

# *What Enables Self-Organizing Behavior in Businesses*

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**T**he complexity of the political, regulatory, and technological changes confronting most organizations today causes an urgency to adapt or even radical organizational change (Greenwood and Hinings, 1996). The increasing interconnectedness of people across the globe is helping to accelerate change, as diverse new customer demands are communicated faster and innovative organizational responses are enabled by collaboration through information technology. The environment is becoming more complex and self-organizing, and often organizations seek to adapt by mirroring it with requisite variety (Miles *et al.*, 1998).

Complexity theory views organizations as “complex adaptive systems” that coevolve with the environment through the self-organizing behavior of agents navigating “fitness landscapes” (Kauffman, 1995) of market opportunities and competitive dynamics. Changing external and internal “attractors” influence the process of adaptation by agents (Kauffman, 1995; Morgan, 1996; Stacey, 1996). Apart from the concepts of agents and attractors, complexity theory suggests that self-organizing behavior will naturally occur without addressing what causes it (cf. Stacey, 1996). Behavior is self-organizing when people (agents) are free to

network with others and pursue their objectives, even if this involves crossing organizational boundaries created by formal structures. Complexity theory suggests that self-organization is the natural “default” behavior, while organization studies recognize barriers to such freedom in bureaucratic structure.

The purpose of this article is to explain more fully self-organizing behavior in adaptation to change by applying concepts of organization theory and organizational behavior. Knowledge has emerged as the creator of wealth in today’s global economy: knowledge applied to work is productivity; knowledge applied to knowledge is innovation (Drucker, 1993). Particularly with the increasing customer demands for innovation, the “management” of knowledge through enabling organization design and controls promotes self-organizing behavior in businesses. Accumulating knowledge is applied to the marketplace by some self-organizing, entrepreneurial companies in the process of adaptation to change (Miles *et al.*, 1998).

COMPLEXITY THEORY  
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### COMPLEXITY THEORY

“Diversity begets diversity, driving the growth of complexity” (Kauffman, 1995, pp. 296–7). In today’s business world, the variety of new opportunities is created by the emergence of new knowledge structures in scientific discoveries. These new market opportunities as attractors “pull” a variety of entrepreneurs and their teams of colleagues to innovate within existing firms or found new enterprises (Miles *et al.*, 1998). As mentioned above, the increasing interconnectedness of people (agents) enables ideas to be translated into innovative offerings in response to rapidly communicated customer demands.

As agents coevolve with the environment of “fitness landscapes,” they do so through a process of self-organization intended for both survival and growth from innovation. The impetus for creativity

comes from the shadow system of learning communities with enough diversity to provoke learning but not enough to overwhelm the legitimate system and cause anarchy. Another factor is the degree of connectivity between the agents in a system: the necessary variety in behavior depends on the strength and number of ties, with few and strong ties producing stable behavior—too little variety for effective learning—and many and weak ties producing unstable behavior—too much variety for effective learning (Stacey, 1996).

Kauffman (1995) explains that instability comes from sensitivity to small changes while stability comes from canalization, or “lock-in,” perpetuated by some rules in an agent’s schema because the rules involve redundancies. “This duplication of functions gives stability to the system, making it much more robust in the face of turbulent change” (Stacey, 1996, p. 85). To operate at the edge of chaos, agents and systems balance canalization and redundancy such that they form landscapes that are neither too smooth nor too rugged (Stacey, 1996).

#### *CREATIVE TENSION AND EXPERIMENTATION*

The space for creativity in an organization is a dialectical state of tension between overcontrol, embodied in the legitimate system, and chaos, embodied in the shadow system (Pascale, 1990; Stacey, 1996). For employees to have enough confidence to take risks and experiment, there must be some stability in the organization; similarly, some order is necessary for employees to recognize novelty. Then, organizations learn when there is new information that is combined with knowledge and applied to new opportunities provided by changes in the external environment. People in the shadow system (learning communities) seize such opportunities to be innovative. If the structure is flexible enough, the firm can adapt and form new project teams or even new business units; otherwise, the path of self-organizing behavior tends toward the founding of new companies.

The above assumes that organizations are open systems—open to flows of data and information that facilitate learning and the

construction of new knowledge. The goal is to encourage experimentation (Senge, 1990; Vicari *et al.*, 1996). “Experiments may be planned, but they may also occur spontaneously as ‘errors’, i.e. perturbations. Leaps in the knowledge development of a company typically stem from events that the firm has neither planned nor hypothesized” (Vicari *et al.*, 1996, p. 189). Experimentation is encouraged by reward-and-control–system incentives that tolerate some failure. A prime example of this working is at Minnesota Mining and Manufacturing (3M): employees are encouraged to spend 15 percent of their paid time working on whatever new projects they choose, and Post-It notes™ developed from the failure of a search for an adhesive substance.

