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Let Chaos Reign, Then Rein In Chaos – Repeatedly: Managing Strategic Dynamics For Corporate Longevity

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LET CHAOS REIGN, THEN REIN IN CHAOS – REPEATEDLY: MANAGING STRATEGIC DYNAMICS FOR CORPORATE LONGEVITY

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Combining longitudinal field research and executive experience, we propose that corporate longevity depends on matching cycles of autonomous and induced strategy processes to different forms of strategic dynamics, and that the role of alert strategic leadership is to appropriately balance the induced and autonomous processes throughout these cycles. We also propose that such *strategic* leadership is the means through which leadership *style* exerts its influence on corporate longevity. Our findings can be related to organizational research on structural inertia, learning and adaptation, as well as to formal theories of complex adaptive systems. They also contribute to resolving the seeming contradiction between a study of corporations that attributes exceptional long-term success to leadership style, and the more common proposition that strategy is the determinant of long-term performance.

INTRODUCTION

It is generally acknowledged that relatively few companies survive as independent entities for very long periods of time. For instance, of the top100 US-based industrial companies listed in *Fortune* magazine in 1965 only 19 remain in the top 100 in 2005, 15 fell out of the top 100, and 66 were acquired or disbanded.[1] We think that an important reason for this lack of institutional longevity is that most of the time companies operate in a stable industry structure and develop a strategy-making process geared toward coping with linear strategic dynamics, which are relatively easy to understand and predict (e.g., Porter, 1980); but at some times in their evolution they face *nonlinear* strategic dynamics that overwhelm their capacity for strategy-making. Nonlinearity is described as "the property that the magnitude of an effect or output is not linearly related to that of the cause or input" (*Oxford English Dictionary*, *Supplement*). Such nonlinear transformations of inputs into outputs are governed by positive feedback loops in the interactions of the components of complex social systems (Arthur, 1989), and their outcomes are difficult to understand and predict.

Nonlinear strategic dynamics come about as industry participants - sometimes incumbents, but probably more frequently new entrants - change the "rules of the game:" normative rules based on laws, customs, and administrative principles; technological rules based on available technical solutions; economic rules reflecting existing bargaining power relationships among the industry players (often captured in contracts); and cognitive rules that are widely shared judgments about key success factors (a kind of "industry recipe" (e.g., Spender, 1989)). Whether implicit or explicit, the rules of the

game usually remain unchallenged for extended periods of time (Grove, 2003), thereby engendering a strong tendency toward strategic inertia among the industry incumbents.

Organizational ecology researchers have provided empirical evidence (e.g., Hannan and Freeman, 1989) and deductive theoretical support (Hannan, Polos, and Carroll, 2004) of the value of inertia for organizational survival. They point to the conundrum leaders intending to improve organizational performance face, for instance through what they call "architectural change"(e.g., form of authority, pattern of control relations, and so on): "Surely some architectural changes do improve performance and thereby reduce mortality hazards. Just as surely, others have the opposite effect. Should we assume the beneficial case as a default? We think not." (Hannan *et al*., 2004: 229). Attempted changes are hazardous because the organization-specific contingencies on which the success depends are very difficult to assess *a priori*; many changes are imitative, simply reflecting fads and fashions; and changes often lead to unforeseen and unintended consequences (Hannan *et al*., 2004: 229-230). Similarly, leading researchers of organizational learning and adaptation warn about the potential dangers of change associated with exploratory activities, because while the upside of correct decisions is very high, the downside of wrong ones can "…lead to major disasters…" (March, 2006: 205).

Yet, while organizational change may be potentially hazardous for corporate longevity, equally dangerous is what we call the "creosote bush conundrum," using a metaphor coined by Craig Barrett, Intel Corporation's former Chief Executive Officer. The

creosote bush is a desert plan that poisons the ground around it, preventing other plants from growing nearby. Accordingly, the creosote bush conundrum refers to the strategic inertia that a successful core business experiences as it gets locked-int its product-market environment. This makes it difficult to explore and exploit new business opportunities that are not directly related to it (Burgelman, 2002). To the extent that corporate longevity depends on the capacity of a company to enter into and exit from businesses in the face of changing strategic dynamics (Burgelman, 1994), this too is a serious conundrum of strategic leadership.

Nonlinear dynamics are systematically discussed in mathematical theories of complex adaptive systems in the physical and biological sciences (e.g., Prigogine, 1980; Kauffman, 1993; Gould, 2002), and increasingly also in social science (e.g., Axelrod and Cohen, 2000) and history (e.g., Gaddis, 2002). Management scholars have also attempted to introduce some of these theoretical ideas into administrative science (e.g., Burgelman, 1983; Thietart and Forgues, 1995; Brown and Eisenhardt, 1997; Levinthal, 1997; McKelvey, 1997; Anderson, 1999; Tsoukas and Chia, 2002; Meyer, Gaba, and Colwell, 2005). Discussing some of the original theorists' work Gould, however, cautions against "… any pure theoretician's claim that success in modeling logically entails reification in nature" (2002: 927).

In this paper, we heed Gould's caution. Grounded in a combination of longitudinal field research and executive experience at Intel Corporation, we construct a conceptual framework of strategic dynamics situations and examine the various *nonlinear* ones that

the company has faced. Since the challenges posed by nonlinear strategic dynamics unavoidably need to be addressed by a company's strategy-making process, we examine the role of induced and autonomous strategy processes (Burgelman, 1991), and associated developmental resource allocation that Intel has managed throughout its evolution.

We arrive at the same fundamental questions as posed in formal theories of complex adaptive systems: What is the balance of exploitation and exploration that will maximize a company's survival chances in the face of different nonlinear strategic dynamics situations? (March, 1991; Axelrod and Cohen, 2000). How can a company's strategy-making process be designed to effectively maintain such balance so as to maximize both "fitness;" that is, adaptation to the current environment, and "evolvability;" that is, ability to adapt to a changing environment and/or to seek out new viable environments? (Kauffman, 1993; Gould, 2002). We propose to show that different nonlinear strategic dynamics situations require different balances of induced and autonomous strategy processes, and that balanced cycles of these processes are at the heart of corporate longevity.

