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# HIGH-TECH HIDEBOUND: CASE STUDIES OF INFORMATION TECHNOLOGIES THAT INHIBITED ORGANIZATIONAL LEARNING

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**Abstract**—Using case studies, the paper demonstrates that heavy reliance on information technology can impair a firm's capacity for organizational learning. After defining organizational learning, recent findings in the theory of complex systems are explored. In a complex environment, it is concluded, firms must simultaneously (a) structure their operational activities to ensure efficient self-regulation, and (b) engage in ill-structured scanning to ensure organizational learning.

Cases studies of two firms, Batterymarch Financial Management and Mrs. Fields' Cookies, are then presented. Both firms experienced explosive growth, and, through innovative use of information technology, enjoyed substantial productivity advantages over their competitors. Both firms, however, entered unexpected periods of decline in the mid- to late-1980s, from which they never emerged. The declines are explained as failures of organizational learning, precipitated by information systems that inadvertently sacrificed important environmental scanning activities in order to achieve efficient self-regulation.

*Keywords:* Batterymarch, Mrs. Fields' Cookies, Organizational learning, Complexity, Complex adaptive systems, Information technology impacts.

## INTRODUCTION

During the late 1970s and early 1980s, a number of firms began developing information technology applications that served to drastically reduce their middle-management and professional ranks. By the mid-1980s, several of these companies had experienced huge productivity benefits, achieving revenue-to-employee ratios several times those of their competitors. Their technology also enabled the companies to go through sustained periods of explosive growth without loss of control or the development of bloated bureaucracies. Two of these companies, Batterymarch Financial Management and Mrs. Fields' Cookies, were particularly noteworthy in their success. As a consequence of their rapid growth, spurred by their innovative use of information technology, they gained considerable recognition in the business and academic press. They were, in fact, cited as being prototypes for the "organization of the future" (e.g., Handy, 1990; Scott Morton, 1988). Shortly after receiving these accolades, both companies entered periods of deteriorating performance that have persisted to the present day.

The present paper considers the question of how the information systems developed by these companies affected their capacity for organizational learning. After choosing a definition of organizational learning grounded in the work of Argyris and Schon (1978), we explore recent findings in the theory of complex systems, along with their implications for organizational learning processes. The cases of the two firms are then considered, emphasizing the role information technology played in their rise and fall. Evidence is then presented that the very reliance on technology that led to initial success for both companies inhibited their long-term ability to learn about their environments. The cases therefore serve to alert managers of a potential danger: that heavy reliance on computers to achieve efficiency can, as a side-effect, seriously diminish organizational learning capacity.

## LEARNING IN COMPLEX ENVIRONMENTS

The objective of the present paper is to present examples of how applying information technology to "streamline" middle-management can affect organizational learning capacity in complex environments. Prior to considering specific cases, however, it is useful to clarify certain terms and to present a framework for analysis. Specifically, we consider:

- Definitions of organizational learning;
- Findings relating to the behavior of complex environments;
- Mechanisms for self-regulation and organizational learning in complex environments.

### *Definitions of organizational learning*

Considerable ambiguity exists regarding what constitutes organizational learning. Huber (1991) asserts that a very broad view should be taken, and that any time the participants in an organization acquire any knowledge—whether or not it is put to use or is widely distributed—some learning has occurred. At the opposite extreme, Weick (1991) observes that stimulus-response definitions of organizational learning have been proposed, whereby learning can be presumed to occur only if an organization responds differently to the same stimulus when it occurs on different occasions. He notes, however, that identical stimuli rarely, if ever, occur in "real world" situations, thereby limiting the practicality of such definitions.

A common compromise between the two extremes is to view organizational learning as coming in two forms: learning which does not require significant organizational restructuring and learning that requires significant modification of organizational structure/strategy/norms. Argyris and Schon (1978), for example, refer to these as single-loop and double-loop learning, respectively. Lant and Mezias (1992) make essentially the same distinction, referring to them as first-order learning and second-order learning. Buckley (1981) distinguishes between self-regulation and adaptation, the former involving minor modifications to existing structures (i.e., "structure maintenance," p. 179), the latter changes to system structure. March and Simon (1958) offer a dichotomy between "reproductive" and "productive" problem-solving, noting that the former can generally be accomplished within the framework of existing organizational programs, whereas the latter is likely to entail significant general problem-solving activities. Cyert and March (1963) distinguish between an organization's short-run behavior, which involves essentially unchanging goals, attention rules and search rules, and long-run behavior, which incorporates the adaptation of the goals and rules that govern short-run behavior.

For the purposes of the present paper, the dual model of organizational learning proves very useful. Specifically, we adopt Argyris and Schon's (1978, p. 14) view that the "norms, strategies, and assumptions," which are actually exhibited by an organization together constitute a theory-in-use. We use *organizational learning* to mean the processes through which an organization's theory-in-use is changed over time. Buckley's (1980) term *self-*

*regulation*, in contrast, is used to refer to those processes through which the organization reacts to its environment without significant modifications to its theory-in-use.

### *Complex environments*

At the heart of an organization's theory-in-use is its model of the external systems with which it interacts, collectively referred to as the environment. In the past few decades, there has been a growing perception that such models have grown more difficult to construct—a direct consequence of the environment's increasing tendency towards abrupt change. There are numerous examples of macroeconomic phenomena that exhibit such sudden, unpredicted, change (e.g., the stock market crash of 1987, oil and sugar price spikes in the 1970s). Peters (1987, p. 3) observes that the same types of sudden shifts may be experienced at a microeconomic level, ruefully commenting that "IBM was declared dead in 1978, the best of the best in 1982, and dead again in 1986. People's Express is the model of the 'new look' firm and flops 24 months later." Handy (1990) premises his theory of organizational design on the assertion that change is becoming increasingly discontinuous, meaning that rapid and unexpected shifts in our world are now commonplace. Virany, Tushman, and Romanelli (1992) discuss how firms go through long periods of convergence punctuated by reorientations, the need for which is a function of environmental turbulence. Drucker (1980, p. 3) states that the firm's "capacity to survive a blow, to adapt to sudden change" has become increasingly critical in today's environment. Further, there is a widespread consensus that we are currently living in a period during which the rate of such changes is rising (e.g., Dertouzos, Lester, & Solow, 1989; Drucker, 1980; Lawrence & Lorsch, 1967; Peters, 1987; Toffler, 1970).

