CAN THE CEO CHURNING PROBLEM BE FIXED?
LESSONS FROM COMPLEXITY SCIENCE, JACK WELCH & AIDS

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ABSTRACT:

CEO dismissals increased dramatically in the 1990's. Observers point to failing top management, dysfunctional Boards, and a changing economy, to name a few. After reviewing the literature attempting to explain the tremendous rise in CEO dismissals, we argue that it reflects a period of transition in the U.S. economy. Firms have struggled to respond to fundamental changes in the economy that have increased competition and economic uncertainty. Building from Ashby's Law of Requisite Variety, we suggest that responding to the current environment requires "creating requisite complexity" inside firms. To do this we take lessons from complexity science and Jack Welch. We present twelve actions that collectively, like the AIDS cocktail, act to foster requisite complexity inside firms and consequently, requisite complexity and efficacious adaptation.

> "More than 1000 CEOs have left office [in 2000] alone, with one third of them departing since September 1. The revolving door is even spinning fast at the biggest companies….CEOs of 39 of the 200 largest U.S. companies have left their jobs [in 2000], compared with just 23 in 1999. In recent months the mounting turnover at the top has taken on the aspect of a crisis…." (*Business Week*, 2000).

In a study titled "*The World's Most Prominent Temp Workers*," Lucier et al. (2005) find that CEOs at more that 14% of the world's 2500 largest corporations left office in 2004; nearly one third of these were forced out because of poor performance. Bennis and O'Toole (2000) conclude that high churning rates occur because Boards do not know how to select visionary leaders. *The Economist* (2001) says, that while Boards are partly to blame, firms are now more difficult to manage for reasons such as flattened hierarchies, globalization, the digital age, and mega-mergers. It is also true that Celebrity CEOs brought in from outside do well at first—by cutting costs—but then fail in the second half of their tenure (Lucier et al., 2005). Cutting costs is easy, but outsiders have a tough time learning about and working within corporate cultures, This fits with Collins's (2001) conclusion in his book, *Good to Great*, that CEOs developed within firms—such as Jack Welch at GE—are more apt to make outstanding CEOs.

Updating Ross Ashby's (1956) famous *Law of Requisite Variety*, we suggest that it takes the development of novel kinds of intrafirm complexity to cope with what *The Economist* sees as multiplicative growth in external complexity. This sea change in complexity flies in the face of traditional leadership theory (Bennis, 1996), which focuses on CEO vision and charisma, employee incentives to carry out the CEO's vision, and an acquiescent corporate culture. We take the perspective that recent changes in the U.S. economic environment have created a transition period for U.S. corporations. As firms attempt to compete in this new environment, new leadership solutions are needed. That they haven't yet materialized is reflected in the unprecedented rise in CEO dismissals in recent years.

We contrast traditional leadership theory with "*complexity leadership*," as formulated by Marion and Uhl-Bien (2003) and Uhl-Bien et al. (2005), which defines a kind of leadership aimed at fostering emergent self-organization and distributed intelligence (McKelvey 2006) rather than top-down vision and control. Our theory suggests that significant environmental changes require a more market-like, adaptive internal structure. We draw on a well-developed literature in evolutionary biology and organization theory to argue that significant increases in competition and uncertainty require a bottom-up, autonomy driven organization design. Our view of how to create requisite complexity inside firms draws from three sources: (1) basic principles from complexity theory; (2) evidence about what Welch did during his 20-year tenure as CEO at GE; and (3) an "AIDS cocktail" therapy lesson about how best to deal with the twelve actions required to *create requisite complexity*.

First, we begin by reviewing potential explanations for why CEO dismissals increased tremendously in the 1990s. Then we further define requisite complexity—both external and internal. Next, the inadequacies of the Bennis/O'Toole explanation and proposed solution are discussed. Finally, we draw on basic ideas from complexity science, AIDS therapy, and what Welch did unknowingly to put complexity theory into effect at GE (Slater, 2001).

THE PROBLEM: CEO CHURNING VS. JACK WELCH'S 20 YEARS AT GE

CEO Churning

Interest in executive turnover continues to grow in both the academic and practitioner literatures (Bennis and O'Toole, 2000; *Business Week,* 2000; *The Economist*, 2001; Goldman et al., 2003; Lucier et al. 2003, 2005). Many observers and scholars find that towards the end of the expansion of the 1990s, CEO turnover was at an unprecedented rate. *Business Week* reports that in the 1990s, one third of CEOs appointed at 450 major corporations lasted three years or less. Additionally, one in four companies went through three or more CEOs in the 1990s (*Business Week*, 2000). Khurana suggests that CEOs are three times more likely to be fired nowadays than in 1985 (cited in Bennis & O'Toole, 2000). *The Economist* (2001) reports that 119 CEO were fired in February of 2001, compared with an average of 30 a month in August of 1999—a total of 1595 CEOs in 19 months. Our own quick look at a sample of Fortune 500 firms shows that, from 1997 to 2002, 62 out of 63 of them lost their CEO.

Evidence suggests that this increased turnover is due to increased dismissals and not other forms of executive departure—i.e., death, illness, mandatory retirement, or voluntary departures (Bennis & O'Toole, 2000). In the most recent study, Lucier et al. (2005) report that:

- Forced CEO turnover is up 300% since 1995;
- Of the more than fourteen percent of the world's 2500 largest firms that lost their CEOs in 2004, nearly one third of these were fired because of poor performance;
- Underperformance is now the main reason why CEOs get fired, mainly due to poor shareholder returns;
- The probability of CEOs being fired in Europe is twice as high as in the US;
- Even successful firms are more likely to fire their CEO than in the past.

Despite the extensive research in corporate governance concerning CEO dismissals, the relationship between economic conditions and aggregate CEO turnover levels is not clear. It may be that CEO turnover is highly sensitive

to firm performance given certain market conditions. Philippon (2003) demonstrates that badly governed firms respond more significantly to aggregate shocks than do well governed firms. Thus, poor overall market performance accompanied by poor governance adds to CEO turnover.

Consistent with the empirical studies, theoretical perspectives in the management literature argue that markets are increasingly hypercompetitive (D'Aveni, 1994), requiring an increased focus on dynamic capabilities (Teece et al., 1997; Eisenhardt & Martin, 2000) or strategic entrepreneurship (Hitt et al., 2001). Firms that can best respond to increasingly volatile environmental pressures are described as those that adapt to unstable and rapidly changing market circumstances and effectively manage what are often ephemeral assets and dynamic capabilities (Kirzner, 1973; Brown & Eisenhardt, 1998). Researchers note that corporations showing long-term performance differences appear to effectively manage fluid, short-term factors in what have become increasingly volatile markets (D'Aveni, 1994).

Since managerial ability is constant during both up and down markets and yet turnover rates are not constant during up and down markets, the sensitivity of CEO turnover to firm performance seems different throughout the business cycle. Building off of research concerning performance thresholds (Goldman et al, 2003), Mackey (2003) shows finds threshold performance expectations are higher during boom times than down times—CEO churning declined in following recession. Thus, how CEO turnover is driven by the combination of CEO decisions/firm performance and by overall market conditions requires further inquiry.