These important questions, in turn, raise another fundamental one about the role of *strategic* leadership: How can the importance of designing a strategy-making process capable of simultaneously maintaining fit and evolvability be reconciled with the observation that strategy does not play a decisive role in the evolution of companies that make it from "good to great" in the long run, but that what matters is a certain leadership

style (Collins, 2001)? Our single case study of Intel Corporation, described in more detail below, allows us to examine the role of strategy-making in great depth, and as a result we propose that *strategic* leadership - how top management designs the strategy-making process - is the means with which leadership *style* exerts its influence on corporate longevity.

Research method

Combining longitudinal field research and executive experience. We draw on longitudinal field research of Intel Corporation's evolution between 1968 and 2005 to highlight some of the strategic dynamics situations the company has faced and the role of its strategy-making process in managing them. Our research design for this paper is thus comparative with respect to time: We compare Intel's strategy-making approach in successive strategic dynamics situations over the course of its evolution. Our research design is also consistent with recommendations of scholars studying nonlinear change (Meyer, Gaba, and Colwell, 2005): we situate Intel's evolution in the context of the highly dynamic industries in which it participates and focus on the periods when these were in flux, away from equilibrium, and discontinuous changes were taking hold.

The longitudinal field research has involved formal and informal interviews with many hundreds of Intel managers since 1988, the observation of strategic planning meetings, and the study of company documents (Burgelman, 1991; 1994; 1996; 2002a, 2002b). We augment relevant findings of this research with insights about managing Intel's strategic dynamics gained through more than thirty-five years of experience in top executive and governance positions at the company (Grove, 1996). With the help of senior Intel finance

staff, we also tried to reconstruct the developmental resource allocation related to induced and autonomous strategy processes throughout the company's evolution. While dollar amount allocation alone does not fully reflect resource deployment, it provides a first approximation of the corporation's efforts to cope with strategic dynamics.

Limitations. The usual caveats associated with case study research apply. Our combination of academic research and executive experience has provided a lens through which various strategic dynamics situations in Intel's evolution could be studied comprehensively and in unusual depth, but it unavoidably contains a subjective element. Also, the personal computer industry is somewhat special because of the importance of increasing returns to adoption (Arthur, 1987), which creates conditions leading to winner-take-all outcomes. Intel benefited from these conditions during part of its history. These limitations require caution about the extent to which our analysis can be generalized.

CONCEPTUAL FRAMEWORK

Strategic dynamics situations

We examine the various ways in which a focal company's strategic actions can interact with the environment. Call this focal company $\boldsymbol{P_i}$ and the environment $\boldsymbol{E}$, which includes the other players, $\boldsymbol{P_j}$, that constitute the traditional industry forces (customers, suppliers, competitors, complementors, potential new entrants, and substitutes), as well as exogenous forces such as technological change, government regulation and deregulation, and major fluctuations in the capital markets. While $\boldsymbol{E}$'s boundaries are relatively well defined at any given time, in a dynamic world other industries or newly emerging environmental segments may potentially affect $\boldsymbol{E}$ at some time. Call these other industries or emerging segments $\boldsymbol{e}$, and consider ($\boldsymbol{E, e}$) the relevant environment for our further

discussion of strategic dynamics. Both $\boldsymbol{P_i}$ and other players in (***E, e***) most of the time engage in rule-abiding strategic actions: Actions that are consistent with the prevalent normative, technological, economic, and cognitive rules that determine how $\boldsymbol{P_i}$ and the other players in (***E, e***) compete and that have guided them toward achieving a relatively stable industry structure. Alternatively, they can seek to turn the basis of competition in the industry decisively to their advantage by engaging in rule-changing strategic actions. Note that (***E***, ***e***) are never identical across a set of $\boldsymbol{P_i}$ comprising an industry; and, given that different $\boldsymbol{P_i}$ have different positional and competence characteristics, it matters which $\boldsymbol{P_i}$ tries to change the rules.

Game theorists note that relatively small changes in the rules can produce enormous changes in outcomes (Brandenburger and Nalebuff, 1996); on the other hand, some rule-changing behavior, such as switching from Cournot (simultaneous) to Stackelberg (leader-follower) strategic action, can lead to quite stable equilibriums (e.g., Saloner, 1991: 126). Organization theorists warn about unanticipated and unforeseen consequences (e.g., Hannan, Polos, and Carroll, 2004). Complexity theory suggests that small changes in the interaction pattern of a large number of rule-abiding agents can have big effects (e.g., Gleick, 1987). In light of these observations, the criterion we adopt for distinguishing rule-changing from rule-abiding strategic actions is that rule-changing actions by one of the players materially changes the competitive context for the other players and thereby the expected outcomes of their strategic actions (Axelrod and Cohen, 2000: 8; Gaddis, 2002: 97; Grove, 2003). We view rule-abiding strategic actions as additive and producing *linear* and fairly predictable change. For instance, assume that

competing by offering rebates has been part of the industry tradition. Typically, the advantage of a rebate given by one competitor is canceled out when another competitor offers a similar or slightly larger one, and the effect of these competitive moves is fairly predictable. Rule-changing strategic actions, on the other hand, are multiplicative and produce strategic dynamics that are *nonlinear* and more difficult to predict. For instance, when one competitor starts using innovative lean manufacturing to achieve lower costs and offer lower prices, the other competitors may continue to respond by giving rebates, but this may reduce their cash reserves and may make it more difficult to catch up with the innovative competitor, leading the other competitors to offer even larger rebates in the next round of competition and falling farther behind; in this situation it is harder to predict what the new equilibrium will be.

Determining *a priori* whether a strategic action by $\boldsymbol{P_i}$ (or one of the other players in ($\boldsymbol{E}$, $\boldsymbol{e}$)) is rule changing - e.g., negotiating a new type of contractual arrangement with customers or suppliers, introducing a technological innovation, successfully lobbying the government, and so on - will often not be possible. $\boldsymbol{P_i}$'s capacity for "strategic recognition" (Burgelman, 1983) of the rule-changing implications of a strategic action *after* it has been taken but *before* others see them seems critical. Such strategic recognition requires a mental state of constant alertness – metaphorically called "paranoia" (Grove, 1996) – widely distributed among $\boldsymbol{P}$'s leadership, which could be measured, for instance, by $\boldsymbol{P_i}$'s reaction time to changes in ($\boldsymbol{E}$, $\boldsymbol{e}$).

Figure 1 presents our framework of strategic dynamics produced by the interplay of the actions of ***P*** and (***E***, ***e***).