Recent research in the field of complex adaptive systems (e.g., summarized in Waldrop, 1992) provides a conceptual framework for understanding the behavior of our increasingly discontinuous environment. In particular, it has been observed that most systems—be they physical, biological, or social—fall into one of three patterns of behavior: ordered, chaotic, or complex. The differences in behavior between the three types of systems prove to have profound implications for organizational learning.

The simplest type of system to describe is an *ordered* system. Such systems typically exhibit two important properties: (a) their behavior can be predicted indefinitely with a model that is sufficiently refined, and (b) small variations in system parameters lead to changes in system behavior that are proportional (i.e., linear or log-linear) to the amount of parameter variation. These properties have important implications. Refinements that improve the model of such a system, for example, will accordingly lead to improved predictions of system behavior. Sensitivity analysis can also be applied to such systems (e.g., if $X$ dollars in advertising produces an increase in sales of $Y$ percent, then $1.1X$ dollars produces approximately $1.1Y$ percent). These properties of ordered systems make them extremely tractable, permitting linear models of environmental behavior to be formulated. Also, once a working model of an ordered system has been established, there is diminished need for further model-building activities, as the behavior of the system persists indefinitely. Unfortunately, there is little evidence that such an "ordered-system" characterization is applicable to most environments encountered in the modern age.

The polar opposite of ordered-systems are *chaotic* systems. These systems are deterministic, yet are inherently unpredictable because their behavior is (a) extremely dependent upon the initial states of all parameters in the system, (b) small variations in parameters lead to non-linear changes in system behavior. To understand the nature of such systems, consider the behavior of a roulette wheel. What would be required to predict its behavior? Most critical, of course, would be extremely accurate measurement of a host of system parameters (e.g., speed of wheel, friction coefficients associated with its bearings, speed and angle of ball at time of release; air temperature, wind, humidity). Even so, however, we would find that the slightest error in measurement, or the tiniest perturbation to the environment (e.g., a truck driving by a block away) could lead to an *entirely different number* (i.e., one not linearly related to the original number) coming up, because microscopic changes in trajectory are amplified dramatically when the ball starts hitting the slots on the moving wheel.

A rich body of research has emerged around the study of chaotic systems (e.g., see Gleick, 1987). Although considerable progress has been made in identifying interesting properties of such systems (e.g., scaling properties of certain systems, "strange attractors," universal constants), the problem of *predicting* the behavior of such systems remains largely intractable. Thus, it is nearly impossible to develop a reasonable long-term model of systems exhibiting a strong chaotic component, such as the weather. As a consequence, in a chaotic environment, the organization will have reason to distrust whatever "environmental model" it has formulated. Accordingly, the importance of changes to the model tend to be down-played, meaning they will not serve as impetus for significant changes to other aspects of the organizational theory-in-use.

Sharing certain characteristics of both orderly and chaotic systems are *complex* systems. Like orderly systems, they may exhibit extended periods of behavior during which they are adequately described by linear models. Like chaotic systems, however, certain aspects of their behavior are unpredictable. Most critically, at intervals that defy prediction, these systems tend to experience sudden changes in behavior, after which they typically return to more orderly behavior—but not necessarily the same pattern of behavior they exhibited before the change. Earthquakes, for example, occur when a long-term build-up of tectonic pressure is suddenly released, after which a new process of pressure build-up commences. Like other exemplars of complex behavior, the challenge is in modelling the transitions. Thus, although modern geology has greatly increased our understanding of the physical processes that result in earthquakes, precisely predicting their onset continues to defy our efforts.

Complex systems are theorized to be particularly ubiquitous in biology, where ordered systems are insufficiently adaptive to evolve and compete, whereas chaotic systems are too turbulent to survive (Waldrop, 1992). Complex systems theory has also been used to explain various phenomena observed in macroeconomics (e.g., Arthur, 1988; Brock, 1988; Kauffman, 1988), finance (Brock, 1988) and economic forecasting (Farmer & Sidorowich, 1988). Complex behaviors—particularly discontinuous change—have also been observed in business environments (e.g., turbulence, Edwards & Harris, 1977; punctuated equilibrium, Gersick, 1991; jolts, Meyer, 1982; high velocity, Bourgeois & Eisenhardt, 1988). Buckley (1981), more generally, argues that society itself can be characterized as a complex adaptive system. The appeal of the emerging theory is obvious: it strives to unravel not only the mysteries of adapting to change, but also to explain why such change tends to be sharp and sudden. The theory's ramifications for organizational design are also significant.

### *Self-regulation and organizational learning in complex environments*

The organization operating in a complex environment faces considerable ambiguity. On the one hand, because such environments exhibit periods of orderly behavior, there is a strong incentive to develop performance programs (March & Simon, 1958) and standard operating procedures (Cyert & March, 1963). Once in place, these programs serve to structure many organizational decision-making activities, and can greatly increase the efficiency of the firm, reducing the information processing load associated with routine decision-making. The result is both increased competitiveness and capacity for controlled growth.

The ever-present potential for sudden shifts in a complex environment cannot be ignored, however. There is evidence, both in groups (Gersick & Hackman, 1990) and organizations (Weiss & Ilgen, 1985; Louis & Sutton, 1991), that when behavior is so routinized as to become habitual, inappropriate responses to novel situations often result. Organizations must therefore also be careful to foster their potential for rapid organizational learning. Lacking such learning capabilities, the organization will be unable to adapt to the post-change environment. And inability to adapt is a formula for rapid decline, *regardless of how well the organization was suited to its pre-change environment.*

What types of organizational processes are associated with understanding, modelling and, ultimately, achieving control of changing environments? The first requirement is that environmental change be rapidly recognized. James Brian Quinn (1980, pp. 103, 105) describes the early stages of environmental scanning as follows:

> Early signals could come from anywhere, and they could initially be quite indistinct from the background noise of ordinary communications. Crises, of course, could announce themselves with strident urgency in operations control systems. However, if the enterprise waited until signals reached high enough amplitude to be sensed by formal measurement systems, smooth efficient transitions might be impossible. The organization might miss chances to exploit important opportunities in a timely way, or it could undergo traumatic losses as it dug out of crises perceived too late.