THE CHALLENGE: CREATING REQUISITE COMPLEXITY

Ashby's Law of Requisite Variety Updated

Halal and Taylor (1999), among others, argue that the *New Age* calls for dramatically new organizational strategies and designs. The new trends appear on a CEO's horizon as increased uncertainty and competition, as well as seemingly countless strategic options. These are what Ashby (1956) long ago termed "*variety,*" arguing that, "Only variety can destroy variety" (1956: 207). More specifically, his *Law of Requisite Variety* holds that for a biological or social entity to be efficaciously adaptive, the variety of its internal order must match the variety of the environmental constraints that it confronts. In defining variety, Ashby (1956: 124–25) pointed to the following series: "*c*, *b*, *c*, *a*, *c*, *c*, *a*, *b*, *c*, *b*, *b*, *a*." He observed that *a*, *b*, and *c* repeat, meaning that there are only three "*distinct* elements"—three kinds of variety or three degrees of freedom. Ashby's subsequent insight, in 1962, was that external variety requires that organizations develop internal variety and—presaging complexity science—he actually used the term, "*self-organization*." Only through developing more internal variety can it self-organize to deal with imposing environmental constraints and complexity. Using the following logic sequence, McKelvey and Boisot (2003) update Ashby's insight to the *Law of Requisite Complexity*:

"Only variety can destroy variety"
Only degrees of freedom can destroy degrees of freedom
Only complexity can destroy complexity

Recognizing that corporations today face increasingly complex environments characterized by increased uncertainty and competition, we apply Ashby's insight and suggest: *Only [internal] bottom-up self-organization can destroy [external] complexity.* In this sense, fundamental changes in the US economy have increased *external complexity*. In this spirit, our essential thesis rests on two points:

(1) CEO dismissals have increased over the past 10 years or so because organizations are facing increasingly complex economic and cross-cultural environments.

(2) Boards and the CEOs they select mostly do not know how to foster emergent self-organization and consequent requisite complexity in their firms.

Thus, the recent rise in CEO churning is a byproduct of a natural transition toward a new economic order. With this updating of Ashby's Law we accomplish three things: (1) We bring his Law into the age of complexity science—internal complexity dynamics have to match those on the outside; (2) We use complexity science to further define how to create requisite internal complexity; and (3) we can connect Ashby's Law with our opening concerns about the roles of Boards and CEOs. In the next two sections we argue that the external environment is, indeed, increasing in complexity but that internal requisite complexity is generally absent.

Increasing External Complexity

The tensions foretelling the trouble at the transition from the 20th to 21st centuries are outlined in Halal & Taylor's (1999) recent work concerning the dawning of the New Age. Drawing on analysis by sixteen other authors' chapters, their conclusions are far reaching (pp. 398–402). They predict an economic revolution over the next two decades as the economies of the 21st century will be dominated by globalization and integrated by sophisticated information networks, as increasingly deregulated economies will mirror the textbook ideal of perfect competition (and marginal profits), as creative destruction from the transition will create social disorder worldwide, and as nearly

autonomous entrepreneurial cellular networks and fundamentally different ways of corporate governance (i.e., organizational architecture) will replace top-down hierarchical control (Halal & Taylor, 1999).

Though some 20% of the recent CEO turnover can be attributed to the dot-com bust, the majority of dismissals can be explained by a failure in both CEOs and Boards to respond to such fundamental changes in the economy (*The Economist,* 2001). *The Economist* also identifies the following challenges facing corporate leaders into the future:

- Increased globalization (more traveling, less time in one place, more cross-cultural management, time zones, languages, etc);
- Increased information (the amount and rate of critical and trivial information CEOs deal with every day as well as more direct-reporting;
- Mega-mergers and merger assimilation problems that are increasingly complex because of globalization, with high stakes and high failure rates a higher possibility.

Researchers also find significant changes in the US economy. Competition appears to have increased, reflected empirically in an increase in the volatility of corporate-level profitability, earnings, sales, productivity growth, as well as market position (Malkiel & Xu, 2003; Philippon, 2003; Comin & Mulani, 2004; Kiousis, 2004; Wiggins & Ruefli, 2004). Environmental uncertainty also appears to have increased, reflected in studies of U.S. stock returns that find that individual stock returns and idiosyncratic firm-specific risk are more volatile (Comin & Philippon, 2005; Campbell et al., 2001).

Deficient Internal Complexity

In his classic book, *Organization in Action*, Thompson (1967) held that the role of top-management was to deal with uncertainty by creating machine-like stable work environments for employees. In the following section, we argue that leadership theory still mostly focuses on CEO charisma and vision and top-down control—both of which act to reduce internal variety production. Traditional, and current leadership theory, we will argue, work against Ashby's call for increased requisite variety.

Opposite to leadership theory, there is, in fact, a growing literature on the adaptive necessity of internal requisite complexity capabilities in firms. Drawing upon a number of ways in which researchers have studied intra-firm dynamics, we characterize a firm's *internal variety,* or *internal complexity*, as bottom-up management approaches that enable self-organization, cellular networks, distributed intelligence, social capital, and so on, all of which are key elements of organizational complexity and new order creation. Mélèse (1991) reinforces the idea that requisite complexity is a bottom up process. It takes several forms in the literature:

Cellular Networks. Miles and Snow (1986, 1992) present the network form as a new organizational design facilitating flexibility and individualized responses. Subsequently, Miles et al. (1999) argue that the emergent form of today is the "*cellular network*." It is based on the principle of a cluster of self-organizing components collaboratively using their knowledge for product innovation to develop existing markets and create new ones. A cellular organization is composed of independent units (self-managing teams, autonomous business units, etc.) continuously interacting with other "cells," and: "*It is this combination of independence and interdependence that allows the cellular organizational form to generate and share know-how that produces continuous innovation*" (Miles et al., 1999: 162).

Self-Organizing. Complexity science focuses on how structures emerge from the interactions of autonomous, heterogeneous *agents*, which may be individuals, groups, or firms. Agents self-organize to create learning, novelty, and new social structures (including new levels of organization) by interacting with, and learning from, each other, coevolving in reaction to each other, revising their behavior continually (Arthur et al., 1997: 3–4). Absent top-down control, complexity scientists point to (1) environmentally imposed energy effects (Nicolis & Prigogine, 1989), or more broadly *adaptive tensions* (McKelvey, 2001, 2004b), that motivate adaptive behavior; and/or (2) heterogeneity among agents (e.g., employees) that increases the fitness payoff from networking so as to pick up new ideas (Kauffman, 1993). For complexity scientists, self-organizing agents take on the adaptive challenge (Kauffman, 1993; Holland, 1995).

