted. Changing these parameters can adjust the possible futures of the organization and enable necessary changes in terms of both the espoused purpose and the potential of the organization to achieve it.

Unifying Leadership and Organizational Forms

The unifying leadership mechanism determines and tunes the parameters at work within models-of-use. Depending upon their predictive value, this mechanism can also impact the organization itself. As parameters are tuned in a certain direction, the dynamics inherent in the organizational system might bifurcate. This change in dynamics, a direct result of unifying

leadership intervention, would potentially allow the system to converge to a wider range of future states. In this way, the possibilities for the organization would be expanded. As an example, unifying leadership might intervene when a strategic alliance or customer partnership is formed. Strict controls might be relaxed—for example, spending authority or confidentiality agreements—to increase information flow across the boundary (boundary permeability). In return, the system would gain additional future possibilities (Zander & Kogut, 1995) as the structural attractor becomes more complex. This is an example of a tension that is navigated by unifying leadership.

In contrast, these same parameters could be adjusted differently, retracing the bifurcation backwards into a less complex dynamical state and thereby limiting the future paths the organization might take. After new products are launched into an uncertain market, for example, decisions and actions are often taken to “manage” parameters that lead to the convergence of the system and its capabilities toward a particular configuration of operating margin, sales growth, and return on assets—a less complex structural attractor. Prior relaxed constraints are once again tightened, clarifying convergence behaviors for members as the choice is made to focus resources on the new products and to phase out the old.

Adjusting structural and human relations parameters creates possibilities for the system. Readjusting them backward focuses action toward chosen pathways. These are aspects of unifying leadership in complex systems. These dynamics lead to the formation, distortion, and reformation of the organization into alternate organizational forms. As some forms are selected by evolutionary pressure and others fail, the leadership mechanisms at work within the system are likewise tested by evolutionary forces (Hannan & Freeman, 1989). As shown in Figure 4, the

failure to sustain innovation and thus to identify and generate future value-creating possibilities, and/or failure to apply execution pressure and thus to gather resources that are within reach, are each ways to limit the success of the organizational system. Unifying leadership signals, shown as ϵ in Figure 4, balance the dynamic tensions resulting from generative and converging leadership at work at various places within and across the system. *Effective unifying leadership* achieves its purpose—it navigates parametric adjustments like those described above to select from among possible organizational futures.

Insert Figure 4 about here

Conclusion

This article argues that leadership matters in human organizations. It also argues that the mechanisms whereby leadership actually creates value are not understood. Recent advances in complexity science offer a language and elements of theory to connect agent decisions and activities to organizational capabilities and to the systemic mechanisms that constitute organizational leadership. This article presents a framework to begin constructive discourse on the topic.

Organizations are considered to be complex adaptive systems of agents connected in networks that accumulate human capital, social capital, and other resources. The organization realizes its value through these networks that accumulate resources and form ensembles of capabilities that implement both exploitation and exploration strategies. Its continued effectiveness in the face of change and uncertainty is dependent upon an “influential increment,”

that is, organizational leadership (Katz & Kahn, 1966), to achieve its purpose. This purpose can be many things; but at a minimum, the system seeks to sustain itself.

The problem faced by leadership in complex social systems is a daunting one. Exploiting existing organizational capabilities requires coordinated agent action that catalyzes continuous convergence to an effective model-in-use—a profit or growth objective, for example. This convergent leadership mechanism is necessary due to an organization’s incompleteness of design and the inevitable changes to the internal structure of the system that result from unpredictability (Hazy, 2006b). Because the environment is changing, the system must change. To do so, agents explore possibilities to generate the internal requisite variety needed to provide the system with options for the future. This generative leadership mechanism is also a prerequisite for survival when the environment is changing (Hazy, 2006b). Both the convergence to efficiency and the generation of variety are constantly occurring at the same time in the system. This causes conflict and tension within the system. The unifying leadership mechanism provides routines and capabilities that enable members of the organizations to balance and resolve conflicts and to relieve tension—but not eliminate them. Unifying leadership does this by identifying and tuning parameters in the system—for example, strategic-planning and/or portfolio-pruning exercises that adjust the organization’s boundaries—to influence the system’s dynamics and balance activities that explore against those that exploit. On the human side, the unifying leadership mechanism adjusts cultural parameters to build and maintain collective identity. Over time, the system’s structural heterogeneity, as well as the heterogeneity among the agents themselves, positions some agents to have greater access to information, resources, and influence (status and power) than do others. The agents in these more highly leveraged positions are identified by

others as formal leaders. But leadership is bigger than any individual agents or their traits. It is a function, an evolving metacapability, of the system itself. This metacapability is the influential increment.