He refers to a company's ability to detect change and opportunity—existing informally, outside of established control systems—as its "network for sensing needs." March and Olsen (1976) offer a similar view, stressing the importance of interpreting ambiguous experience in organizational learning. Mintzberg, Raisinghani, and Theoret (1976) talk about a recognition phase that acts as a catalyst for invoking decision-making activities.

Once environmental change has been identified, a new model must replace the prevailing one in the organization's theory-in-use. Jaikumar and Bohn (1986), drawing from the findings in cognitive psychology, propose that knowledge of a system progresses through a series of stages. The initial set of stages involves environmental scanning activities, including identifying prototypes of desirable system behavior, determining key system attributes and learning how to measure these attributes. These activities, in the parlance of Newell and Simon (1972), entail ill-structured problem-solving, as neither the attributes of the environment nor the operators that can be used to affect the environment are clearly understood.

Once an acceptable tentative model of a system has been developed, the organization must learn what aspects of the system are under its control, and how to control them. Jaikumar and Bohn's (1986) second series of stages, aimed at achieving process control, reflect a more structured type of problem solving, making use of the attributes and relationships developed earlier to model the process. Changes to organizational structure, programs and standard operating procedures emerge during this stage, including the adaptation of information systems to the new organization/environment. Once acceptable control has been achieved, the final stage—complete procedural knowledge—is reached. This stage is characterized by formalization of all system knowledge, and the ability to program (e.g., automate) most or all activities. Where knowledge of a system is in the final stage, virtually all change can occur through the mechanisms of self-regulation.

*Conclusions: Thriving in complex environments*

Lawrence and Lorsch (1967) showed that organizations must adapt to their environments in order to thrive. The nature of a complex environment dictates an organization form with substantial capacity for both self-regulation and organizational learning. Failing to develop programs to handle routine activities, the organization will lag in efficiency. Thus, it will find itself at a disadvantage relative to its competitors, particularly if high rates of growth are to be sustained. On the other hand, the organization must be equally sure to promote unstructured scanning and problem-solving activities; the prerequisites for understanding new environments. Otherwise, those efficiency advantages gained through fine-tuning its activities to its current environment can instantly evaporate when that environment changes. And such change is inevitable, in a complex world. Unable to rapidly adapt to its new environment, the firm may find itself suddenly and unexpectedly entering a period of decline.

The balancing act between structured and ill-structured activities is further complicated by the presence of information technology. One role that such technology can play in the process of organizational learning is illustrated by the two cases in the next section.

## CASE STUDIES

How does application of information technology impact an organization's ability to learn? Such impact is likely to be highly situation-specific, with the nature of the organization involved, the nature of the technology being applied and the nature of the external environment all influencing the outcome. We now turn our attention to one such situation, where an entrepreneurial organization—operating in a complex environment—relies heavily on information technology as an engine for achieving unusually high productivity and sustaining explosive growth. Two case studies illustrating the situation are presented.

*Case: Batterymarch Financial Management*

Batterymarch Financial Management, located in Boston, Massachusetts, constructs and manages stock portfolios for individual and institutional clients, such as pension funds. The company was founded in 1969 by Dean LeBaron, formerly a fund manager with Keystone Custodial Growth Fund, and a few associates. The company's original philosophy was to apply academic research findings to portfolio management, focusing on identifying small and medium sized firms that were often overlooked by larger funds (Reich, 1985).

Initially, LeBaron's intent had been to build a firm of relatively modest size (under $200 million in managed assets), which would be run on contrarian principles. During the first 5 years of the firm's startup, however, the need to attract new business led Batterymarch to become one of the first fund managers to develop index funds, portfolios which mimicked the behavior of well-known indexes, such as the S&P 500. The availability of these new funds—combined with the company's early performance, which equalled or exceeded the S&P 500 in 5 of its first 6 years (Batterymarch Annual Report, 1986)—led to a dramatic increase in the firm's business. Within 2 years of introducing indexing, "assets under management had multiplied six-fold, to just over $1 billion" (Reich, 1985, p. 110). By 1977, the firm had largely abandoned its small-company-only philosophy, along with its desire to stay small. As a consequence, several of the original founders departed to start their own firm (Gallese, 1988), and LeBaron acquired their shares in the company. By the end of 1979, LeBaron had acquired the remaining outstanding shares in the company, leaving him in sole control (Reich, 1985).

Perhaps the key event in Batterymarch's early history was the introduction of its first computer, a Prime 300, in 1975. LeBaron soon realized the power that information technology could wield at Batterymarch, and had quickly implemented systems for stock selection and automated trading. Sometimes referred to as the "granddaddy of automated trading" (Hansell, 1987), LeBaron's aggressive use of computers to improve his company's efficiency became an industry legend. Together with his second in command, Alan Strassman, LeBaron used information technology to radically restructure the firm, from screening stocks:

> it could facilitate the quantitative stock screening that was fast becoming Batterymarch's main modus operandi. Until then, the screening had been done by running perforated paper masks over the stock tables in the *Media General Financial Daily.* Now data bases could be cranked in, and the computer could spew out lists of stocks. (Reich, 1985, p. 110)

to research:

> In the past, Batterymarch had always done a certain amount of conventional research on the stocks the screens had generated. But now LeBaron and Strassman concluded that such research could be eliminated entirely. "When we looked back at the stocks we rejected versus the ones we picked" explains Strassman, "we didn't see we were adding a hell of a lot by that exercise. And all of us had a great deal of skepticism about the value of going and calling on managements. We didn't see it adding any value. We'd rather simply take *all* stocks that had the set of major investment characteristics that we find appealing." (Reich, 1985, p. 112)

to trading:

> For more than a decade, the "trading room" of Batterymarch Financial Management has been the chips inside a Prime computer. Starting at 9:30 each weekday morning, about 25 brokers dial into the Batterymarch system and view a list of trades the firm wants to do. To execute an order, the broker enters the security, the size of the block and a price, and the Batterymarch system—with no human involvement at all—will either accept the bid or make a counteroffer. (Hansell, 1987, p. 160).