Human agents in organizations respond to the stresses of conflicting demands by ignoring some of the constraints some of the time. Ignoring constraints in a judicious way can help avoid being trapped on poor local optima. Furthermore, as independent “patches” within the system selfishly seek their own optima, they can at least temporarily move the entire system the wrong way on the fitness landscape; thus, such independent actions can allow the entirety to avoid bad local minima (Kauffman, 1995).

### AUTOPOIESIS

The ideas of boundaries and identity are addressed by autopoiesis. According to autopoietic theory, organizations are open to data inflows but are closed systems with respect to information and knowledge; the emphasis is on knowledge as personal and not transferable; written documents are seen as data outside the cognitive systems of persons (von Krogh and Roos, 1996). Autopoietic theory refers to systems that maintain their defining organization throughout a history of environmental perturbation and structural change and regenerate their components in the course of operation (Maturana and Varela, 1987). Entrepreneurial behavior is spontaneous in response to perceived opportunities to create an organization in the first place. Self-organization can take place once there is a circular exchange of energy with the environment that maintains

the identity of the organization through different interactions. To be self-organizing, there has to be a cognitive domain of interaction; spontaneous entrepreneurship precedes self-organization.

*ORGANIZATION THEORY AND  
ORGANIZATIONAL BEHAVIOR*

With the increase of market opportunities calling for innovative offerings and accumulating knowledge seeking outlets in the marketplace, leading-edge organizations are being designed to “manage” knowledge (Davenport and Prusak, 1998; Miles *et al.*, 1998). The capacity for adaptation in turbulent environments is enhanced by the operating logic of new organizational forms like the emerging “cellular” form (Miles *et al.*, 1997). With autonomous small teams, or “cells,” each pursuing entrepreneurial opportunities and sharing knowhow among themselves, the overall organization is more potent than each cell operating alone. When environmental demands change, new cells can be formed and old ones disbanded as necessary; like an amoeba changing with its surroundings, the operating logic of the form is based on flexibility with accepted protocols of knowledge sharing substituting for hierarchical controls. Thus, cellular organizations are designed to be reconfigurable according to shifts in the market and/or the emergence of new knowledge. Because the scientific community organizes itself in small groups, or pockets, of knowledge, a cellular design in response to complexity provides some order that creates enough stability for employees to feel comfortable in taking risks and experimenting. The cellular concept compares favorably with Kauffman’s (1995) notion of “patches.”

New knowledge is constructed in “communities of practice” (Brown and Duguid, 1991), the shadow system of learning organizations (Stacey, 1996). Knowledge workers join communities because they have something to learn and something to contribute (Stewart, 1997). Self-organizing behavior in communities of practice is partially predicated on incentives to construct, articulate,

share, and use new knowledge for innovative products/services (Coleman, 1998). Even more important may be the motivation of knowledge workers to collaborate in pursuit of innovation; besides intrinsic and extrinsic incentives in reward systems, knowledge workers may be motivated primarily by the urgency to develop new offerings before competitors do, like at Intel (Ghoshal and Bartlett, 1997; Quinn, Baruch, and Zien, 1997).

*ORGANIZATION DESIGN*

The organization design/structure can facilitate change by being flexible. The concept is to design the organization for the purpose of evolution with the changing environment, to design for emergence by avoiding the rigidities of bureaucratic hierarchy. This means creating organizational arrangements that do not inhibit evolutionary change and that accept discontinuous change in the environment as entrepreneurial opportunity. The idea is to design the formal organization such that structures, systems, and processes “fit” the goals, rewards, and structures of the informal organization (Nadler, 1998). To extend this concept a little further, change is facilitated by a formal design that exists only to validate informal behavior in line with the corporate mission. Leadership may be anywhere, and everyone is a champion of change, with no need to bust bureaucracy because there is none.

An emerging example of this is the cellular form at Technical and Computer Graphics (TCG), headquartered in Sydney, Australia, and at the Acer Group, based in Taiwan (Miles *et al.*, 1997). Top management in these firms has recognized that organizational survival as well as growth is best nurtured through tolerating disequilibrium; that disorder is the price of progress in a dynamic world (Quinn *et al.*, 1997). Alignment of members with the company purpose is reinforced by both identity-creating information about how each unit is contributing to the enterprise goals and extrinsic incentives of member ownership that support this identity. The intrinsic incentives are the challenge of the task, personal recognition, and freedom of activity in pursuit of

entrepreneurial innovation (Quinn *et al.*, 1997). Accepted protocols for knowledge sharing are consistent with intrinsic incentives and substitute for hierarchical controls (Miles *et al.*, 1997). Because the strategy is to be opportunistic and the culture is entrepreneurial, the basic organization design at a cellular firm like TCG would not require radical change unless new attractors were to cause it to “flip” to a whole new identity (Morgan, 1996), to change its perceived mission by entering a new industry and exiting the old one.