Figure 1 About Here

Most of the time $\boldsymbol{P_i}$'s strategic actions are rule abiding because $\boldsymbol{P_i}$ does not have the resources necessary to try to change them or because $\boldsymbol{P_i}$ anticipates that the other players can respond in kind. For the same reasons, the other players in (***E, e***) also engage in rule-abiding strategic actions. Our example of matching rebates with rebates illustrates this situation (see above). The interplay of rule-abiding strategic actions on the part of $\boldsymbol{P_i}$ and (***E***, ***e)*** preserves a *stable industry structure*, even though the industry participants compete vigorously. The competitive context facing the various players is not materially altered and the distribution of the potential industry earnings (PIE) (Saloner, Shepard, and Podolny, 2001) is fairly predictable, with relatively small shifts one way or the other over time that are reversible. Some scholars have called this "Red Queen" competitive dynamics, as it evokes the image of the *Alice in Wonderland* character running as hard as she can just to stay in the same place (Barnett and Hansen, 1996).

Sometimes players in (***E, e)*** engage in rule-changing strategic actions that adversely impact $\boldsymbol{P_i}$. Such rule-changing strategic actions produce ***P****-independent industry change*, which significantly reduces $\boldsymbol{P_i}$'s power relative to (***E***, ***e***). ***P***-independent industry change is nonlinear and disruptive (from $\boldsymbol{P_i}$'s point of view): the rule-changing actions by players in (***E***, ***e***) and $\boldsymbol{P_i}$'s inertial rule-abiding actions combine multiplicatively to materially and unfavorably change the context from $\boldsymbol{P_i}$'s perspective. This is likely to be reflected in $\boldsymbol{P_i}$'s

decreasing relative share of the PIE. Our example of a competitor responding with rebates to another competitor's lower prices based on a new manufacturing strategy illustrates this situation (see above). In this case, $\boldsymbol{P_i}$ is rule abiding in the face of rule changing by others in (***E***, ***e***). Conversely, sometimes $\boldsymbol{P_i}$ is able to engage in rule-changing strategic actions while the other players in (***E, e)*** continue to engage in rule-abiding strategic action. $\boldsymbol{P_i}$'s successful rule-changing strategic actions produce ***P****-controlled industry change*, which significantly increases $\boldsymbol{P_i}$'s power relative to (***E***, ***e***). ***P***-controlled change is nonlinear and complex: $\boldsymbol{P_i}$'s rule-changing actions lead the other players in (***E***, ***e***) to respond defensively, which multiplies their effect and materially changes the context to $\boldsymbol{P_i}$'s advantage. This is likely to be reflected in ***P***'s increasing relative share of the PIE.

Rule-changing strategic actions may be planned, but probably more often are unplanned and depend on strategic recognition of an opportunity that arises in a more or less fortuitous way. Forces driving toward commoditization, for instance, may change the rules (e.g., lead customers to expect lower price and higher quality) so that manufacturing process rather than product innovation becomes the new basis of competition (e.g., Utterback and Abernathy, 1975); or, a "disruptive technology" (Christensen and Bower, 1996) becomes "good enough" to change the basis of competition. In other cases, increasing returns to adoption (e.g., Arthur, 1989), such as in the personal computer industry, and digitization of content, such as in the music industry, may make changing the rules possible. These sorts of technological developments, as well as some regulatory

developments (e.g., the deregulation of the telecommunications industry), may engender ***P***-independent industry change or make ***P***-controlled industry change possible.

Sometimes both $\boldsymbol{P_i}$ and other players in (***E***, ***e***) engage in rule-changing strategic actions simultaneously. Such compounded rule-changing strategic actions lead to *runaway industry change*. Runaway industry change is nonlinear and can be characterized as chaotic. In contrast to complexity, "… chaos deals with situations such as turbulence (…) that rapidly become highly disordered and unmanageable…"(Axelrod and Cohen, 2000: xv). Accordingly, the rule-changing strategic actions of players in (***E***, ***e***) with $\boldsymbol{P_i}$'s rule-changing action interact multiplicatively and change the context in ways that are difficult to anticipate. While a runaway industry is the least stable situation and will eventually revert back to one of the other situations, it is difficult to predict which one. In the mean time, it is unclear whether $\boldsymbol{P_i}$'s rule-changing strategic actions will ultimately be to its advantage. Technological or regulatory forces driving the convergence or collision of different industry segments (e.g., Internet computing and desktop computing), or of entire industries (e.g., computing, communications, and consumer electronics), create conditions for *runaway industry change*.

Internal ecology of strategy making

The co-evolving interactions of $\boldsymbol{P_i}$ and (***E***, ***e***) constitute an ecological system (e.g., Hannan and Freeman, 1989). We propose that $\boldsymbol{P_i}$'s fate in this dynamic system depends, at least in part, on its own internal ecology of strategy making (Burgelman, 1991). Consequently, we view $\boldsymbol{P_i}$ as an ecological system within which strategic initiatives emerge in patterned ways and compete for $\boldsymbol{P_i}$'s limited resources through two distinct

processes. Through the *induced strategy process* $\boldsymbol{P_i}$ exploits opportunities in its familiar environment. To do so, $\boldsymbol{P_i}$'s top management sets the corporate strategy and induces strategic actions by executives deeper in the organization that are aligned with it. The induced strategy process limits actions that deviate from the corporate strategy for at least two reasons. First, $\boldsymbol{P_i}$ survived environmental selection by satisfying its customers and other constituencies in reliable ways and wants to continue to abide by the rules. This reactive propensity constitutes a rational source of strategic inertia (Hannan and Freeman, 1989). Second, $\boldsymbol{P_i}$ successfully changes the rules and aligns all the forces at its disposition to reshape the environment to its advantage, but this proactive propensity results in co-evolutionary lock-in and becomes another rational source of strategic inertia (Burgelman, 2002a).