Further research is needed to demonstrate the usefulness of considering leadership in this way. Although the analytical adequacy of the model described (McKelvey, 2002) has elsewhere been demonstrated using computational modeling techniques (Hazy, 2006b, 2007), the leadership constructs and variables described here must be further defined and tested empirically. Variables are needed to measure the three different leadership mechanisms, to track their interrelationships, and to explore their predictive value against performance and value creation variables. Further, the nature of the links from agent to capabilities and to leadership mechanisms must be specified and demonstrated empirically.

This perspective has important implications for practice. It breaks the individual frame that currently dominates leadership research and offers a road map to understanding the mechanisms through which leadership has its effects on specific desirable outcomes: efficiency, innovation, or wholesale transformation, for example. As individuals learn these mechanisms, they may be called leaders—*convergent leaders* if they move the system toward a model-in-use such as a total quality management, *generative leaders* if they are effective at creating internal variety to match the environment, through innovation, and *unifying leaders* if they adjust organizational parameters like boundaries, culture, or identity to maintain unity and effect change. Most importantly, by learning these mechanisms, individual actors will become more effective in ways that ensure that their leadership will matter.

References

- Adams, J. S. (1976). The structure and dynamics of behavior in organizational boundary roles. In M. D. Dunnette (Ed.), *Handbook of industrial and organizational psychology* (pp. 1175-1200). Chicago: Rand McNally College Publishing Company.
- Aldrich, H., & Herker, D. (1977). Boundary spanning roles and organization structure. *Academy of Management Review*, 2(2), 217-230.
- Aldrich, H. E. (1999). *Organizations evolving*. London: Sage.
- Allen, P. M. (2001). A complex systems approach to learning in adaptive networks. *International Journal of Innovation Management*, 5, 149-180.
- Argyris, C., & Schon, D. (1978). *Organizational learning*. Reading, MA: Addison-Wesley.
- Ashby, W. R. (1962). Principles of the self-organizing system. In H. von Foerster & G. W. Zoph (Eds.), *Principles of self-organization* (pp. 255-278). New York: Pergamon.
- Axtell, R. (1999). The emergence of firms in a population of agents: Local increasing returns, unstable Nash equilibria and power law size distributions. In *Center on Social and Economic Dynamics* (Vol. 3: *Working Papers*). Washington, DC: Brookings Institute.
- Barnard, C. I. (1938). *The functions of the executive*. Cambridge, MA: Harvard University Press.
- Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120.
- Bass, B. M. (1985). *Leadership and performance beyond expectations*. New York: The Free Press.
- Bass, B. M. (1990). *Bass & Stogdill's handbook of leadership: A survey of theory and research*. New York: Free Press.

- Bass, B. M. (1996). *A new paradigm of leadership: An inquiry into transformational leadership*. Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Bass, B. M., & Avolio, B. J. (1994). *Improving organizational effectiveness through transformational leadership*. Thousand Oaks, CA: Sage.
- Bennis, W., & Nanus, B. (1985). *Leaders: Strategies for taking charge* (2nd ed.). New York: Harper and Row.
- Burgelman, R., & Doz, Y. (2001). The power of strategic integration. *MIT Sloan Management Review*, 42(3), 28-38.
- Burns, J. M. (1978). *Leadership*. New York: Harper & Row, Publishers.
- Burton, R. M., & Obel, B. (2002). *Strategic organizational diagnosis and design: The dynamics of fit* (3rd ed.). New York: Springer.
- Carley, K. M., & Svoboda, D. M. (1996). Modeling organizational adaptation as a simulated annealing process. *Sociological Methods & Research*, 25(1), 138-168.
- Christensen, C. M. (1997). *The innovator's dilemma*. New York: HarperBusiness.
- Conger, J. A. (1989). *The charismatic leader: Behind the mystique of exceptional leadership*. San Francisco: Jossey-Bass.
- Cyert, R., & March, J. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.
- Davila, T., Epstein, M. J., & Shelton, R. (2006). *Making innovation work: How to manage it, measure it, and profit from it*. Upper Saddle River, NJ: Wharton School Publishing.
- Denison, D. R. (1990). *Corporate culture and organizational effectiveness*. New York: John Wiley & Sons.