Together, these applications of computers and telecommunications led to the evolution of a firm whose structure was radically different from that of other investment management firms (Scott Morton, 1988). In place of salesmen, word-of-mouth was used to market the company. In place of traders, the phone-in order system was substituted, with pricing determined from Quotron and Telerate real-time data (Dhebar, Warbelow, & Ostrofsky, 1987). Although some traders felt the system could be manipulated, Batterymarch argued that it still outperformed a typical human trader (Hansell, 1987). Further, the system was so automated that during the Boston blizzard of 1978, "while other investment firms were shut down, Batterymarch continued to trade—even though no one was in the office" (Dhebar, Warbelow, & Ostrofsky, 1987, p. 4). In place of analysts, Batterymarch relied exclusively on publicly available electronic data for both its domestic and international investment screening. In 1987, the domestic data consisted of tapes from Compustat, Value Line, Vickers and Institutional Brokers Estimate System (IBES); for international scoring, Morgan Stanley International Capital (MSCI) was the primary source. Actual scoring used both valuation and contrarian-based models developed internally by the company, with actual portfolio optimization being done by an outside service bureau (Dhebar, Warbelow, & Ostrofsky, 1987).

The early application of information technology at Batterymarch translated directly into high levels of efficiency and performance. Because automation drastically reduced the need for both analysts and traders, its revenues per employee rose to nearly $1,000,000 (Gallese, 1988; Stern, 1983), roughly 10 times industry average (Dhebar, Warbelow, & Ostrofsky, 1987). Their automated trading system drastically reduced transaction costs, with brokers sometimes going so far as to offer "positive commissions" to participate in Batterymarch trades (Mattlin & Reich, 1987). Finally, LeBaron's automated models and scoring systems were generating outstanding results, beating the S&P 500 in 9 of the 10 years between 1974 and 1983—by over 20 points in two of those years (1977 and 1978).

As a result of these successes, Batterymarch experienced dramatic growth—reaching over $12 billion in managed assets by the end of 1983 (Beam, 1987). The company, and LeBaron personally, also received numerous accolades during this period. In Institutional Investor's 1981 "Pension Olympics," Batterymarch made the top five firms nationwide (Wallace, 1981). In 1985, LeBaron, himself, was named one of Pension World's "Outstanding Achievers" (Pension World, 1985) and was featured in a flattering cover story by Institutional Investor (Reich, 1985). Accompanying the accolades were financial rewards. LeBaron's personal compensation was approximately $20 million/year during the period, with his net worth estimated at $220 million (Gallese, 1988; Reich, 1985).

Just as Batterymarch began to appear invincible, however, cracks in its performance began to emerge. Their contrarian strategy, which had yielded spectacular results in the late 1970s and outset of the 1980s, ceased to perform well during the bull market of the 1980s. The company's domestic portfolio significantly under performed the S&P 500 during the remainder of the 1980s and early 1990s (Dhebar, Warbelow & Ostrofsky, 1987; Glass, 1992; Smith, 1990). Although LeBaron downplayed the under-performance when it first appeared in the mid-1980s—publicly asserting that it actually "confirmed the wisdom of the [Batterymarch] strategy" (Reich, 1985, p. 114)—the firm nonetheless attempted to remedy these problems, both by shifting emphasis to more traditional value-based rather than contrarian models in stock scoring, and by developing innovative international funds (Dhebar, Warbelow, & Ostrofsky, 1987). Despite these efforts, the company's performance continued to lag. In consequence, during the decade from 1983 to 1993—a period when the dollar value of managed equities grew dramatically, spurred by a three-fold increase in the DJIA and an increasing trend towards institutional rather than individual ownership of securities—Batterymarch's managed assets fell by more than 50% (Smith, 1990). Ironically, precisely 10 years after the company's top five score in the 1981 Pension Olympics (Wallace, 1981), Batterymarch found itself a member of the "major-losers" group in the 1991 Pension Olympics, for the *fifth* consecutive year (Institutional Investor, 1991).

*Case: Mrs. Fields' Cookies*

The role of information technology in the "success story" of Mrs. Fields' Cookies has become so legendary in the field of MIS that it has been whimsically granted membership in the "Information Technology Hall of Fame" (Hopper, 1990). The company was founded in 1977 by Debbi Fields who, at the age of 20, together with her husband Randy, borrowed $50,000 and opened a store selling home-baked cookies in Palo Alto, CA. Within a year, a second store opened in San Francisco and, shortly thereafter, several more stores spread throughout northern California. By 1981, the company had 14 stores (Ostrofsky & Cash, 1989).

The use of information technology was critical to the initial success and rapid growth of Mrs. Fields' Cookies. As the potential of the company began to manifest itself in the late 1970s, Randy Fields, a Stanford University graduate, economist, and computer enthusiast, moved into an active role as chairman of the company. He perceived that the newly introduced microcomputer technology could be harnessed to afford far greater control of far-flung cookie stores than could be achieved with conventional techniques. His concept, in short, was to provide expertise directly from headquarters to every store. More specifically, the goal was to create systems with embedded knowledge that was "based on Debbi Fields's personal and successful experience in running one of her first stores" (Walton, 1989, p. 39).

As the system evolved in the early 1980s, each store was given a terminal (initially a Tandy computer). The system provided managers with explicit directions for planning the day's production, sales and scheduling labor, along with conventional applications such as inventory control and ordering. It also supplied managers with utilities such as electronic mail and an employee time clock that interfaced with corporate payroll. Even traditionally qualitative activities were not exempt from automation. For example, the system provided on-line skills testing and interactive interviews, which managers were required to use in hiring employees (Ostrofsky & Cash, 1989; Walton, 1989). The terminal-based system was augmented by a sophisticated voice mail application, permitting managers to leave messages that would go directly to Debbi Fields. She personally replied to many of these messages, and frequently called store managers to converse with them and offer advice (Richman, 1987).