Through the autonomous strategy process $\boldsymbol{P_i}$ explores new opportunities that are outside the scope of the existing corporate strategy, relate to new environmental segments, and are often based, at least in part, on distinctive competencies that are new to the company. Autonomous strategic initiatives usually, but not necessarily, originate at operational or middle management levels. They often come about fortuitously and somewhat unexpectedly as a result of $\boldsymbol{P_i}$'s dynamic capabilities (e.g., Teece, Pisano, and Shuen, 1997) that co-evolve with ($\boldsymbol{E}$, $\boldsymbol{e}$). To overcome the selective effects of the company's structural context, which is set up to support initiatives that are aligned with the current corporate strategy (Bower, 1970), the initiators of these autonomous initiatives try to activate a process - which we call strategic context determination (Burgelman, 1983) - to convince top management to amend $\boldsymbol{P_i}$'s corporate strategy, thereby integrating them into

the induced process going forward. The key role of the autonomous process is to extend the boundaries of $\boldsymbol{P_i}$'s competencies and opportunities and/or to help $\boldsymbol{P_i}$ prepare for disruptive technologies. On the other hand, resources can be spread thin if ***P*** supports too many autonomous initiatives (and halts too few), perhaps at the expense of its core businesses. Most dangerously, autonomous initiatives may undermine $\boldsymbol{P_i}$'s existing competitive position without providing a secure new one.

In general, the effectiveness of P_i's internal ecology of strategy making depends on maintaining P_i's ability to exploit existing opportunities through the induced process, while *simultaneously* maintaining P_i's ability to pursue new opportunities through the autonomous process.

MATCHING STRATEGY-MAKING AND STRATEGIC DYNAMICS: OBSERVATIONS FROM INTEL'S EVOLUTION

P-independent industry change: Intel's exit from DRAM

The entry into the dynamic random access memory (DRAM) industry of several large, vertically integrated Japanese companies, which were supported by the Japanese government in their quest for dominance of the DRAM industry, fundamentally changed the rules: As DRAM products became commoditized, customers demanded consistently high quality and low prices. Hence, it took manufacturing competence to win. Intel's competence, however, was circuit design and process technology. For several product generations Intel's inertial induced strategy process led the company to engage in strategic actions based on its existing distinctive competencies, which increasingly undermined its ability to compete in the changed DRAM industry.

Intel's induced strategy process became unhinged, with stated strategy and strategic action in the DRAM business diverging, as middle-level product planning managers gradually allocated scarce manufacturing capacity away from DRAM products to other, higher-margin products, including microprocessors. These actions were consistent with Intel's generic strategy of differentiation and product leadership, which favored specialty products over commodities. But it exacerbated the decline of Intel's ability to compete in the DRAM industry. As a result of these external and internal forces, Intel's share of the DRAM PIE declined rapidly.

The availability of new business opportunities associated with microprocessors facilitated exiting from the DRAM business and highlights the importance of Intel's autonomous strategy process. Intel's microprocessor business had emerged in the early 1970s outside the scope of the company's official corporate strategy (focused on semiconductor memory products) and in relation to a set of new market segments (electronic calculators and other embedded applications). The growth of microprocessors as specialty products drove further development of Intel's distinctive competencies, especially in circuit design; and by the mid-1980s, Intel had moved from a silicon-based distinctive competence in memory products to a distinctive competence in implementing design architectures in logic products. As long as they remained niche products, however, top management was not ready to embrace microprocessors as its new core business because the sum of these relatively small niches was not viewed as equivalent to the large DRAM business. Hence, between 1982 and 1985 Intel's induced strategy process remained in disarray as top management was uncertain about how to proceed. The rapid growth of the

IBM PC business, however, facilitated top management's decision to exit the DRAM business and focus the company on microprocessors. By 1985 top management officially adopted microprocessors for the PC market segment as Intel's new core business.

***P*-controlled industry change: Intel's sole source strategy**

It was not until after Intel had provided the first two generations of microprocessors for PCs (8088 and 286) under cross-licensing arrangements imposed by IBM, Intel's largest original equipment manufacturer (OEM) customer, that top management realized that it was in effect giving away its designs to the competition (second-source agreements had generally been a strong industry legacy practice). Intel funded the development of next-generation processors and the cross-licensees expected to get those designs for free from Intel because the OEM customers basically demanded it. Hence, Intel's rivals got a free ride. And, in spite of its innovative design work, this arrangement made it difficult for Intel to take a significant share of the PIE. When Intel tried to change the arrangement, asking for compensation from second sources, these rivals declined. Rivals were ready to wait until the Original Equipment Manufacturer (OEM) customers would browbeat Intel into giving the designs away. Consequently, Intel insisted on becoming sole source supplier to the OEMs. This strategic action was rule-changing because it fundamentally changed the balance of power between Intel, its OEM customers, and its competitors. Fairly quickly this led to a major shift of influence toward Intel in terms of its ability to set industry-wide standards and to appropriate a rapidly increasing share of the PIE.

It worked because of the emergence of new patterns of behavior in the PC market segment associated with increasing returns to adoption and the "horizontalization"

(Grove, 1993; Farrell, Monroe, and Saloner, 1998) of the computer industry. These new patterns favored Intel because of the strong product-market position it had achieved as a result of IBM's efforts to create a large installed base for its PC product in the emerging personal computer market segment, whose users demanded backward and forward compatibility (they wanted to be able to continue to use their application software). This motivated independent software developers to write new applications running on Intel microprocessors, creating thereby a fast growing ecosystem around the Intel Architecture. The resulting "virtuous circle" - based on increasing returns to adoption (Arthur, 1989) - favored Intel (and Microsoft), even though it had been caused by IBM and not by Intel (and Microsoft), because Intel (and Microsoft) owned the key technological components of the PC and were free to license these technologies to other OEMs (IBM had not insisted on exclusive licensing arrangements). Consequently, Intel didn't buckle under pressure to continue to cross-license its technology.[2]

During 1987-1997, Intel successfully maintained ***P***-controlled industry change. The "Intel inside" marketing campaign, another rule-changing strategic action that changed the relationship with its OEM customers and solidified its leadership position, was instrumental in this. Still another rule-changing strategic action involved the bottom-up development and championing of Intel's chipset business around a new technology coming out of the Intel Architecture Labs. Traditionally, specialized companies and the major OEM customers developed most of the chipsets for Intel's microprocessors. Top management initially wanted to introduce the new technology into the industry through a consortium effort. The general manager of Intel's declining chipset division, faced with

highly mature products, however, successfully engaged in an autonomous strategic effort to turn chipsets into a major Intel business. Having gained strategic control of the chipset business turned out to be extremely important at the time of the ramp-up of Intel's new Pentium product line.