- Dosi, G., Nelson, R. R., & Winter, S. G. (Eds.). (2000). *The nature and dynamics of organizational capabilities*. Oxford: Oxford University Press.
- Drucker, P. F. (1966). *The effective executive*. New York: Harper & Row.
- Drucker, P. F. (2004, December 30). The American CEO. *The Wall Street Journal*, p. A8.
- Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: What are they? *Strategic Management Journal*, 21, 1105-1121.
- Gavetti, G., & Levinthal, D. A. (2000). Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly*, 45, 113-137.
- Giddens, A. (1984). *The constitution of society*. Berkeley, CA: University of California Press.
- Gioia, D. A., Schultz, M., & Corley, K. G. (2000). Organizational identity, image, and adaptive instability. *Academy of Management Review*, 25(1), 63-81.
- Gleick, J. (1987). *Chaos: Making a new science*. New York: Viking.
- Goldstein, J., & Hazy, J. (2006). Editorial introduction to the Special Issue: From complexity to leadership and back to complexity. *Emergence: Complexity and Organization (E:CO)*, 8(4).
- Griffin, D. (2002). *The emergence of leadership*. New York: Routledge.
- Hambrick, D. C., & Brandon, G. L. (1988). Executive values. In D. C. Hambrick (Ed.), *The executive effect: Concepts and methods for studying top managers* (Vol. 2, pp. 3-34). Greenwich, CN: JAI Press.
- Hannan, M. T., & Freeman, J. (1989). *Organizational ecology*. Cambridge, MA: Harvard University Press.

- Hazy, J. K. (2006a). *Emergent signaling networks in complex socio-technical systems: How cooperative interactions among agents contribute to system sustainability*. Paper presented at the North American Association of Computational Social and Organization Science, University of Notre Dame, South Bend, Indiana, USA.
- Hazy, J. K. (2006b, August 11-16). *Leadership as an organizational meta-capability: A system dynamics simulation showing the role of leadership in organizational sustainability*. Paper presented at the Academy of Management, Atlanta.
- Hazy, J. K. (2006c). Measuring leadership effectiveness in complex socio-technical systems. *Emergence: Complexity and Organization (E:CO)*, 8(3), 58-77.
- Hazy, J. K. (2007). Computer models of leadership: Foundation for a new discipline or meaningless diversion? *The Leadership Quarterly* 18(4), 391-410.
- Hazy, J. K., & Goldstein, J. (2006). Introduction to Chester Barnard’s *The function of the executive*: What is leadership in a complex systems paradigm? *Emergence: Complexity and Organization (E:CO)*, 8(4).
- Hazy, J. K., & Tivnan, B. F. (2004). On building an organizationally realistic agent-based model of local interaction and emergent network structure. In R. G. Ingals, M. D. Rossetti, J. S. Smith, & B. A. Peters (Eds.), *Proceedings of 2004 Winter Simulation Conference*. Washington, DC: INFORMS College of Simulation.
- Hazy, J. K., Tivnan, B. F., & Schwandt, D. R. (2003). The impact of boundary spanning on organizational learning: Computational explorations. *Emergence*, 5(4), 86-124.