In an interview with the magazine *Chain Store Age Executive* (1988, pp. 73–74), Randy Fields described his philosophy as follows:

> We felt that every store needed to run the way Debbi ran her first store. What we did was to take Debbi's operational ideas and embody them in a computer . . .
>
> Store managers tend to be either great sales drivers or great cost controllers, in which case they can't drive sales. . . . I came to the conclusion that we wanted our managers to be sales drivers, and our computers to control the costs for them . . .
>
> At the store level, what we said was, "put a computer that makes every decision for the store" . . .
>
> The only thing a computer can't do is interact with people, so humans ought to do things that are uniquely human—and that's people interaction—while the computers ought to do the analysis and decision-making . . .

Fields' philosophy of automation proved highly consistent with another guiding principle of the company: to own, rather than franchise, all Mrs. Fields' stores. Ownership, which afforded the founders the control needed to ensure that all stores were run with a "feel good" approach and that the "profit motive" never worked its way to a dominant position (Ostrofsky & Cash, 1989, p. 5), had certain serious drawbacks when contrasted with franchising. Because Mrs. Fields units had much lower sales volumes than other fast food chain outlets, the company was "precluded from attempting to hire the best all-around retail store managers" (Walton, 1989, p. 43). As a consequence, lacking the incentive franchise ownership would provide, the company could only attract managers of declining caliber (*Chief Executive*, 1990).

The high turnover rate that characterized the fast food industry also worked against corporate ownership. With manager turnover rates of 100% per year (Ostrofsky & Cash, 1989), there was little time for them to learn all the complex tasks associated with operating a unit. In fact, Randy Fields was outspoken in his pessimism about the benefits of teaching such tasks, if the managers could learn them at all:

> I once heard a terrific expression: You cannot teach a pig to sing, and not only that, it wears the hell out of the pig. It's absurd to teach people who want to be salespeople to do linear programming . . .
>
> What we used to do with a store manager or any manager was to spend 90 percent of our training dollars teaching him to do tasks. Here's how to do labor scheduling. Here's how you fill out an employment application. Here's how you hire people. Here's how you do this. Eight minutes before the end of the training session, now we want to talk about how you manage people and get results. Well, there's something silly in that. (*Chief Executive*, 1990, pp. 84–85)

The early 1980s were a period of heady growth for the company. By the end of 1983, the company had 150 stores, all company-owned (McManus, 1983). By 1986, the company had opened over 300 stores and had achieved annual sales of $87 million (Richman, 1987). Particularly impressive was that, throughout the whole period of double digit sales growth in the early 1980s, the company had managed to remain consistently profitable, with 1987 earnings reaching $17.7 million on sales of $113 million (Ostrofsky & Cash, 1989). These achievements of the company did not go unnoticed, with considerable press being given to the company's unique structure (e.g., Handy, 1990; Richman, 1987; Walton, 1989), along with the fact that it had been founded by a woman entrepreneur with a unique philosophy of doing business (e.g., Fields, 1987).

The period from 1987 to 1989 witnessed a dramatic shift in the company's fortunes. Significant changes in the business climate were becoming apparent. Competition in the cookie business, which had begun to heat up in the mid-1980s (McManus, 1983), had grown intense. A vocal health movement specifically targeted cookies, tarnishing the public's perceptions of cookies and forcing major food manufacturers to reformulate their cookie recipes (*Time*, 1989). These forces led to a number of changes at Mrs. Fields, including the closing of 90 stores (Walkowitz, 1990) and the adoption of an aggressive policy of diversifying the company through acquisition. In 1987, the company acquired a 119 French bakery/sandwich chain, La Petite Boulangerie (LPB), from Pepsico (Ostrofsky & Cash, 1989). These stores were quickly integrated into the Mrs. Fields' information system:

> the soft drink giant had 53 headquarters staff people to administer the French bakery/sandwich chain's 119 stores. Randy needed just four weeks to cut the number to 3 people (Richman, 1987, p. 66)

The acquisition served as the basis for the company's foray into "combination stores," closer to a cafe in concept than a cookie store. The initial design of programs for running theses stores was based on specialists' analysis, with subsequent modifications to be made based upon the experience of senior managers, each of whom would take a turn at running a store for 2 months (Walton, 1989). Store managers who resisted taking direction from computers were "weeded out," a process that took about 8 months (O'Brien, 1990, p. 146).

The financing of Mrs. Fields' expansion had always been accomplished primarily through debt. Although the company had gone public on the London Stock Exchange in 1986, the response to its initial offering had been disappointing, perhaps because English institutional buyers were not very familiar with the company and doubted growth could be sustained without franchising (Ostrofsky & Cash, 1989). As a consequence, the company's long-term debt more than quintupled between 1986 and 1988, rising from $13 million to $70 million, with annual interest payments rising from $2.3 million to $6.0 million. The increase in interest, combined with the costs of shutting down unprofitable stores and R&D associated with developing information systems for the new combination stores, led the company to experience a loss of $18.5 million in 1988, a dramatic drop when contrasted with its $17.7 million profit in 1987.

Even after the write-offs associated with the LPB acquisition were completed, the company could not restore its former profitability. Although the company showed small profits in 1989, a downturn in the economy resulted in substantial losses being experienced in the early 1990s. These losses entailed taking on more debt, stretching the company's capacity. Lackluster performance, combined with increasing demands of lenders—such as requiring that the company begin to franchise—also placed serious pressures on the public and personal relationships of Debbi and Randy Fields. By 1990, a considerable percentage of Randy's time was devoted to his outside business, the Fields Software Group—later renamed the Park City Group, to "disassociate itself from cookies" (Fox, 1993, p. 74)—which focussed on selling his trademark software to other retail companies. In 1992, Randy left the company, leaving Debbi in complete control. In 1993, lenders forced Mrs. Fields' Cookies to go private, then to provide them with 79% of the company's stock in exchange for writing off $94 million in debt. Debbi Fields was also required to step down as president and CEO (Pogrebin, 1993).

## DISCUSSION

A number of interesting parallels can be drawn between the Batterymarch and Mrs. Fields' Cookies cases. At the outset of both cases, we find:

- An organization, managed by an outspoken entrepreneur (or, in the case of Mrs. Fields', two outspoken entrepreneurs), dedicates itself to achieving rapid growth, with strong (and vocal) commitment to information technology being a principal component of the strategy.
- One of the primary thrusts of each firm's use of technology is to streamline the organization, improving productivity and control of operations by reducing—or eliminating—layers of middle management.
- A complex environment, with rapid growth in intra-industry competition and changes in the marketplace being experienced.