Potential runaway industry change: The battle of RISC versus CISC within Intel

Reduced instruction set computing (RISC) had been developed in IBM's research labs in the early-to-mid 1970s, but it was MIPS Computer Systems, a Silicon Valley startup that attempted to commercialize this alternative microprocessor architecture in the mid-1980s for workstation computers. Soon thereafter several other companies, including Sun, HP, IBM, and DEC began work on their own RISC architectures. During the late 1980s, the workstation market segment had settled on RISC-based machines, and many technologists had become convinced that the performance advantage of RISC would eventually make complex instruction set computing (CISC) obsolete. Intel's vice president of corporate marketing, for instance, confirmed that in the late 1980s Intel, whose microprocessor architecture was CISC based, was perceived as a technology laggard and that this hurt the company's growth in the workstation market.

In the late 1980s, Intel's official corporate strategy had been not to enter the RISC business, but rather to focus its induced strategy process on its x86 (CISC) architecture. The sole-source strategy for the 386 processor was highly successful, and with the upcoming 486 microprocessor Intel was poised to further strengthen its position as the architectural leader in the early 1990s. Intel top management called RISC "the technology of the have not." Operating autonomously, however, a young engineer had

been attempting to get Intel into the RISC processor business ever since joining the company in 1982. He ventured to sell the design for the i860 processor to top management as a co-processor for the 486 rather than as a stand-alone processor. By the time top management realized what their "co-processor" was, he and two other champions had already lined up a workstation customer base that was different than the companies who purchased the 486 chips. Thus the i860 team could argue that they were broadening Intel's business rather than cannibalizing it. Even though top management had not officially sanctioned its development, Intel did in fact introduce the i860 as a stand-alone RISC microprocessor in February 1989. At the time, a top-level executive pointed out that RISC was still viewed as relatively less important than CISC in Intel's strategy, but that its availability made it possible for Intel to be a strong competitor in what might become an important new market.

The threat of RISC, however, took a different form than envisaged by the RISC supporters within Intel. Some industry observers interpreted the introduction of the i860 as a signal that Intel was endorsing RISC. But this could confuse Intel’s existing PC OEM customers, who might fear that Intel would reduce support for the x86 architecture in the future. That fear was not unfounded. The RISC team within Intel had created a strong following. Distinct CISC and RISC camps had formed and they were competing for the best engineering talent of the company. The RISC effort siphoned off hundreds of people just on the marketing side. By 1989, RISC-based processor development had begun to absorb about one third of the total resources allocated to microprocessor development. The two camps were also trying to gain allies in the industry (Microsoft

encouraged the i860; Compaq opposed it). The battle between CISC and RISC within Intel had turned into “civil war.” RISC proponents prepared a development trajectory showing the Intel Architecture transitioning to RISC after the 486 and wanted to rename the i860 processor 486r to facilitate the transition. But in response to serious concerns by Intel’s VP of Marketing and other senior executives, top management decided that the i860 could not be re-named 486r. Eventually, the i860 was not successful because demand for it petered out as every workstation vendor decided to develop its own RISC processor. By 1993, most of the technical people of the i860 team had left Intel. Intel, however, succeeded in retaining many members of the team who had honed skills in ecosystem development.

Looking back, this was a confusing period for Intel. The i860 was a very successful renegade product that could have destroyed the virtuous circle enjoyed by the Intel Architecture. Intel was helping RISC by legitimizing it. Yet the company was dabbling, trying to be the best of the second best. A key lesson was that not all purported “paradigm shifts” are in fact paradigm shifts. Another key lesson concerned Intel’s strategy-making process. Positively, it looked like a Darwinian process: Top management lets the best ideas win, adapts by ruthlessly exiting businesses, provides autonomy and is the referee who waits to see who wins and then re-articulates the strategy, and matches evolving skills with evolving opportunities. Negatively it looked like Intel is reactive, lacks focus and has no constancy of purpose. It looked like chaos – ready to reigned in. And so it was.

Having concluded that RISC did not constitute a paradigm shift, top management determined to fully exploit Intel's favorable strategic position by vectoring everybody in the same direction through the induced strategy process. Intel's subsequent success with its highly focused strategy during 1991-97 then created "co-evolutionary lock-in" (Burgelman, 2002a) with the PC market segment. However, the associated strategic inertia then impeded the company's autonomous strategy process. As a result, when the PC market segment growth started to slow down by 1998, the company experienced difficulty in extending itself into new directions for continued profitable growth.

New *P*-controlled industry change: Intel's "right hand turn"

As described above, during 1987-1997 Intel grew very successful by developing new microprocessors along the performance dimension, mainly by increasing clock speeds. Their success informed the expectations in the market for market processors, a clear example of ***P***-controlled industry change. However, toward the end of the decade the market was beginning to place less value on high performance (customers still liked higher speed but were reluctant to pay for it). Also, by the early 2000s Intel's traditional rival had begun to catch up on the speed dimension. Intel had in some ways come full cycle. It faced a second *stable industry structure* situation, this time in the core microprocessor business. It was a favorable one given its market segment share, but nevertheless one in which competition had become narrowly defined in terms of bringing out the faster microprocessor the fastest in the newly tightened race with the traditional competitor. Consequently, Intel began to broaden its view of microprocessor performance along different dimensions, primarily power consumption and communications capabilities. Top management referred to this as a "right hand turn," and

indeed it did signal a major course change for the company and provided the opportunity for a repeat of ***P***-controlled industry change.

A key ingredient in this right hand turn was the acquisition of communications capabilities. This came about as a result of moves by Intel's new CEO, who felt the need to turbo-charge the company's autonomous strategy process. In 1998, top management concluded that the microprocessor business by itself would not be able to sustain the company's future growth objectives. During 1998-2001, top management encouraged and supported initiatives in many different directions and spent many billions of dollars on acquisitions. Most of these ventures failed. However, some of them did significantly augment Intel's distinctive competences in communications technologies, which was important in view of the rapid convergence of the computing and wireless communications industries.

It is important to note that in spite of the sharp declines in Intel's revenues and profits during the early 2000s information technology slump, the Board of Directors decided to let top management maintain cash reserves sufficient to cover one year of R&D and one generation of capital investments. Maintaining sufficient financial reserves gave the company enough resources to fully pursue the existing opportunities in the induced strategy process through continued heavy capital and technology investments, and a time buffer to decide which new strategic direction to take.