- Hazy, J. K., Tivnan, B. F., & Schwandt, D. R. (2004). Permeable boundaries in organizational learning: Computational modeling explorations. *InterJournal Complex Systems 1063*, Manuscript number 1063, 8.
- Hazy, J. K., Torras, M., & Ashley, A. S. (2008). Reconceptualizing value creation with limited resources. *Journal of Technology Management and Innovation*, 3(3), 45-54.
- Helfat, C. E., Finkelstein, S., Mitchell, W., Peteraf, M. A., Singh, H., Teece, D. J., et al. (2006). *Dynamic capabilities: Understanding strategic change in organizations*. New York: Blackwell Publishing.
- Judge, T. A., & Piccolo, R. F. (2004). Transformational and transactional leadership: A meta-analytic test of their relative validity. *Journal of Applied Psychology*, 89(5), 755-768.
- Kaplan, R. E., Drath, W. H., & Kofodimos, J. R. (1987). High hurdles: The challenge of executive self-development. *The Academy of Management Executive*, 1(3), 195-206.
- Katz, D., & Kahn, R. L. (1966). *The social psychology of organizations* (2nd ed.). New York: John Wiley & Sons.
- Kauffman, S. A. (1993). *The origins of order: Self-organization and the selection in evolution*. New York: Oxford University Press.
- Kouzes, J. M., & Posner, B. Z. (1987). *The leadership challenge: How to get extraordinary things done in organizations*. San Francisco, CA: Jossey-Bass.
- Krackhardt, D., & Carley, K. M. (1998, June). *A PCANS model structure in organization*. Paper presented at the 1998 International Symposium on Command and Control Research and Technology, Monterrey, CA.
- Levinthal, D. (1997). Adaptation on rugged landscapes. *Management Science*, 43(7), 934-950.

- Levinthal, D. A. (2001). Modeling adaptation on rugged landscapes. In A. Lomi & E. R. Larsen (Eds.), *Dynamics of organizations: Computational modeling and organizational theories* (pp. 329-348). Menlo Park, CA: AAAI Press/MIT Press.
- Levinthal, D. A., & March, J. G. (1981). A model of adaptive search. *Journal of Economic Behavior and Organization*, 2, 307-333.
- Levinthal, D. A., & Siggelkow, N. (2001, August 7). *Linking the old and the new: Modular and integrated adaptation to the internet*. Paper presented at the Academy of Management Meeting, Washington, DC.
- Lewin, A. Y., Long, C. P., & Carroll, T. N. (1999). The coevolution of new organization forms. *Organization Science*, 10(5), 535-550.
- Lewin, A. Y., & Volberda, H. W. (1999). Prolegomena on coevolution: A framework for research on strategy and new organizational forms. *Organization Science*, 10(5), 519-534.
- Lichtenstein, B. B., Uhl-Bien, M., Marion, R., Seers, A., Orton, J. D., & Schreiber, C. (2006). Complexity leadership theory: An interactive process on leading in complex adaptive systems. *Emergence: Complexity and Organization (E:CO)*, 8(4).
- Makadok, R. (2001). Toward a synthesis of the resource-based and dynamic-capability views of rent creation. *Strategic Management Journal*, 22, 387-401.
- March, J. G. (1981). Footnotes to organizational change. *Administrative Science Quarterly*, 26, 563-577.
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), 71-87.