The similarity extends to the outcomes of both cases, where:

- During an initial period of explosive growth, information technology serves as an engine for achieving extraordinary levels of productivity, typically an order of magnitude better than industry averages.
- Arriving at the apparent pinnacle of success, each firm experiences a reversal of fortune, with performance, sales and profitability abruptly suffering sharp declines.
- Despite numerous attempts to repair the problems, made over a period of 5–10 years, neither firm is able to restore its former luster.

In this section, we consider the pattern exhibited by both companies in the context of self-regulation and organizational learning, emphasizing the role played by information technology in each case.

### *Information technology and self-regulation*

The impact of technology on the self-regulating capacity of both Batterymarch and Mrs. Fields' was profound. In both companies, there were numerous examples of computers and telecommunications being applied to permit automatic response to environmental changes without affecting fundamental strategy or structure. At Batterymarch, for example, there was the automated trading system which, using a complex set of decision rules, automatically set prices consistent with a constant flow of market data. The company's stock scoring system, with its user-adjustable parameters such as those which determined the weights applied to each model, permitted the company to alter its buying and selling tactics without changing its fundamental strategy. At Mrs. Fields', almost every system provided to managers on their terminals served to ensure appropriate self-regulating actions were undertaken. Nor were these programs entirely mechanistic; techniques derived from artificial intelligence (AI) and expert systems (ES) were incorporated into the applications, so that the systems could recognize occurrences like a "bad day," and adjust targets accordingly (Walton, 1989).

The use of information technology for the purposes of achieving better self-regulation was not limited to the operations of the two firms. At Batterymarch, staff members played "market war games" to test their strategies before incorporating them in the formal scoring system (Reich, 1985). At Mrs. Fields', the firm's concept of what constituted the "ideal employee" was incorporated into a series of expert systems, which were then used to identify applicants who were "Mrs. Fields' kind of people" (Ostrofsky & Cash, 1989, p. 10). Conceptually, such systems can be viewed as serving the goals of self-regulation by ensuring that each future organization would be supported by models and employees that were in harmony with the current strategy, programs, and norms of the company.

The contribution of information technology to achieving the goals of automated self regulation cannot be denied for either company. Both companies survived sustained periods of unprecedented growth, far exceeding the original expectations of their founders, without losing control. Both companies succeeded in achieving productivity levels far higher than industry norms. The CEOs of both companies were quick to share credit with information technology for their achievements. Neither Dean LeBaron nor the Fields felt their companies could have succeeded as they did without the systems that were employed.

### *Information technology and organizational learning*

In order to assess information technology's impact on organizational learning in the two cases, we must address two questions:

1. To what extent can the problems encountered by the companies be characterized as organizational learning deficits?
2. To what extent can any organization learning deficits be attributed to the information technologies they employed?

Each question is now considered.

*Deficits in organizational learning.* There is considerable evidence to support the contention that a failure of organizational learning was, in both cases, a significant factor in the decline of both companies. Both companies experienced a string of successful years followed by a string of bad years. Such a pattern is more comfortably explained in the context of a process change (and subsequent failure to adapt), rather than as a purely stochastic phenomenon. There is also substantial evidence that rapid environmental change was occurring at about the time of the downturn for both companies. Batterymarch's reversal of fortune, for example, occurred at almost the precise time that the bull market of the 1980s began. It also represented the onset of a period of rapid automization in the financial services industry. Similarly, Mrs. Fields' problems coincided with market saturation in the cookie industry, the initiation of vocal nutritional movements and the onset of the "bicoastal recession" of the late 1980s, which turned into the national recession of the early 1990s. Further, the increased size and visibility of the two companies may have played a significant role in altering the environment. Being vocal market leaders, with a successful track record, their words and actions could have precipitated many of the environmental changes they experienced (e.g., the early success of Batterymarch was used as a justification for other firms to adopt computer trading).

There is also little evidence that either company actively considered organizational restructuring on a scale commensurate with the level of environmental change experienced. In the mid-1980s, Batterymarch was still trying to accommodate the market by adjusting the parameters in its existing models and by deriving new models based on its existing data sources. Even as lenders were breathing down her neck, Debbi Fields continued to assert that she would be continuing to direct the company, according to her own special philosophy (Pogrebin, 1993).

Finally, and perhaps most convincingly, even as the two companies experienced their most serious problems, their competition survived, often thriving. For example, precisely when Batterymarch started to falter, the pension and investment industry as a whole entered an unprecedented period of expansion. Many of Mrs. Fields' problems also seemed to be specific to the company (Pogrebin, 1993). In fact, when lenders finally forced the company to franchise, business in the newly-franchised units tended to improve, doubling in some cases (Matusky, 1993). It is therefore hard to argue that the two companies declined because their environments became inherently hostile. Instead, it is reasonable to conclude that failure to achieve organizational learning in a complex environment was a significant contributor to each company's downturn.

*Affect of information technology on organizational learning.* Assessing the contribution of information technology to an observed organizational learning deficit is a difficult task. Unfortunately, no crystal ball exists that allows us to see how a company would have adapted to the changing environment in the absence of its systems. It is possible to make a closely related case, however, namely that *the technologies applied at Batterymarch and Mrs. Fields' Cookies enabled the development of organizations that would, by their nature, suffer from significant deficits in organizational learning.* The argument draws upon the Jaikumar and Bohn (1986) model presented in Section II.C, which emphasizes the ill-structured nature of many of the early activities associated with learning to control complex processes. While computers may serve to support humans in such activities (Gorry & Scott Morton, 1971), they cannot be relied upon to perform them unaugmented. Thus, for the early stages of organizational learning to occur, a substantial human presence—requiring individuals possessing "common sense and a broad knowledge of different problem domains" (Jaikumar & Bohn, 1986, p. 188)—is required. Because a rapid environmental change will reduce the perceived analyzability of the environment, highly structured information must be supplanted by richer media (Daft & Lengel, 1986), with greater reliance of external information gained from other individuals also to be expected (Daft & Weick, 1984). We focus, therefore, on how information technology served to change the human presence in the two organizations, particularly with respect to environmental scanning activities.