At the time of the “right hand turn,” Intel’s Mobile Computing Group (MPG) had already begun to work autonomously on developing a Pentium processor architecture optimized for the mobile PC. In late 2002, the group launched a project codenamed “Banias,” a new mobile PC microprocessor featuring an entirely new micro-architecture. The Banias project was designed to provide PC makers with ingredients to build mobile PCs with extended battery life, improved performance, reduced/varied form factors, and easier-to-use wireless connectivity. A PC based on Banias would include Wi-Fi capability through a communication device codenamed “Calexico,” which contained the first 802.11 chips made by Intel.

It is important to note that the performance dimensions that the MPG sought were in conflict with those that had driven Intel's success in the past, particularly in the desktop market segment. One of the leaders of the group said: “Being located in Israel both helped and hurt the effort to convince the company to pursue mobility. The Israeli team has a ‘renegade’ culture, so we were very open to the idea of mobility in the first place. However, being in Israel, far apart from Intel’s HQ, made it difficult to convince the company to move toward mobility. It took blood, sweat and tears.” He also said, however, that the effort was greatly helped by the fact that top Intel executives were concerned that the microprocessor was starting to use too much power, particularly in power-sensitive environments like mobile PCs, and that the CEO found the idea of a low power microprocessor very appealing (Burgelman and Meza, 2003).

In early 2003, Intel publicly launched Banias by for the first time branding a combination of technologies under the “Centrino” name. Intel decided to bet on Centrino and subsequently spent several hundred millions of dollars helping develop the “hot spot” infrastructure necessary for mobile users to take advantage of the Centrino capability in places ranging from airports to Starbuck coffee shops. The company also invested several hundred millions of dollars in 2003 and 2004 marketing Centrino. The investment paid off. Not only was Intel able to successfully launch a new, system-level brand, but Intel’s laptop and notebook computers with the Centrino capability increased the worldwide market segment for these types of computers, commanded higher average sales prices, and increased Intel’s share of the product’s bill of materials. In 2005, the success of the mobile group’s initiative was helping drive Intel toward becoming a “platform” company.

STRATEGIC LEADERSHIP OR LEADERSHIP STYLE - WHAT DID WE LEARN?

Our longitudinal study of Intel’s evolution focused on turbulent periods in the company’s history, when the existing equilibriums between it and its environment became undone, and strategic dynamics were nonlinear. Our framework of strategic dynamics (Figure 1) helped identify the challenges that different nonlinear dynamics situations pose for top management. We were able to link these to our framework of induced and autonomous processes, and our findings suggest that the most important contribution top management can make is to appropriately balance induced and autonomous strategy processes to meet the challenges of different strategic dynamics situations.

Accumulating resources

Our research also attempted to track Intel's developmental resource allocation to get an indication of how the company managed the balancing of induced and autonomous strategy processes throughout its evolution. We found that it was difficult to find information about conscious and formal decisions about developmental resource allocation to autonomous initiatives. This should perhaps not be surprising given that such initiatives, by definition, are not "planned." Based on the second author's executive experience and with the help of Intel's senior finance staff, however, we were able to roughly estimate the percentage of developmental resource allocation to induced and autonomous strategy processes at critical times in Intel's evolution. Table 1 shows these estimates.

Table 1 About Here

We can see that most of the time a surprisingly large proportion of the company's developmental resources have been deployed in autonomous activities. It seems that companies naturally generate a "portfolio" of autonomous initiatives. Autonomous initiatives tend to emerge as middle managers search for opportunities to sustain their business in the face of internal and external selection pressures, and find resources that are not completely absorbed by the induced strategy process and use them for their initiative. For example, in the ***P***-independent industry change situation, middle level managers allocated manufacturing capacity away from DRAM to microprocessors (even though the official corporate strategy was still focused on memory products); in the ***P***-controlled industry change situation, the chipset business development was initially

funded by the general manager of a division that was on the decline with cash generated from its very mature products; in the potential *runaway* industry change situation, the RISC team was able to get almost a third of the company's microprocessor development resources even though top management had not made a corporate-level strategic decision to pursue RISC; In a recent ***P***-controlled industry change situation, Centrino grew out of a design team in Israel that faced disbanding, and the project was helped by the autonomous development, also in Israel, of a specialized chipset.

It is instructive to follow this development. What started as an autonomous initiative with Centrino during the tenure of one CEO became the driving force of the induced strategy process - by the name "platformization" - under the next CEO in early 2005. With the autonomous initiative of the last several years having become the driving force of the new induced strategy process, a new cycle of autonomous initiatives emerged; for example an effort to develop digital products for health care applications, which by year end represented about 2 percent of development spending.

Table 1 suggests that companies might be engaging in significantly more autonomous activity than is generally believed. This may surprise many management experts, who, as March (2006: 211) points out, tend to presume that the level of "exploration" is usually less than would be optimal. Yet, most of them don't contribute significantly to the longevity of the company. This has several important implications. Most likely it is far more difficult for strategic initiatives to be truly effectively induced by the corporate

strategy than is generally understood. And, it poses distinct challenges related to resource allocation and top management control.

Scaling up and vectoring resources

In order to take advantage of the portfolio of autonomous initiatives we propose that it is necessary for top management to adopt an approach of experimentation-and-selection with novel ideas that initially require only small bets (e.g., Burgelman, 1983; March, 1991, 2006). Such an approach implies that middle mangers must be able to engage in autonomous initiatives before they actually have formally obtained resources to do so. However, since autonomous initiatives start small they need to scale-up in order to be relevant from the corporate strategy point of view. Scaling up depends on the capacity of middle-level executives to build on the initial success of an initiative by combining it with other autonomous initiatives from different parts of the company (often existing there as "orphan" projects), and/or with relatively small acquisitions. Such activities require "strategic context determination," which, however, is beyond the purview of middle management. It is top management, who must evaluate how these initiatives fit into, or reshape or even radically change, the corporate strategy going forward.

We also propose that as an autonomous initiative gains impetus in the strategy-making process, a critical top management *strategic* role is to evaluate first, the extent to which the autonomous opportunity has been validated (through the process of strategic context determination), and second, the extent to which available cash reserves are sufficient to protect the company from disaster in case the scaled-up autonomous initiative ultimately fails. This suggests four possible strategic choices: (1) "safe bet:" validated opportunity

and sufficient cash reserves; (2) “bet the company:” validated opportunity but insufficient reserves; (3) “wait to bet:” not-yet-validated opportunity and sufficient cash reserves; and (4) “desperate bet:” not-yet-validated opportunity and insufficient cash reserves. Figure 2 shows the four strategic choices.