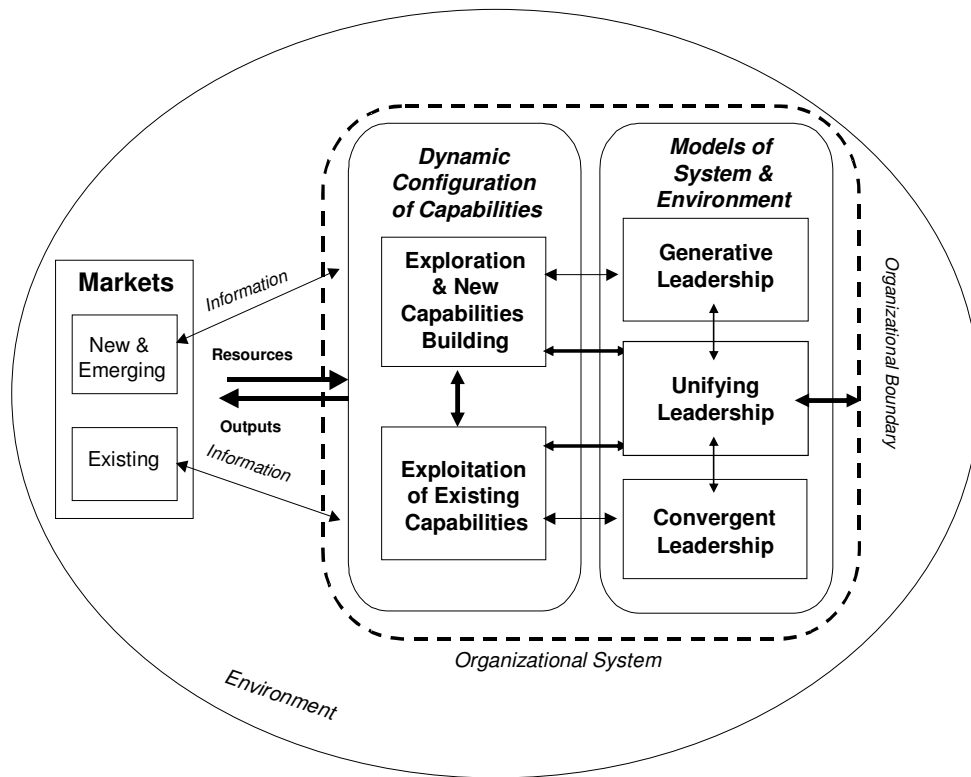
- March, J. G., & Coutu, D. L. (2006). Ideas as art: A conversation with James G. March. *Harvard Business Review*, 9.
- March, J. G., & Olsen, J. P. (1988). The uncertainty of the past: Organizational learning under ambiguity. In J. G. March (Ed.), *Decisions and organizations* (pp. 335-358). New York: Basil Blackwell.
- Marion, R. (1999). *The edge of organization: Chaos and complexity theories of formal social systems*. Thousand Oaks, CA: Sage.
- Maritan, C. A. (2001). Capital investment and investing in organizational capabilities: An empirically grounded process model. *Academy of Management Journal*, 44(3), 513-532.
- Maturana, H. R., & Varela, F. J. (1998). *The tree of knowledge: The biological roots of human understanding* (R. Paolucci, Trans.). Boston: Shambhala.
- McCall, M. W., Lombardo, M. M., & Morrison, A. M. (1988). *The lessons of experience: How successful executives develop on the job*. New York: The Free Press.
- McKelvey, B. (2002). Model-centered organization science epistemology. In J. A. C. Baum (Ed.), *Companion to organizations* (pp. 752-780). Oxford, UK: Blackwell.
- Mintzberg, H., Ahlstrand, B., & Lampel, J. (1998). *Strategic safari: A guided tour through the wilds of strategic management*. New York: The Free Press.
- Morgenson, G. (2006, October 15). Corporate America's pay pal. *New York Times*, pp. 1, 7-8.
- Nelson, R. R., & Winter, S. G. (1982). *An evolutionary theory of economic change*. Cambridge, MA: The Belknap Press of Harvard University Press.
- Nohria, N., & Gulati, R. (1996). Is slack good or bad for innovation? *Academy of Management Journal*, 39(5), 1245-1264.

- Penrose, E. T. (1959). *The theory of the growth of the firm*. New York: Wiley.
- Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14(3), 179-191.
- Powell, W. W., Koput, K. W., & Smith-Doerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Sciences Quarterly*, 41, 116-145.
- Prigogine, I., & Stengers, I. (1984). *Order out of chaos*. New York: Bantam Books.
- Rivkin, J. W., & Siggelkow, N. (2003). Balancing search and stability: Interdependencies among elements of organizational design. *Management Science*, 49(3), 290-311.
- Sashkin, M. (2000). *Visionary leadership: The research evidence* (Working Paper No. 313-95). Washington, DC: The George Washington University.
- Sashkin, M., & Sashkin, M. G. (2003). *Leadership that matters: Critical factors for making a difference in people's lives and organizations' success*. San Francisco: Barret-Koehler.
- Schein, E. H. (1992). *Organizational culture and leadership* (2nd ed.). San Francisco: Jossey-Bass.
- Schreiber, C., & Carley, K. M. (2006). Leadership style as an enabler of complex functioning and innovation in a network organization. *Emergence: Complexity and Organization*, 8(4).
- Schwandt, D. R., & Marquardt, M. J. (2000). *Organizational learning: From world-class theories to global best practices*. Boca Raton, FL: St. Lucie Press.
- Siggelkow, N., & Rivkin, J. W. (2005). Speed and search: Designing organizations for turbulence and complexity. *Organization Science*, 16(2), 101-122.