Distributed Intelligence: Fuster explains that intelligence in brains rests entirely on the production of emergent networks among neurons—intelligence "is the network" (1995: 11). As intelligence increases, it is represented in the brain as emergent connections (synaptic links) among neurons. Human intelligence is thus "distributed" across really dumb agents (McKelvey, 2001, 2006). In the context of corporations, firms consist of workers (with human capital) who may or may not communicate with one another (social capital) (Becker, 1975; Burt, 1992). Together they comprise *distributed intelligence*. Given that workers earn a wage reflecting their human capital, competitive advantage lies in the firm's unique capabilities—or its network. A firm's core competence thus lies in its network of human capital holders—corroborated in "transactive memory" research (Argote, 1999). In this sense, the economic value of human capital housed in a firm is subject to the nature of the social networks in which the human agents are embedded (Granovetter, 1985, 1992).

Adaptive Change Rate. Fisher (1930) noted long ago that higher-speed internal change rates have higher

survival value. Given the Red Queen Paradox effect, adaptive rate needs to constantly increase for firms to stay ahead of competitors (Barnett & Hansen, 1996). Eisenhardt (1989) introduces the notion of high-velocity environments. Prusak (1996) observes that "…producing new knowledge fast" is critical in the 21st century knowledge era. Simon (1999) noted that environmental variety hits lower levels of firms at a higher frequency rate than higher levels. All this adds up to the requirement that lower-level networks have to operate at a much faster adaptive rate than networks or managers at higher levels. In the title of their book, Jennings and Haughton (2000) say it best: *it's not the BIG that eat the SMALL…it's the FAST that eat the SLOW* (their emphasis).

WHAT WENT WRONG?

Leadership Theory at the Top

Requisite internal complexity calls for leaders able to create complex adaptive systems, and specifically cellular networks (Marion & Uhl-Bien, 2001, 2003). They need to learn how to promote agent heterogeneity and enable connectionist networking, self-organization, adaptive learning, in search of improved agent and collective fitness. Traditional leadership theory goes opposite to this.

Traditional leadership theory focuses on attributes and skills of leaders and the subsequent impact of leaders on individuals and groups of followers within the organization (Bennis & Nanus, 1985; Bennis & Biederman, 1996; Dansereau & Yammarino, 1998a,b). Klein and House (1998: 3) say, "charisma is a fire that ignites followers' energy, commitment, and performance." Their approach focuses on "mythic," "heroic," "visionary," leaders. Building from House (1977) and Nanus (1992), Bennis (1996) describes the visionary leadership school of thought:

> Leaders need to have a strongly defined sense of purpose. A sense of vision… Leading means doing the right things…creating a compelling, overarching vision…. The capacity clearly to articulate a vision…. It's about *living* the vision, day in day out—embodying it—and empowering every other person…to implement and execute that vision…. The vision has to be shared. And the only way that it can be shared is for it to have meaning for the people who are involved in it. Leaders have to specify the steps that behaviorally fit into that vision, and then reward people for following those steps." (pp. 149–151; his italics)

Drawing from tradition, Bennis and O'Toole (2000) attribute the recent increase in CEO turnover to lack of charisma and vision. Leadership scholars stress the importance of the "mythic," "heroic," "visionary," leader for creating strong cultures (Peters & Waterman, 1982; Schein, 1990, 1992) and to lead culture change (Kotter & Heskett, 1992). Sorensen (2002), however, shows that strong cultures are assets in stable environments but liabilities in changing times. Willmott (1993) claims that "culture management" is a new form of managerial control.

Bryman (1996) takes us from trait, style, and contingency approaches to what he calls the "new leadership approach." It is based on Bass's (1985) transformational leadership concept, which consists of four components: vision, and charisma; high expectations; personal attention to followers; and challenging followers with new ideas. But even this approach works against CEOs trying to build decentralized, self-organizing cellular networks. Why? According to Marion and Uhl-Bien (2003), transformational/transactive leadership is still vision-driven, top down, consensus and control oriented, with direct influence attempts by the leader. It focuses on follower "buy-in" to the leader's vision of the future. More specifically, they argue that transformational leadership still holds to:

- Top-down, leader controlled views of organizational processes;
- Hierarchical- and position-based formal leadership initiatives;
- Emphasis on followers carrying out the leader's vision;
- Stimulation of followers to align with the leader's vision;
- Direct influence efforts to assure that followers are following the leader's vision;

Though transformational leadership *tries* to emphasize follower alignment with the core vision, in reality it still relies on followers' compliance behavior.

Taking a different approach, Finkelstein (2003) suggests that "normal" explanations such as leadership failures are inadequate to explain CEO dismissal. Supporting *The Economist*'s view, Finkelstein concludes that CEOs fail to carryout standard strategic essentials competently. He does not attribute CEO failure to Board processes in selection as it would be hard to imagine a modern Board hiring a CEO who did not include the "strategic basics" in his/her "vision." Who would hire a CEO who is "against" entrepreneurship, innovation, synergies from M&A, and understanding the competition? Since all CEOs have this vision, he argues, especially in a boom economy and at the so-called Dawn of the New Age, this focus on strategic essentials takes "vision" out of the mix.

Board Dynamics in Executive Selection

As noted at the outset, CEO firing rates rose geometrically toward the end of the 1990s (Bennis & O'Toole, 2000; *The Economist*, 2001; Mackey, 2004). Bennis & O'Toole suggest that "the self-defeating way in which Boards select leaders" is to blame for the increased CEO firing rates. Currently there is substantial disagreement among academics and practitioners about what leadership "looks" like. Traditional leadership theorists, as noted above, posit that leadership requires vision and charisma to "move the human heart" (Bennis & O'Toole, 2000).

Quite contrary to that viewpoint, are those who suggest that effective leaders "blend extreme personal humility with intense professional will" (Collins, 2001: 21). Yet many corporate Boards ignore both of these ideas; instead they hire celebrity CEOs—the "Corporate Saviors" (Khurana, 2002).

Beyond defining leadership, the process by which corporate Boards evaluate which managers will be real leaders and possess extraordinary amounts of managerial talent has been described as dysfunctional (Bennis & O'Toole, 2000) and wrought with cognitive biases (Khurana, 2004). Boards only have access to imperfect information regarding a potential candidate's level of managerial talent; as a result, Boards tend to rely on heuristics to make selection decisions. Corporate Boards have been found to attribute leadership qualities to individuals from high status firms, high performing firms, or those who have held the CEO position in the past (Khurana, 2004). Thus, Boards seem to rely on the efficiency of the managerial labor market in making their selection decisions. Yet, the competitive imperfections in the market suggest that the allocation of talent throughout the managerial labor market will not be efficient (i.e., the most talented managers will not necessarily occupy the most prestigious, well-compensated positions) (Mackey & Barney, 2005). It is also true that many CEOs appear competent only because they are (like a cork) sitting atop an already well-performing firm (Lewin & McKelvey, 2006).