Figure 2 About Here

Even though Intel lost almost 200 million dollars in 1986, when top management decided (in 1985) to give up on the DRAM business and re-focus the company on microprocessors for the PC market segment it was already a “safe bet;” while if done a few years earlier, it would have been a “bet the company” move. Having sufficient cash reserves but not yet being sure about the potential competitive threat of RISC, Intel decided to “wait to bet” for a while, but put restraints on the autonomous initiative (for example, no renaming of the i860) until strategic context determination took its course (the autonomous RISC initiative died out). Intel’s decision to move to a platform strategy based on the success with Centrino is another example of a “safe bet.” (So far, Intel has not faced a “desperate bet” strategic choice.)

Strategically balancing induced and autonomous processes

Based on our analysis of Intel’s evolution, we propose that different strategic dynamics situations call for different balances of induced and autonomous strategy processes. In the base case of *limited industry change*, $\boldsymbol{P_i}$ must continue to exploit the opportunities associated with the current corporate strategy, which is achieved through the induced strategy process. $\boldsymbol{P_i}$’s sustained profitable growth, however, depends on being able to continue to develop new business opportunities to replace declining ones over time,

which requires an active portfolio of autonomous initiatives and a commensurate degree of accessible uncommitted resources and looseness of managerial control. Hence, top management should watch evolving growth opportunities and marginally re-balance resource allocation to the induced and autonomous processes.

In the case of ***P****-independent industry change*, the autonomous strategy process becomes key. As other players are able to engage in rule-changing strategic action, $\boldsymbol{P_i}$'s induced process does not readily respond to these changes because of strategic inertia. But even if $\boldsymbol{P_i}$ could adapt to the changing basis of competition it is unlikely that it would be better than an also-ran. Ultimately, $\boldsymbol{P_i}$ is better off pursuing new opportunities created by the autonomous strategy process that continue to capitalize on the company's distinctive competencies. Hence, top management should significantly increase resource allocation to the autonomous strategy process to generate a higher rate of new initiatives in the portfolio, and gradually increase resource allocation to winning initiatives before existing opportunities in the induced process wither away.

In the case of ***P****-controlled industry change* the induced process becomes key. While opportunities for $\boldsymbol{P_i}$'s potential rule-breaking strategic actions often can be traced back to initiatives that started in the autonomous strategy process, ***P***-controlled change requires that $\boldsymbol{P_i}$ align the internal and external forces to its advantage and massively increases resource allocation to the induced strategy process. As a result, however, successful ***P***-controlled change may make it difficult to pay attention to future new business opportunities. Hence, top management should continue to allocate a minimum amount of

resources to keep the autonomous process viable and maintain at least a limited portfolio of autonomous initiatives.

The extreme uncertainty of r*unaway industry change* creates a resource allocation conundrum because $\boldsymbol{P_i}$ cannot support both processes at increased levels simultaneously. Top management must decide between two different courses of action with respect to the balance of induced and autonomous processes. If $\boldsymbol{P_i}$ already has a validated new opportunity to make a "safe bet" or "bet the company," the induced strategy process is key to impose a new strategic direction. If $\boldsymbol{P_i}$ does not yet have a validated new opportunity and decides to "wait to bet," the autonomous strategy process is key for discovering a viable new strategic direction. Figure 3 summarizes our proposed appropriate balancing of the induced and autonomous strategy processes for each of the strategic dynamics situations.

Figure 3 About Here

IMPLICATIONS AND CONCLUSION: STRATEGIC LEADERSHIP AS THE EXPRESSION OF LEADERSHIP STYLE

Collins (2001) defined great companies as those 11 that for a period of 15 years after a major transition were able to achieve average cumulative stock returns at least 3 times those of the overall stock market.[3] He and his research team found that such enduring greatness depended on "level 5" leadership style: "a paradoxical blend of personal humility and professional will." Such leaders "get the right people on the bus before they figure out the best path to greatness;" are willing to "confront the brutal facts without

losing faith;" pursue a fairly simple core business in which they can be the best in the world, feel passionate about, and get tremendous profits on a carefully chosen denominator (the "hedgehog concept"); develop a culture that combines discipline with entrepreneurship; and pioneer the use of carefully selected technologies to accelerate their profitable growth. Rather than the result of dramatic transformations, the process that generates greatness is metaphorically described as "…relentlessly pushing a giant heavy flywheel in one direction…" (2001: 14).

While academic researchers have pointed at potential weaknesses in Collins's methodology, for instance, the fact that "long leads in random walks" may produce sustained interfirm performance differences based on chance only (Denrell, 2004), this is not our concern here.[4] We do, however, note that Collin's large sample study, while thorough and capably carried out, did not examine the role of balancing cycles of induced and autonomous processes in the long-lived success of the companies studied, and thus may have missed a deeper and primal reinforcing relationship between leadership and strategy-making process.

The strategic management field has long been interested in developing a truly dynamic theory that explains how superior competitive positions are attained longitudinally (Porter, 1991). While Collins's study finds, surprisingly, that strategy does not play a decisive role, we think the paradox is resolved if what sets apart such leaders is the ability to design a strategy-making process that is capable of effectively balancing induced and autonomous strategy processes to meet the various strategic dynamics situations that their

companies unavoidably face as they evolve. Like the phenotype is the expression of the genotype in biology, we propose that *strategic* leadership is the expression of Collins's level 5 leadership *style* in organizations.

Alert strategic leadership is cognizant of the important role of both induced and autonomous processes in strategy-making, tolerates a sufficient level of uncommitted resources and looseness in control to continue to maintain a portfolio of autonomous initiatives, and is able to select at the right time those that need to be converted to the discipline of the induced process in order to cope with nonlinear strategic dynamics. We think that our framework of different strategic dynamics situations may help top management to better identify the associated challenges and match the dynamics of the internal machinery of strategy making - characterized by the balance of induced and autonomous strategy processes – with the dynamics of the external ecology in which the company operates. Our fundamental proposition is that corporate longevity depends on the coincidence, at different key moments in a company's evolution, of such alert strategic leadership and the complex, on-going cycles of induced and autonomous processes that renew the organization and keep it viable.