Scott Morton (1988) praised Batterymarch for its use of technology to rethink the process of investing, thereby creating a new value chain. He noted that the company required only 35 employees to match the output of a 175 person competitor. In fact, much of the savings in "new value chain" derived from automating almost all functions that incorporated ill-structured scanning of the environment in a normal investment firm. Use of database tapes—company information captured in highly structured form—substituted for company research, an activity involving calling, and even visiting, companies. Automated trading replaced conversations with other traders, an important source of subjective insight into market dynamics. Even the sales function was indirectly affected by Batterymarch's highly visible reliance on computers, which one competitor described as nothing but "a brilliant marketing ploy" (Reich, 1985, p. 108). Instead of utilizing a sales force, which would entail one-on-one interactions with customers, the company relied on word-of-mouth, augmented by LeBaron's enthusiastic presentations of his ideas and demonstrations of his technologies. Thus, as long as adjusting to the environment could be accomplished solely though self-regulation, Batterymarch operated at the peak of efficiency. But, when changes in the environment dictated *major* adaptations to the company's theory-in-use, it lacked the capacity to engage in the ill-structured problem-solving necessary to regain control in the altered environment.

At Mrs. Fields' Cookies, the stumbling block to organizational learning seems to have been the processing of ill-structured environmental information. The high turnover rate among managers, combined with Randy Fields' deeply held (and often expressed) opinion that they should (or could) not be trained to see the "big picture" of managing a store, meant that those environmental changes which manifested themselves operationally, at the store level, would tend to go unnoticed. Even if changes were observed, the channels supplied for communicating such observations—electronic mail and voice mail to Debbi Fields—lacked the richness of face-to-face communications. To make matters worse, the type of statistics that the company gathered may have actually inhibited recognition of change by upper management. For example, Randy Fields reported:

> The fifth of the store managers who use the program the least, or who regularly ignore its advice, are also the managers of stores performing relatively poorly. (Walton, 1989, p. 39)

This, he interpreted as strong support for continuing to urge managers to use the system, ignoring its recommendations at "their own risk" (Walton, 1989, p. 39). Such an interpretation misses another possibility: that managers who started to ignore the system may have been trying to adapt to adverse environmental changes by experimenting—because they perceived the system to be doing an inadequate job.

Nowhere was the insensitivity to environmental scanning at Mrs. Fields as evident as in the LPB acquisition. Within 8 months of acquiring the unprofitable chain, software had been designed to manage the units, terminals had been installed, LPB headquarters had been downsized from 64 to 4, and unit managers who resisted taking direction from computer were "weeded out" (O'Brien, 1990, p. 146). Only after all these actions had been accomplished did the Fields consider sending senior managers out to run the new units for a few months, so they could get a feel for them (Walton, 1989). Choosing such a sequence of activities, with unstructured observation at the tail rather than the head, virtually guaranteed no significant changes to the company's theory-in-use would be realized as a result.

## CONCLUSIONS

The cases of Batterymarch and Mrs. Fields' Cookies both represent examples of situations where heavy reliance on information technology inhibited organizational learning. In each case, computers and communications were applied to successfully automate tasks which, in more traditional companies, had served environmental scanning as well as operational functions. As a consequence, when experiencing the rapid change that is inherent to complex environments, the companies were deficient in their capacity to engage in the ill-structured activities of scanning and processing information, which are necessary to learn about the new environment. And failure to understand led to failure to adapt, shortly followed by failure to prosper.

To what extent should we be concerned about these two cases? After all, both companies were maverick players in their respective industries, run by CEO/founders who were both highly opinionated and reluctant to yield control as their companies grew. Do their experiences portend similar problems for other companies in the future? Or are they simply examples of the already well-documented phenomenon of entrepreneurs overstaying their own usefulness?

### *Information technology in the "organization of the future"*

A justification for taking the experiences of Batterymarch and Mrs. Fields seriously can be found in what researchers currently conceptualize as the "organization of the future". The consensus of such researchers (e.g., Drucker, 1993; Handy, 1990; Naisbitt, 1982; Peters, 1987; Toffler, 1970) seems to be that a drastic reshaping of the structure of U.S. business—away from its traditional hierarchy—is taking place. Such restructuring will, in turn, lead to vast reductions in the ranks of middle-management. Similarly, these experts contend that the mobility of employees will increase dramatically (e.g., Toffler's "modular man"), and that employees, particularly those whose specialized skills qualify them as "knowledge workers," may feel far more allegiance to their craft than to their employer (Drucker, 1989).

There is universal consensus that information technology will play a critical role in shaping the "organization of the future." Applegate, Cash, and Quinn Mills (1988) have made specific predictions about that role. They assert:

> Executives and senior managers will be less insulated from operations because executive information systems will help them get the information they need to monitor, coordinate and control their businesses. Rather than waiting for the analysts and middle managers to prepare reports at the end of a prolonged reporting period, executives will have immediate access to information. Software will help do the analysis and present it in a useable format. With such immediate feedback, managers will be able to adjust their strategy and tactics as circumstances evolve rather than at fixed time intervals. (p. 42)

Stated another way, executives will have rapid access to *structured information*, just as they did at Batterymarch and Mrs. Fields'. The authors also contend:

> Information systems will maintain the corporate history, experience and expertise that long-term employees now hold. The information systems themselves—not the people—can become the stable structure of the organization. People will be free to come and go, but the value of their experience will be incorporated into the systems that help them and their successors run the business. (p. 44)

Once again, their vision is well instantiated in the two cases. Precisely such knowledge was incorporated into the models of Batterymarch and into the operational systems of Mrs. Fields'—where unit managers also "came and went" at an astonishing pace.

The similarity between the "organization of the future" and our two cases suggests that managers should exercise considerable caution in applying information technology to restructure their firms. In a complex environment, maintaining a substantial capacity for organizational learning is vital to long-term survival. Managers must therefore avoid the temptation of using automation to over-program their organizations in order to achieve dramatic productivity gains, inadvertently disabling their "network for sensing needs" (Quinn, 1980). The role of middle managers in scanning and interpreting the environment—even though it may not manifest itself on a daily basis—cannot be replaced with information technology. Thus, even as middle management's operational activities are automated, care must be taken to ensure their scanning activities continue.