The recent increase in CEO turnover may be due to Boards simply picking inappropriate CEOs because of the difficulty in choosing the right metrics to assess executive leadership attributes or the increase may be due to other forms of Board failures in the selection process. For example, the threat of poor performance has been shown to lead CEOs to narrow their networks of contacts from whom they seek advice (McDonald & Westphal, 2003). Boards, as well, are known to rely on inter-Board networks as sources of contacts, advice, and even CEO candidates (Westphal, Gulati, & Shortell, 1997; Westphal & Zajac, 1998). Thus the tendency to react rigidly in threatening situations (Zajonc, 1966; Janis, 1972) can cause Boards to narrow their contacts and thus wall themselves off from better advice and information about CEO candidates—ultimately producing selection errors.

Selection problems can also occur when CEOs remain on the Board after their departure and assist in the process of choosing and/or assimilating the new CEO (Lucier et al., 2005). Allowing the predecessor this type of role in the organization creates numerous problems such as the predecessor undermining the success of the incoming CEO, the successor failing to make needed strategic changes to preserve the image and feelings of the predecessor, and the outgoing CEO feeling resentment towards the new CEO and thus, creating dissension among the Board about the success of the new CEO.

CEO dismissal is a widely studied event in the corporate governance literature. The received view is that CEOs are significantly more likely to lose their jobs following poor firm performance (Coughlan & Schmidt, 1985; Warner et al., 1988; Kaplan, 1994; Huson et al., 2001, Goldman et al., 2003). This view has been subject to considerable criticism, however. Finkelstein and Hambrick (1996) find that it is not particularly powerful in explaining much of the variance on departure rates. Extreme changes in firm performance have been found to produce only small changes in the likelihood of CEO turnover (Weisbach, 1988; Huson et al., 2001). Goldman, et al. (2003) demonstrate that Board actions are sensitive to firm performance only when the absolute level of performance is low. For firms satisfying a performance threshold, there is no relationship between changes in performance and CEO turnover. The empirical work (1971–1995) shows the absolute level of a company's stock price is a key break point in the CEO turnover-performance relationship. Jensen and Murphy (1990) conclude that Boards are generally a *weak device* for effective corporate governance.

Individual vs. Aggregate Perspectives. Suppose we set aside the foregoing problematic findings about Board behavior and assume that Boards do take action and appropriate turnover events occur. If this were true, the executive selection process would impact the turnover rate of CEOs. Yet, the foregoing theories are insufficient to explain why more Boards would be failing all at once and why selection errors would be increasing, especially during the late 1990s boom economy. We wish to first draw attention to the importance of explicitly demarcating between the individual and aggregate level of analysis in the theory of CEO dismissals.

Traditional explanations of executive dismissals such as firm performance, agency conditions (i.e., ownership configurations), firm characteristics (e.g. size and structure), environmental conditions (e.g. industry growth rates and concentration), and the individual characteristics of the incumbent CEO (e.g. power, personality) have been advanced to explain turnover at the *individual*-level of analysis (Finkelstein & Hambrick, 1996). However, the literature does little to provide insight into *aggregate* changes in CEO dismissals. Further inquiry is needed to understand why we might observe an aggregate increase in the level and rate of CEO dismissals.

Recent research shows that CEO dismissals went down across the board as the post-2001 recession took hold (Mackey, 2003). So why would Boards collectively be more apt to fire CEOs during the 1990s boom? One option is Board herding behavior (Scharfstein & Stein, 1990; Bikhchandani et al. 1992; Trueman, 1994; Demski, 2003; González et al., 2004). Expectations for firm performance are systematically higher during a booming economy.

Boards are now much quicker to make CEO firing decisions (Lucier et al., 2005). Now it is more within the range of legitimate Board behavior to dismiss the CEO if shareholder expectations are not met. The herding instinct idea is that Boards are more quick to follow the behavior of other Boards. Thus, once a few Boards decide to dismiss their CEO during the boom for poor performance, what started as a few individual Board actions quickly spreads to the aggregate.

Recently, academic researchers have documented significant changes in the US economy. As already noted, competition appears to have increased, reflected empirically in an increase in the volatility of corporate-level profitability, earnings, sales, productivity growth, as well as market position (Malkiel and Xu, 2003; Philippon, 2003; Comin and Mulani, 2004; Kiousis, 2004; Wiggins & Ruefli, 2004). Environmental uncertainty also appears to have increased, reflected, for example, in studies of US stock returns. Campbell et al. (2001) corroborate this finding, demonstrating a very similar upward trend in idiosyncratic firm-specific risk. Aggregate idiosyncratic volatility also appears to have increased, reaching significantly high levels in the 1970s (between 1968 and 1983) and in the post-1993 period. It is almost natural to ask, What organizational changes appropriately respond to these significant changes in the corporate environment? Moreover, how might the aggregate rate of CEO dismissals be affected?

THE SOLUTION: AN AIDS COCKTAIL OF REQUISITE COMPLEXITY CREATION

Basic Complexity Theory

"New Science" is Wheatley's (1992) label for complexity science. To see how New Science offers insight for organizational CEO-level leadership, we find it useful to divide complexity science into two Schools, European and American (McKelvey, 2004b,c). Our view is that the dynamics highlighted by each School are "*co-producers*" of new order, to use a classic term introduced by Churchman and Ackoff (1950).

The European School. The European School of thought consists of Prigogine (1955, 1997), Haken (1977), Cramer (1993), Mainzer (1994/2004), among many others. This school has focused on the impact of external environment. For example, in a Bénard process (1901), "critical values" in the energy differential (measured as temperature, ΔT) between warmer and cooler surfaces of a container affect the velocity, R (the so-called Reynolds number), of the fluid flow, which correlates with ΔT. The critical values define the region of emergent new structures, that is, emergent complexity. Prigogine termed these "dissipative structures" because they speed up the natural progression from high energy to low energy (randomness). Since Bénard (1901), fluid dynamics' (Lagerstrom, 1996) has primarily focused on the 1st critical value, R_{C1}—the Rayleigh number—that separates laminar from turbulent flows. Below the 1st critical value, viscous damping dominates so self-organized emergent (new) order does not occur; above the R_{C1} number, new order occurs. They emphasize the causal tension dynamics of environmentally imposed shocks that lead to phase transitions.

The American School. While the Europeans focus on phase transitions and lower bound of the region of emergent complexity, the American school, largely associated with the Santa Fe Institute, investigates what happens at the 2nd critical value, the so-called "edge of chaos," and the spontaneous co-evolution of agents (Kauffman, 1993, 2000; Lewin, 1999). The basic driver for this School is a set of heterogeneous agents attempting to improve their fitness. Fitness improvements can't happen if all the agents are the same or—even though they are heterogeneous—no connections among agents occur. What sets off bursts of order-creation? One explanation by Lorenz (1963), the "butterfly effect" (the fabled story of a butterfly flapping its wings in Brazil causing a storm in North America), is popularized Gleick (1987). He details chaos theory, its focus on the butterfly effect and aperiodic. Bak (1996) reports on his discovery of *self-organized criticality*—a power law dynamic—in which falling grains of sand can lead to complexity cascades from very small to avalanche proportions. Casti (1994) and Brock (2000) continue the focus on power laws—which emphasize the extremes of distributions rather than the means (Andriani & McKelvey, 2005). Power laws frequently result from "deviation-amplifying" *positive feedback* processes (Maruyama, 1963; Milsum 1968). Boulding (1968) and Arthur (1988, 2000) focus on "*positive feedbacks*" in economies. Deviation amplifying or coevolutionary processes are inherently nonlinear—large-scale effects may be instigated by very small initiating events, as noted by Gleick (1987), Bak, 1997 and Ormerod (1998).