- Simon, H. A. (1962). The architecture of complexity. *Proceedings of the American Philosophical Society*, 106(6), 467-482.
- Simon, H. A. (1997). *Administrative behavior: A study of decision-making processes in administrative organizations* (4th ed.). New York: The Free Press. (Original work published 1957)
- Singh, J. V. (1986). Performance, slack, and risk taking in organizational decision making. *Academy of Management Journal*, 29(3), 562-585.
- Sperry, L. (1997). Leadership dynamics: Character and character structure in executives. *Consulting Psychology Journal*, 49(4), 268-280.
- Stacey, R. D. (1995). The science of complexity: An alternative perspective for strategic change processes. *Strategic Change Journal*, 16, 477-495.
- Surie, G., & Hazy, J. K. (2006). Generative leadership: Nurturing innovation in complex systems. *Emergence: Complexity and Organization (E:CO)*, 8(4).
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.
- Tejeda, M. J., Scandura, T. A., & Pillai, R. (2001). The MLQ revisited: Psychometric properties and recommendations. *The Leadership Quarterly*, 12, 31-52.
- Thietart, R. A., & Forgues, B. (1995). Chaos theory and organization. *Organizational Science*, 6(1), 19-31.
- von Bertalanffy, L. (1950). The theory of open systems in physics and biology. *Science*, 3, 23-29.
- Weick, K. (1979). *The social psychology of organizing* (2nd ed.). New York: McGraw-Hill.

- Weick, K. E. (1995). *Sensemaking in organizations*. Thousand Oaks, CA: Sage.
- Westhoff, F. H., Yarbrough, B. V., & Yarbrough, R. M. (1996). Complexity, organization and Stuart Kauffman’s *The origins of order*. *Economic Behavior and Organization*, 29, 1-25.
- Yakura, E. K. (2002). Charting time: Timelines as temporal boundary objects. *Academy of Management Journal*, 45(5), 956-970.
- Zander, U., & Kogut, B. (1995). Knowledge and the speed of the transfer and imitation of organizational capabilities: An empirical test. *Organization Science*, 6(1), 76-92.

Figure 1. How the organizational system interacts with its environment.



Note. The organizational system interacts with its environment by (1) taking in resources, (2) providing outputs, and (3) exchanging information; within the system boundary, capabilities are organized and slack resources are accumulated for future use. The leadership metacapability regulates this activity by generating, using, and improving models of the system and the environment to guide decision and action.

Figure 2. Convergent leadership drives value-gathering through exploitation by catalyzing (α) individual engagement in system processes and (β) investment in process effectiveness improvements.