*Using information technology to support organizational learning*

The two cases presented here have shown how information technology can adversely impact organizational learning. Should we therefore deduce that, as a general rule, application of information technology will inhibit learning? The answer is clearly not. Just as Walton (1989) pointed out that technology can be applied either to force compliance or foster commitment, it can either impair or improve organizational learning processes. It is up to managers to ensure that learning is supported, rather than inhibited, by technology.

*Supporting organizational learning with existing information technology.* In both the Batterymarch and Mrs. Fields' cases, organizational learning was impaired by loss of capacity for unstructured environmental scanning. Such impairment need not occur inevitably, however. At Mrs. Fields', for example, a team of managers—whose sole function was to go into units, run them for extended periods of time and then rethink their systems, strategies and goals—could have been established. That same group could have gone into LPB units *before* systems were instituted. A critical role for middle management in the organization of the future is to promote "upside-down thinking" (Handy, 1990), thereby challenging the existing organizational orthodoxy (Peters, 1987). There is no reason that such a middle-management "networks for sensing needs" (Quinn, 1980) cannot exist in parallel with information systems promoting efficient self-regulation.

More generally, the fact that today's information technology is best suited for *processing* structured forms of information does not mean that it cannot be employed to increase capacity for unstructured processing. Rather, it means that *the design of the human-system partnership must be given careful thought.* In the two cases described, the design of the partnership had three important characteristics:

- Bidirectional communications channels that would have conveyed both structured and unstructured information were replaced with channels best suited for simple exchange of structured information (e.g., communication between stores and headquarters at Mrs. Fields'; automated trading at Batterymarch).
- Traditional paths for acquiring unstructured organizational knowledge of the environment were eliminated (e.g, the high turnover and low skill requirements of Mrs. Fields' managers; the virtual elimination of the sales and research functions at Batterymarch).
- Tasks previously entailing human decision-making and analysis were completely automated (e.g., store production scheduling at Mrs. Fields'; investment scoring at Batterymarch).

While these design characteristics are quite consistent with the goals of improving short-term efficiency and performance (as seen in both cases), other goals for information technology can also be envisioned—including the goal of improving environmental scanning.

An example how to use the capabilities of computers and communications to enhance the environmental scanning capability of the organization can be found in the customer support functions of many high technology firms. The Microsoft Developer Network (MSDN), for example, provides technical support to users of the company's development products (e.g., compilers and languages). Although making extensive use of information technology, its design is the antithesis of what was observed in the two cases. Specifically:

- *Efforts have been made to greatly increase the amount and richness of bidirectional information flow.* For example, the MSDN provides developers with CD-ROMs containing the same information used internally by Microsoft developers (e.g., technical documentation, bug reports, pre-release versions of development tools and software development kits, product updates). In the other direction, the company encourages the flow of information from member developers by offering free technical support, special phone lines with lower hold times, and a newsletter that actively seeks their opinions. Microsoft also calls back many of its customers who have reported difficulties, to ensure problems have been resolved.
- *New communications channels are continually being opened with customers.* While maintaining its traditional channel of phone-based technical support, the company employs technology to increase significantly the number of ways customers can communicate with the company. For example, customers are encouraged to post their questions and opinions on numerous Compuserve Forums maintained by the company, where they are then responded to both by Microsoft technical support personnel and by other customers. In addition, the company can be contacted via facsimile, electronic mail, and internal bulletin board systems.
- *Emphasis of technology is on performing tasks that cannot be accomplished manually, rather than on automating those decision-making tasks already being performed by humans.* Examples of such uses of information technology include the sophisticated database tracking system used to ensure complete records of customer problems and resolutions are maintained and the sophisticated automated tools provided to developers for producing detailed problem reports, helping Microsoft personnel in the quick and accurate diagnosis of the problems (and, at the same time, alerting them to possible bugs in their own products).

Obviously, these uses of technology are not primarily directed toward increasing productivity or reducing costs. Instead, computers and communications are being used to ensure that Microsoft maintains close relationships with the members of its most technically sophisticated customer group: software developers. Because the opinions of such developers influence the technical decisions in many organizations (e.g., what type of PC processor to buy, what operating system to use, what compatibility standards for software should be adopted by the firm), such relationships can be extremely beneficial to Microsoft in trying to predict long-term behavior of the turbulent microcomputer marketplace. Indeed, the presence of these relationships may help explain the company's uncanny knack of being able to put out products that achieve widespread acceptance in nearly every software category (e.g., MS-DOS, Windows, Excel, Word, PowerPoint, Access)—transforming it from a tiny firm to the largest software company in the world in under 15 years.

*Supporting organizational learning in the future.* In the future, technological advances may also broaden the role that technology can play in organizational learning. Without human partnership, today's information technology is largely limited to processing information that is relatively well-structured. Even advanced technologies, such as expert systems, can only be applied to problems that are well-understood (Waterman, 1986). Such a limitation may not apply to tomorrow's technologies. Neural networks, for example, are starting to show significant promise in pattern recognition, where they can actually learn to detect significant attributes of a pattern. Some day, they may serve as important adjuncts to human judgement in environmental scanning. Similarly, the rapid proliferation of multimedia and communications capabilities may dramatically increase the level of "media richness" supported by the typical system, thereby increasing the range of meanings that may be successfully communicated. Thus, the role played by information technology in organizational learning, even its early stages, is likely to grow with the capabilities of the technology.

### *Implications for managers*

Few of today's managers need to be convinced of the importance of information technology. The key lesson to be learned from Batterymarch and Mrs. Fields' Cookies is that, in a complex environment, ensuring capacity for sustained organizational learning is equally important. In a sense, improved technological capabilities have just added a new wrinkle to an old problem: the competition between exploration and exploitation (March, 1991). Thus, while we may believe that learning capacity and information technology can exist in harmony, we can be sure that such peaceful coexistence will not occur automatically. Managers must therefore be ever-vigilant that the short-term benefits of efficiency that computers promise do not inadvertently jeopardize their company's long-term survival.

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