Both European and American perspectives are important to our discussion. Phase transitions are often required to overcome the threshold-gate effects characteristic of most human agents—so that there is a broader co-evolutionary dynamic set in motion once the tag—what Holland (1995) terms the instigation event—occurs. This requires the adaptive tension driver to rise above R_{C1}. Once the adaptive tension force is strong enough to overcome the threshold gates, and given that a tag occurs, and assuming the other requirements are present (heterogeneous, adaptive learning agents, connectivity, etc.), coevolution then starts. Neither $R > R_{C1}$ nor tag-plus-coevolution seems both necessary and sufficient by itself, especially in social settings. This is why phase transition and coevolution are co-producers.

Learning from Jack Welch's Methods at GE.

We have reviewed arguments why CEO performance at the dawn of the New Age is failing. First, the New Age calls for the creation of self-organized cellular networks in firms. Second, New Age leadership calls for ways in which CEOs can initially create and then maintain cellular networks, given that they are inherently unstable. Third, we have reached into complexity science for basic theories about why self-organizing cellular networks are called for, what their basic "ingredients" are, and what causal forces set self-organizing dynamics in motion.

We have critiqued current leadership theory and presented an approach to Ashby's "variety destruction"—what we term "creating requisite complexity"—that focuses on network designs and how CEOs can bring them to life in their firms. CEOs cannot destroy variety directly; however, Boards hire celebrity CEOs thinking that they can. Herein lies the problem. Charismatic visionary leadership theory presumes that CEOs can create requisite complexity. Directly they cannot. Indirectly they can—by creating variety-destroying complexity—*but not by a CEOs' exercise of strong top-down control.* To get a lesson on how to create requisite complexity in real-world firms, we turn to Jack Welch's approach at GE and build from this.

Why Jack Welch at GE?

- In great contrast to the modern CEO as a "temp" worker, Welch was CEO for 20 years—1981–2001;
- GE's revenues in 1980 were $25 billion; the year before Welch retired in 1981 they were $129.9 billion; GE's stock averaged a return of 24% per year during Welch's first 18 years in office; from 1995–1999 GE's stock climbed 40–50% per year; Welch raised GE's market value from $12 billion in 1981 to more than $400 billion in 2001 (Hartman, 2003);
- Named *Manager of the Century* by *Fortune* magazine in 1999.

In what follows, we argue that Welch's leadership approach puts many elements of complexity theory into managerial practice—albeit something that neither he nor anyone else seems to be aware of. Since GE developed its "boundaryless organization" approach (Ashkenas et al., 1995), GE has moved to elaborate a system whereby "*best-practices*" discovered in one section are quickly spread to other parts of what is now a vast "related multidivisional" kind of firm (Kerr, 2000)—GE has 350 business units within 43 strategic business units (Slater, 2001: 41). GE accomplishes this by developing rules along with fairly draconian incentives to make sure the flow of best-practice discoveries throughout the GE network occurs as fast as possible. GE is a particularly important example, since it has outperformed every major corporation around the globe in producing shareholder value (Byrne, 1998).

A preliminary analysis of the many actions by Welch, as recorded in Slater's (2001) book, his creation of agent heterogeneity, use of various devices to create effective network functioning, and management by tension, are strong characteristics of his leadership approach. Our hypothesis is, in general, that Welch was effective because his approach was—albeit unknowingly—drawing strongly and consistently on basic theories and findings from complexity science.

Learning from "AIDS Cocktail" Therapy.

The AIDS Cocktail came into practice in 1996. It was discovered that the growth of the HIV virus in the body could be suppressed as long as three drugs were taken in combination. Two chemicals are called "*reverse transcriptase inhibitors*" and the third is a "*protease inhibitor*." These chemicals, in three- or four-drug combinations, comprise the cocktail (Henkel, 1999). There are various actual combinations involved, making up a total of twenty kinds of drugs a doctor could prescribe as part of the cocktail (Johnson, 2003). On a day-to-day basis, from a patient's perspective, this meant that up to 21 pills had to be taken at specific times of the day, and under specific conditions, such as with food or with water; it proved to be a hard regimen to get right. Recently (ca2003), firms overseas have been allowed to create a one-a-day pill (*San Francisco Chronicle*, 2005).

These details are important because they point to two things. There are only three or four base chemicals in the cocktail, but in order to get the full effect, up to 21 pills had to be taken in a complicated regimen. The lessons from complexity science boil down to four basic elements—*heterogeneous agents*, *connections*, *tension*, and *positive feedback*—these are analogous to the three base chemicals in the cocktail. The actual managerial actions—the pills—comprise a larger set. We suggest twelve actions, but like the pills in the cocktail, there could be more or less depending on the circumstances.

We argue that, collectively, these actions are necessary and sufficient to reduce CEO churning. They do so because they give rise to effective management in complex, changing environments. The effective installation of these actions serves to make firms and CEOs more quickly and efficaciously adaptive. These actions are the means by which CEOs can enable and steer their firms in ways that do not destroy autonomy, agent heterogeneity, connectivity, incentives, and emergent self-organization without inadvertently creating an organizational culture dominated by top-down control and incentivized to carry out the CEO's vision. In a real sense, these "actions" represent complexity theory put into practice. We argue that:

- Many of these actions lie at the heart of Welch's success at GE.

- These actions are more apt to characterize effective firms in the New Age than in ineffective ones.
- These actions represent the four key ingredients required to create requisite complexity: *heterogeneous agents*, *connections*, *tension*, and *positive feedback*;
- Like the pills of the AIDS cocktail, the actions may appear as more or less specific observable "activities" by managers.

Our approach for creating requisite complexity boils down to a single overarching proposition:

Proposition 1: All the action-rules—implemented by managers or employees—have to be present consistently over time to create lasting efficacious requisite complexity under changing conditions.

Twelve Required Managerial Action-Rules to Assure Requisite Complexity

Building from the AIDS cocktail therapy, we outline twelve "action-rules" (based on McKelvey's, 2004a, "simple rules") to draw together the ideas we have presented from basic complexity science itself and from our application of its basic ideas to more applied "external complexity destruction" approaches for use in firms. Each action-rule stands as a complexity-based hypothesis about how the basic themes of complexity science foster network development in firms and the effectiveness of firms at the dawn of the New Age. We also take pains to show as well, that each is a Welch-based hypothesis, in that we can induce each from his managerial activities at GE.