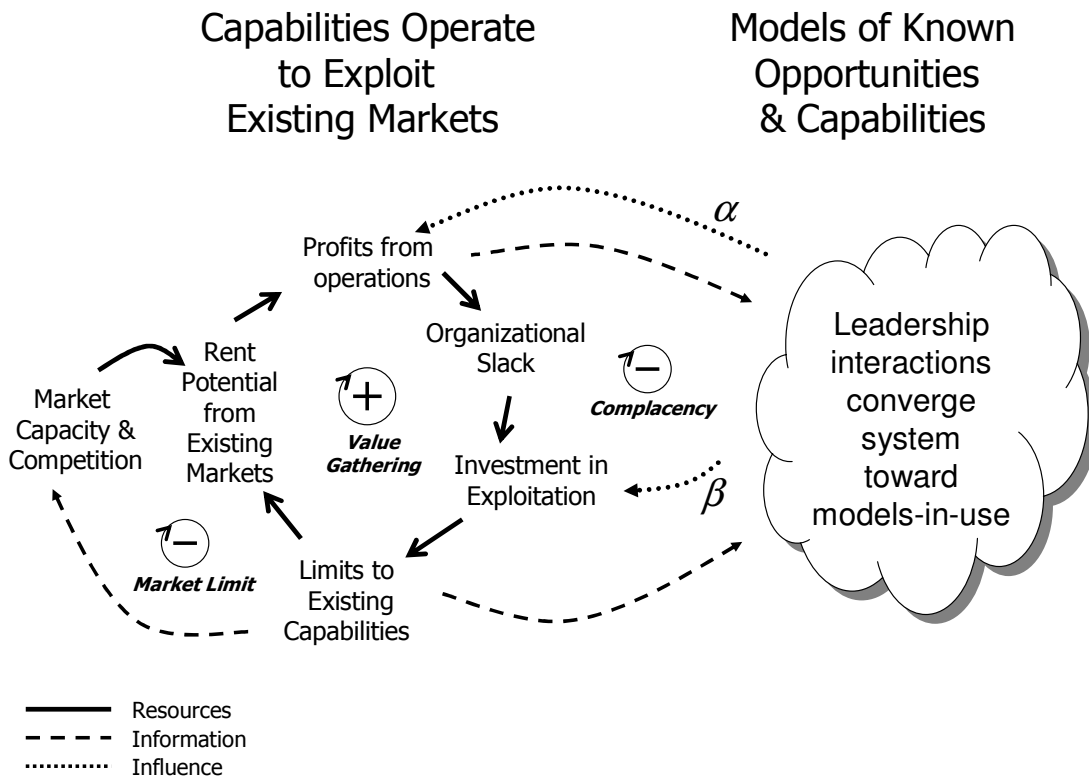


Figure 3. Generative leadership drives the value-identifying process of exploration by catalyzing (γ) individual learning and knowledge sharing and (δ) product and process innovation.

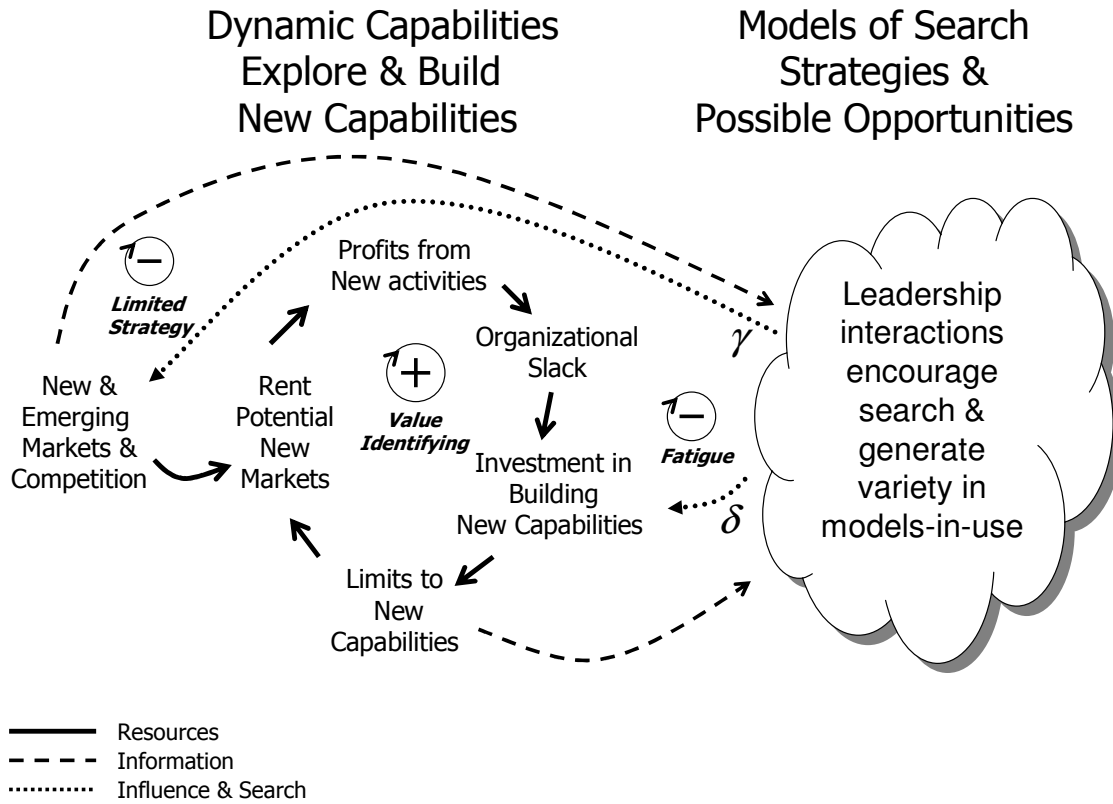


Figure 4. Unifying leadership (ϵ) identifies and tunes system parameters (such as boundaries, identity, and models-in-use) to maintain unity while balancing convergence and the generation of new possibilities.