Our confidence in this fundamental proposition is bolstered by the fact that it parallels insights from formal theories of complex adaptive systems. Prigogine (1980: 128), for instance, observes that the continued evolution of complex adaptive systems depends on "mutations" and "innovations" occurring stochastically (in our terms: generated through the autonomous process) and becoming integrated into the system by the "deterministic

relations prevailing at the moment" (in our terms: becoming part of the induced process). Similarly, it parallels the idea of "adaptation at the edge of chaos," (Kauffman, 1993) which suggests, in Gould's succinct translation "… that a system must be adaptive, but that too much (and too precise) a local fitting may freeze a system in transient optimality with insufficient capacity for future change. Too much chaos may prove fatal by excessive and unpredictable fluctuation, both in external environments and internal states. (…) Adaptation at the edge of chaos balances both desiderata of current functionality and potential for future change, or evolvability." (2002: 1273-74).

Achieving such a balance by design as compared to evolution is difficult and requires the juggling of opposing tendencies. Lining up potentially diverging strategies and keeping them lined up through the induced strategy process is itself a demanding task. Yet, as we have seen in the Intel case, the company must also prepare itself for the next big opportunity by continuing to let middle management experiment with, and then select, new strategic initiatives through the autonomous process before converting them to the discipline of the induced process. The appropriate balance of induced and autonomous strategy processes at different times in a company's evolution may be thought of in terms of linear combinations of the two processes, with varying weights on each of them over time, but with none of the weights ever becoming zero. Finding the right weights for each time period is the supreme challenge of top management. The process of changing these weights can be characterized by the exhortation that during times of nonlinear change, management should let chaos reign, then rein in chaos -- but, as we have learned, never quite completely.

NOTES

[1] These 19 survivors of the top 100 of 1965 are: General Motors, Exxon Mobile, Ford Motors, General Electric, IBM, Chevron Texaco, Boeing, Procter & Gamble, Lockheed Martin, Conoco Philips, United Technologies, Dow Chemical, Caterpillar, DuPont, International Paper, Honeywell International, Alcoa, Coca Cola, and Weyerhauser.

[2] It is interesting to note that IBM probably lost its power because it did initially not recognize the enormous growth potential of the PC market segment (neither did Intel). This is probably why IBM did not insist on an exclusive technology licensing agreement with Intel. IBM was of course interested in keeping prices for microprocessors low and did insist that Intel cross-license its technology to other manufacturers. Without the constraint of an exclusive licensing agreement with IBM, Intel could sell its microprocessors to other PC manufactures, such as Compaq. Hence, if IBM did not want to bring to market PCs with the next generation Intel microprocessor, these other manufactures could; and given the importance of backward compatibility to customers (they wanted to continue to use the application software they had bought for the previous PC generation). This created the "virtuous circle" that gave Intel the power to adopt a sole source strategy as of the 386 microprocessor generation, and IBM little choice but to go along.

[3] Intel was not part of the set of great companies. As Collins put it, "Most technology companies were eliminated from consideration because they are not old enough to show the good-to-great pattern. We required at least thirty years of history to consider a

company for the study (fifteen years of good results followed by fifteen years of great results)… Intel, for example, never had a fifteen-year period of only good performance; Intel has always been great. … ”(2001: 213).

[4] Since 2001, of the 11 “good-to-great” companies, two were acquired (Gillette by P&G, and Wells Fargo by Norwest); six have underperformed, or performed at the level of, the S&P 500 (Circuit City, Fannie Mae, Kimberly Clark, Kroger, Philip Morris, ands Pitney Bowes); and three have continued to outperform the S&P (Abbott, Nucor, and Walgreens).

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Figure 1 A Framework of Strategic Dynamics

	P's Strategic actions	
	Rule-abiding	Rule-changing*
Rule-abiding	**Stable industry structure**	***P*-controlled industry change**
(***E*, *e***)'s Strategic actions		
Rule-changing	***P*-independent industry change**	**Runaway industry change**

***** Rule-changing actions have the potential to change the competitive context for all the players (they materially change the competitive value of existing product-market positions and/or distinctive competences of the players).

Table 1: Percentage of Developmental Resources Allocated to Induced and Autonomous Strategy Processes at Critical Times in Intel's Evolution*

	1976[1]	1984[1]	1989[2]	1991[2]	1998-2001[3]	2003[4]	2005[4]
Induced (I):	75	65	66	87	65	70	50
Autonomous (A):	25	35	34	13	35	30	50

* As estimated by the second author, based on personal experience and company documents

[1] I = memory related; A = microprocessor related
[2] I = x86 microprocessor related; A = non-x86 (RISC) microprocessor related
[3] I = x86 microprocessor business related; A = related to networking and communications businesses
[4] I = pure microprocessor business related; A = platform-business related (including Centrino)

Figure 2: Top management strategic choices related to autonomous opportunities

		Autonomous Opportunity	
		Validated	Not-yet-validated
Cash Reserves	Sufficient	**Safe bet**	**Wait to bet**
	Insufficient	**Bet the company**	**Desperate bet**

Figure 3: Matching Induced and Autonomous Processes to Strategic Dynamics Situations

	STRATEGIC DYNAMICS SITUATIONS				
	Stable Industry Structure (Base Case)	***P*-independent Industry Change**	***P*-controlled Industry Change**		**Runaway Industry Change (Uncertainty)**
Induced Strategy Process	Serves to exploit core business opportunities	Serves to retreat orderly from core business	**KEY:** Serves to exploit new major opportunities through "vectoring" the organization in the new strategic direction	**KEY:** Serves to align the organization behind a "safe bet,"[1] or "bet the company"[2] strategic direction **OR**	Serves to maintain alignment during "wait to bet"[3] decision
Autonomous Strategy Process	Serves to explore potential new growth opportunities	**KEY:** Serves to develop new opportunities consistent with distinctive competence in advance of threats to current ones	Serves to continue to explore potential new future growth opportunities	Serves to reduce uncertainty of new possible strategic directions before betting on one	**KEY:** Serves to continue to experiment with new opportunities While waiting to bet

[1] *Safe bet* = validated opportunity and cash reserves; [2] *Bet the company* = validated opportunity and no cash reserves; [3] *Wait to bet* = not-yet-validated opportunity and cash reserves.