The managerial action-rules serving to create and maintain internal complexity in firms are:

Heterogeneous Agents. If all the agents have similar abilities, there is no advantage to networking (Holland, 1995). End of story. We have some 3.8 billion years of mutation and crossover creating biological diversity to support this. Campbell (1974) called it "blind variation," arguing that "blind" variation was much more relevant for social innovation than "rational" variations. Furthermore, Johnson (2000), LeBaron (2000), and Allen (2001) all show that novelty, innovation, and learning all collapse as the attributes of agents collapse from heterogeneous to homogeneous. The definition of creativity favored by psychologists—"remote associates"— holds that creativity emerges when agents having different ideas or concepts interact and, consequently, are joined to produce something new (Mednick & Halpern, 1962).

In the first ten years or so after Welch took over GE (his "Neutron Jack" era), he divested ~130,000 of its 400,000 employees and acquired ~70,000 (Slater, 2001: 99). This effort brought together employees with diverse experience and abilities (as compared to the long-term GE employees). This brought an immense increase in diversity at GE.

Build Human Capital. Human capital is the basis of agent heterogeneity. The idea of networked idiots does not offer much promise. The "human capital" idea dates back to Becker's (1975) early work on the subject. He argued that the economists' Cobb-Douglas production function needs a component to reflect the knowledge people hold, as well as capital and labour. This is especially true in today's knowledge economy. In some sense, the economic advantage of the U.S., today, is much more a function of human capital, and its embodiment in physical and intangible capital, than financial capital or raw labor. Zucker and Darby (1996) find that one genius appropriately networked is superior to larger networks comprised of less talented agents.

The "*absorptive capacity*" literature (Cohen & Levinthal, 1990) suggests that if agents do not have some pre-existing level of knowledge relevant to understanding impinging "*variety*" (Ashby, 1956), they will not be very good at collecting additional information pertaining to the impinging contextual adaptive tensions. Also, absorptive capacity is a positive feedback process—the more absorptive capacity an agent has the more new, technical information he/she absorbs; the more information absorbed, the higher his/her absorptive capacity.

As he hired more diverse employees (heterogeneous agents), Welch also added to the human capital of GE, but the employees were not chosen and placed randomly in the corporation (one way of bringing in heterogeneity). Instead, they were chosen and placed in specific organizational units, meaning that their human capital was relevant and integrated into some kind of already working network. Because of GE's ability to assimilate (they were successfully bringing in around 3–5 acquisitions per week (Kerr, 2000), the newly acquired human capital moved down the learning curve quickly and productively effected the bottom line. As Slater (2001: 59) characterizes, Welch used "acquisitions to make the quantum leap."

Moderate Networking. Kauffman (1993), in an important book in the evolutionary biology literature, argues that some connections—not very many, actually—among agents improves system fitness. However, this fitness deteriorates as the number of connections among agent increases past an optimal level. He calls this effect "*complexity catastrophe*," arguing that it thwarts Darwin's selectionist evolution-toward-improved-fitness theory. Using his *NK*[*C*] model, Kauffman also finds that the upper bound at which "catastrophe" sets in is raised if agents within the system are connected to a moderate extent with agents outside the system (McKelvey, 1999). To this end, Barabási and Bonabeau (2003) find that number of connections per node follows a power law, so it should be expected that one individual in a network will have many links and some will have almost none. In other words, it is

not necessary that all agents have the same number of connections (Yuan & McKelvey, 2004). Moderate complexity is confirmed by the research of Rivkin (2000, 2001), among many others (Maguire et al., 2006)—parallel to Simon's (1962) "nearly decomposable" systems, as we note below.

Welch set in motion a number of network producing ideas—the "Work-Out" process got employees to talk to each other and then to the boss (Slater, 2001); the "no hording of best practices" forced people to get their ideas into the GE network of idea circulation (Kerr, 2000); the yearly meetings in Boca Raton, Florida brought managers from all parts of GE together in ways that developed weak-ties (Granovetter, 1973, 1982) across organizational units; the acquisitions brought new people in who were already in networks. At the same time, there was no sense of massive networking that would bring on "catastrophe." Moving people who have succeeded in one job into another—that is, changing their job position and physical location is a way of creating new weak-ties, as GE has found out (Kerr, 2000).

Appropriate Physical Conditions: People who see each other all the time usually develop strong ties. People who never see each other tend not to interact. This is to say, networking is a function of physical adjacency. Of course, the Internet, electronic mail, telephones, and so forth, overcome many limitations of physical adjacency, but many remain. Therefore, it is important to create physical "mixing" events that bring heterogeneous agents into person-to-person contact. Combining these mixing events with increased awareness of newly appearing adaptive tensions meets some of the basic conditions of new order creation, as outlined in McKelvey (2003, 2006). CEOs can also create tags, which serve to set off coevolutionary dynamics. Job related "new" mixing is also possible.

GE used two kinds of physical dynamics to foster appropriate internal complexity. First, the training facility at Crotonville was a key place for "Work-Outs." Whether here or in a hotel, employees spent some three days off-site in a physical location where they could first talk to each other and then to their boss. Frequently, diverse members of a particular business were brought together—engineers, production, marketing, etc. (Slater: 117–122). Second, the yearly meetings in Boca Raton were larger events where 500 managers from all 350 businesses of GE would congregate and attending sessions of various kinds (p. 35). Here, the physical setting was key to making network development and weak-tie formation possible. The Work-Outs were about confronting the boss, while the Boca Raton meetings were platforms for Welch to talk to all the key players. Underneath these overt agendas, the physical sites fostered networking.

Coaching: The OD literature (French & Bell, 1984) and researchers applying complexity theory to issues of business both realize that coaching is needed to help many employees form network connections expeditiously (Goldstein, 1994; Kelly & Allison, 1998). One cannot assume that all relevant employees arrive with networking skills. Given the possibility of both personal and task conflict, there is every reason to expect that coaches need to act as catalysts to help networking along. At GE professional "facilitators" were used to make sure the Work-Outs worked (Slater, 2001).

Decomposability: How can corporations create "cells" in cellular networks? Simon (1962) argued that systems (i.e., cellular networks) evolve toward fitness fastest when the cells (modules) are nearly, but not totally, disconnected from higher levels in biological or social system hierarchies. Sanchez (1993, 1999; Sanchez & Mahoney, 1996) confirms this empirically in his extensive research on the effectiveness of modularly designed firms; also corroborated by Schilling (2000). Economists have long argued that we have to worry whether managers (or autonomous agents) always serve the best interests of shareholders. It is clear from the recent Enron, WorldCom, and investment bank investigations that CEOs and lower-level managers *do not* always put shareholder interests first. Even so, it is clear that the alternative—of strong top management control—is also antithetical to shareholders' best interests. CEOs have to aim at giving cellular networks much freedom and autonomy, but not total autonomy. We deal with this in the "Strange Attractor" paragraph.

Welch tried to get GE to think small, and "act like a small company" (Slater, 2001: 99). He did away with several layers of management. He "unleashed empowered workers" (p. 100). Getting rid of layers of hierarchy, while at the same time focusing on worker empowerment and autonomy, is consistent with Simon's near decomposability. By doing this, Welch's emphasis was on adaptive speed. He held that small thinking companies "communicate better," "move faster," and "waste less" (p. 100–101), again fitting Simon's evolutionary advantage from near decomposability. Welch said: "We found that with fewer layers, we had wider spans of management. We weren't managing better. We were managing less, and that was better" (p. 18).

Adaptive Tension:[1] Externally imposing and internally creating *adaptive tension*—see our earlier description of the European School—which activates agents fosters the creation of requisite complexity (McKelvey, 2001, 2006).

[1] Rules 4, 5, 6, & 7 are elaborated in McKelvey (2006).

Tensions are not goals (point attractors), but they serve as energizing devices for CEOs to take advantage of. Adaptive tensions may stem from any selectionist context—from outside a firm, from any higher level within a firm, or from more specific domains such as technology, markets, costs, competitors, political changes, etc. Absent tension, nothing happens.

Welch's "Be #1 or 2 or else…" is the most obvious parallel here (Tichy & Sherman, 1994). Another phrase was "face reality" (p. 17), which is where the important tensions come from. Welch put the "face reality" at the top of his list. He very much possessed a "survival of the fittest" mentality (p. 49). He always emphasized "broad objectives" (p. 30), "a few clear, general goals" (p. 28). He followed Clausewitz saying, "strategy was not a lengthy action plan. It was the evolution of a central idea through continually changing circumstances." (p. 29). (for background on Clausewitz, see Ghyczy et al., 2001).

Critical Values: Adaptive tensions cause phase transitions, (these are abrupt transitions to a new order), if the tension, *T*, is above the 1st critical value. Use of the 1st and 2nd *critical values* to define the *region of emergence* is critically important—below the 1st critical value, bureaucratic behavior prevails; above the 2nd critical value, chaos prevails (Brown & Eisenhardt, 1997; McKelvey, 2006). Employee training and experience works to lower threshold gates so that adaptive tensions may take effect at lower values. Employees can also be trained so as to work in high-tension conditions without becoming dysfunctional.

For example, public utilities are notorious for having very high threshold gates before employees are apt to take innovative approaches. Worse, incentive systems do nothing to change this. In contrast, a reading of Slater (2001) on Welch's "leadership secrets" shows that Welch tried to create a corporation with a flavor very much the opposite of a utility. He emphasized draconian incentives that lowered employees' threshold gates against networking, innovating, sharing, "exceeding goals" (Slater, 2001: 131). The 1st critical value, which employees have to cross to reach the region of complexity, was lowered by the use of the incentives; the 2nd was raised by getting people more easily able to "Stretch" past normal levels of achievement to aim for higher levels, tougher goals, more difficult objectives without becoming dysfunctional. He said, "…people, excited by speed and inspired by Stretch dreams, have an absolutely infinite capacity to improve everything" (Slater, 2001: 133).

Strange Attractors: Steering a network by "*strange attractor limit setting*" rather than by goals (point attractors) created by top-down goal setting (McKelvey, 2006), is reminiscent of Bennis's (1996) "herding cats" phrase, and Morgan's (1997) "avoidance of noxiants"—is not just an opportunity available to CEOs. The idea of leaders enabling and steering complexity development is at the heart of the recent paper on "complex leadership" by Marion and Uhl-Bien (2001). Everything that traditional leadership theory teaches managers tilts them toward trying to incentivize employees to carry out the leader's vision. This leads to top-down control and passive dependency by employees (Argyris, 1957). Slater also says, "Let's keep in mind that the managers of American businesses have been trained to do just that—manage. That means managing, controlling, supervising, [and] creating corporate structures that assure that things get done" (Slater, 2001: 21).

Welch said, "manage less…instill confidence…get out of the way…emphasize vision, not supervision" (Slater, 2001: 22); "managing less is managing better" (Slater, 2001: 18). But like the strange attractor, there is a point where corrections may need to be inserted—as Morgan would say, the noxiants have to be avoided; the chain jerked as others might say. Thus, Welch pursued "strategic audits" (Slater, 2001: 45) and downsizing as ways of maintaining focus.

Weak Tie Flooding: Granovetter's (1973, 1982) classic research finding is that novelty and innovation happen more frequently in networks consisting of "*weak ties*" as opposed to "*strong ties.*" The latter tend to produce groupthink (Janis, 1972). This weak-tie effect is reconfirmed by Burt's (1992) discovery of the entrepreneurial power of "*weak-tie bridges*." And, of course, weak-tie effects go hand in hand with our first action-rule's emphasis of agent heterogeneity. Given an existing system, which tends toward strong-tie formations as agents get to know each other better and experience the build-up of what McKelvey (2003) terms "*entanglement ties*"—path dependencies resulting from ties that build up over repeated interactions, with the effect that the behaviors of entangled-tie agents become increasingly similar and predictable (see also March, 1991). While modularization speeds up adaptive response rates, modules (cells) are also prone to become strong-tie cliques. Put in terms of Burt's weak-tie bridging, weak-tie flooding is even more effective when bridging activities are included. The positive effects of weak-tie flooding appear in Uzzi's (2001, 2005) study of the evolution of the Broadway music industry.

Welch set the stage for weak-tie flooding by divesting units containing ~130,000 employees and then acquiring firms bringing back ~70,000 (Slater, 2001: 99–100). While acquired firms may enter with strong-tie networks within firms, they immediately have weak-tie potential across the rest of a corporation. Coupled with the physical facility rule, the flooding of GE with weak-tie effects was inevitable. We have already mentioned GE's emphasis of networking.

Coevolution: Coevolution is a fundamental dynamic in the American School of complexity science. From biology, two key points are relevant: (1) Coevolution implies heterogeneous agents (genes), erosion of barriers so gene pools mix, and the interaction of species and habitat elements such that they constantly impose on each other to create adaptive tension. Even so, (2) coevolution is kept under control by damping mechanisms such as food stocks, climate, geology, diseases, and predator-prey relationships; organisms have no control over the rate at which they progress toward new order. Evolution and ecology have long been part of organization theory (Aldrich, 1979, 1999; McKelvey, 1982; Nelson & Winter, 1982; Hannan & Freeman, 1989) with coevolution a more recent arrival (McKelvey, 1997; Lewin and Volberda, 1999). These treatments leave explicit managerial actions out of the mix. But, in organizations, as McKelvey discusses elsewhere (2002), coevolving systems are always liable to coevolve in unwanted directions, not coevolve fast enough in the right directions, start at a good rate and then suffer the effects of damping processes, etc. As a result, coevolution has to be managed. He discusses twelve ways in which this may be pursued but space precludes our getting into this here.

"Welch was convinced that GE's diversity and complexity could be turned into an asset by creating what he called 'a learning culture'" (Slater, 2001: 70). "The boundaryless learning culture killed any view that assumed the GE Way was the only way, or even the best way" (p. 72). "That belief drove us to create a boundaryless company by de-layering and destroying organizational silos. Selflessly sharing good ideas, while endlessly search for better ideas, became a natural act. We purged NIH—not invented here—for our system…." (Slater, 2001: 73). Breaking down boundaries and emphasizing idea sharing surely set coevolution in motion at GE. Thus: "Our core competence is sharing best ideas across businesses…. Reward employees for knowledge sharing…. Hold idea sharing meetings on a regular basis" (Slater, 2001: 78, 80).

Incentive Structures: Our discussion here is mostly patterned after network incentives developed at GE, under the leadership of Welch (Kerr, 2000). The sub-rules that GE focused on for incentivizing agents are:

- Agents are incentivized to focus on adaptive tension—the "Be #1 or 2…" challenge;
- Agents incentivized to get information out on the network in a form abstract enough for all users to try out (Kerr, 2000);
- Agents gaining success in one part of the network, or with one kind of human capital, are moved around—given additional "opportunities to fail" (Kerr, 2000)—which is a way of building competence, diversity, and weak ties;
- Agents incentivized to produce novelties, with the most critical (top priority) novelties expected at a consistent rate each year (say, five "most critical" novelties per year)—novelties created in response to the prevailing contextual tensions and rates of change in the external environment;
- Agents incentivized to build learning cultures and unleash the energy of theory workers (Slater, 2001: 70–74);
- Agents incentivized to "delayer…get rid of fat…remove the boundaries, listen…" etc. (Slater, 2001: 89–93);
- Agents are activated by the "A, B, C rules"—people rated C are to be fired (Slater, 2001: 35–36);
- Agents "above" the cellular networks, such as CEOs, are incentivized to expect and review some specific number of "most critical" novelties, and some novelties of lesser criticality without reservation—but remember the "nearly decomposable" rule.

CONCLUSION

The facts are clear. CEO turnover increased dramatically during 1990s economic boom. Our question is, "Why?" Bennis and O'Toole (2000) hold onto traditional leadership theory's view that "charismatic visionary leaders" are the answer and, thus, place most of the blame on Corporate Boards for failing to select visionary leaders. *The Economist* (2001), picking up the story, argues that the problem is mainly that exogenous economic circumstances have become more demanding, hence leadership at the top is more difficult for both CEOs and Boards. In addition, a large empirical literature documents fundamental changes taking place in the economy, creating increased competition and uncertainty. External complexity is clearly increasing, given globalization, flattening of hierarchies, the speed of the digital age, mega-mergers, the intangibility of the Knowledge Era, and the rapid pace of change as we enter the 21st Century.

Building from Ross Ashby's (1956) *Law of Requisite Variety*, we define the problem as Boards and CEOs failing to develop the kinds of emergent requisite internal complexity necessary for firms to efficaciously adapt to New Age complex, changing competitive environments. Given this changing New Age context, we argue that traditional leadership theory falls short of providing an explanation for why CEOs dismissals occurred at an unprecedented rate. Following traditional leadership theory makes things worse by actually destroying internal complexity rather than creating it.

To find a solution, we draw on three sources: (1) We use complexity science to define twelve "action-rules" corporate leaders need to follow to create requisite complexity; (2) We match our action-rules to descriptions of Jack Welch's leadership actions during his 20 years as CEO of GE—as described in Slater's book, *Get Better or Get Beaten* (2001); and (3) We build from AIDS cocktail therapy to set up our key proposition: *All twelve action-rules have to be in effect consistently over time to create efficacious requisite complexity under changing conditions*. Needless to say, Boards have to buy into the action-rules as well as CEOs, otherwise Boards won't be able to differentiate effective CEOs from the others.

A number of questions and discussion points remain, however. First: Are all twelve action-rules necessary? Welch lasted for 20 years, created record shareholder value, and was Manager of the Century. He appears to follow all of them. One way to test this would be to study how successful the nineteen Welch-trained executives have been who became CEOs elsewhere. It seems that they typically use only one or very few of the rules and most are not doing very well.

Second, there is a clear message from our analysis that good medicine is *Corporate Governance* and *Complexity Leadership*—the latter phrase coined by Uhl-Bien et al. (2005). So far in the literature these topics remain separate for the most part—all separate sessions at recent Academy Meetings, for example. Board governance at GE under Welch was not much of a problem. When CEOs fail, however, Governance is a terrible problem. The better that Boards select CEOs in the first place, the less of a problem thereafter.

Third, hiring a "Celebrity CEO" is usually a false promise and failing solution. There is little evidence that any of them are able to enable requisite complexity. Mostly they worsen it. Far from understanding the existing corporate culture and far from knowing how to lead it into requisite complexity, they are prone to "Hacksaw Al"-type quick fixes, which erode complexity and add to the churning rate—data in the Lucier (2005) study appear to confirm this.

Fourth, on the other hand, enabling requisite complexity, may be a significant *portion* of the success that Collins (2001) has discovered in the so-called "self-effacing," home-grown CEOs that have turned pretty good companies into "great" ones. His are clearly not celebrity CEOs. But, we have not yet done on his CEOs the kind of analysis we have with Welch—but we think there is more to it than self-effacement. We think a more complete explanation is that they, like Welch, are doing an undercover job of enabling requisite complexity as dictated by the context they confronted at the time. Again, the indication is that complexity leadership offers more lasting value than celebrity status.

Fifth, can we develop a "complexity leader IQ" measure by which one could identify prospective CEOs? Perhaps it can be done with a questionnaire. Alternatively, given our experience teasing out *complexity leadership* by Welch from quotes and descriptions in Slater's book, another possibility is our action-rules are more or less evident if we go study a CEO's track record. In fact, this is what Boards do—they look for CEOs that have a track record of success at other firms, except that they look at the wrong information (Khurana, 2004; Lewin & McKelvey, 2005); theirs is a very superficial look with no attention paid to matching requisite complexity or a CEO's ability to take on this job in their particular firm.

Sixth, there was clearly a tough side to Welch's leadership at GE. He was not called "Neutron Jack" for nothing. Divesting 130,000 employees is not for the weak hearted. Labeling employees As, Bs, and Cs and then firing the Cs, and then firing the managers who can't fire the Cs, is surely tough minded. The "Be #1 or 2…" rule is not for the weak hearted either. On it goes. In contrast, many introductions of complexity theory to practitioners have been on the soft side, like much of OD—translating self-organization into a modern version of empowerment, using complexity sciences as a modern-day re-legitimization of prosaic OD approaches (we won't say who). Our action-rules make it patently obvious that "complexity in action" is very different from updated OD. Saying "Be #1 or 2…" is meaningless absent the threat of divestiture and losing one's job. Welch was tough and had a vision, but clearly avoided the kind of top-down control that thwarts innovation, stops risk-taking, stops two-way communication, and builds weak-tie networks rather than strong-tie defensive cliques. Put rather crassly, Welch replaced old-style, top-down "*Management by Objectives*" by "*Management by Tension*"—along with our other action-rules as well.

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