The lack of bureaucracy at TCG is illustrated by the fact that cells consist of 12–15 technical professionals coordinated by accepted protocols of knowledge sharing. These cells conduct business by partnering with a large customer, which receives a customized product, and another firm (e.g., Hitachi), which has technological expertise, distribution channels, and financial capital to invest in the TCG entrepreneurial venture (Miles *et al.*, 1997). When technical professionals at TCG perceive a new entrepreneurial opportunity, they may draw on the expertise in other cells, and they are free to seek the necessary outside partners.

The “organic” model of formal structure enables employees to pursue a shared direction through self-control. Such direction is innate in the identity of the firm, guided by the corporate equivalent of DNA, as each cell embraces an entrepreneurial vision. By weaving the sense of purpose into the structure of the organization, organic models like the cellular firm do not need visionary leaders to control them; rather, they need senior managers to act as the central nervous system by coordinating the activities of the parts and monitoring the overall health of the system so that each cell is free to be entrepreneurial (Baskin, 1998).

According to Stacey (1996), leadership is different from traditional direction of the legitimate system when the organization is adapting on the edge of chaos; then, leaders operate on the boundary of the shadow system and serve to contain anxiety for others while provoking double-loop learning. “Provoking double-loop learning requires the capacity to play with metaphor and images and pose stretching

challenges for others and the ability to listen and hold oneself open to changing one's mind" (Stacey, 1996, p. 276). When an organization is operating on the edge of chaos, not even its leaders can know its future direction. At such a time it is appropriate to operate in a mode of inquiry, surfacing and questioning assumptions (Senge, 1990).

*LOOSE-TIGHT CONTROLS*

The freedom of activity in entrepreneurship is a key to enabling self-organizing behavior. This relative autonomy within boundaries for opportunity seeking works according to a system of "loose-tight" controls (cf. Peters and Waterman, 1982). The shared values of corporate culture in belief systems provide tight control as a form of protocol, and control systems that are based on interaction

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between supervisor and employees encourage information sharing and learning (Simons, 1994). Together, belief systems and interactive control systems create intrinsic motivation in employees (Deci and Ryan, 1985) and provide the context for empowerment

to pursue entrepreneurial initiatives. The key to loose controls is management's confidence and trust in employees to act according to the shared values, therefore setting them free to search for opportunities, learn, and apply accumulating knowledge to innovative efforts.

The tension between empowerment and control is managed by measuring outputs and holding people accountable for them, as opposed to a focus on inputs. At firms like Sun Microsystems, this means using a system of management by objectives (MBO) that is linked to the reward system through the criteria for awarding bonuses. At Sun, reward systems linked to MBO encourage collaboration by employees because performance on bonus criteria cannot be achieved by individuals working alone. Employees freely seek each other out, regardless of organizational boundaries, and share knowledge in order to achieve their performance criteria.

### *HUMAN NEED SATISFACTION*

Whether the force of entrepreneurial behavior is spontaneous or self-organizing, the point is that people are behind it; in the course of satisfying their own needs, they have the intention to achieve change and take advantage of new market opportunities. We must not be confused by any abstract conceptualizations of either autopoiesis or complexity theory that treat systems as entities that we observe outside ourselves. We are parts of both the solution and the problem; the organizations and society we get, we deserve.

Similarly, the accelerating pace of change is often attributed to the advance of technology, but technology is only the catalyst. What effects rapid change is what people do with the tools they have. Computers and telecommunications have dramatically increased the interconnectedness of people and the speed of sharing knowledge and information. This has fueled an explosion of innovation, but it would not have been the case if people had not been motivated to use technology for new products and services. Spontaneous and self-organizing behaviors are intended to satisfy human needs, and the variety of needs and market opportunities drives the growth of complexity.

### *EMPOWERMENT*

Ultimately, self-organizing behavior depends on the firm's being staffed with people who respond to empowerment practices by taking the initiative to resolve creative tension through experimentation. Empowerment is defined as enabling feelings of meaning in work, autonomy, choice, and having an impact on outcomes (Thomas and Velthouse, 1990; Spreitzer, 1995, 1996).

Empowerment means releasing the self-motivation of employees to take responsibility and initiative by trusting them to accept deep-seated psychological ownership of results and encouraging them to think, experiment, and improve (Coleman 1996). Empowerment will not work if employees do not have some intrinsic motivation to make a contribution (Coleman, 1996). Trust in the efficacy of employees and their own feelings of efficacy

increase self-esteem and motivation to make a contribution (Gardner and Pierce, 1998). Given employee self-motivation, management's task is to build trust, responsibility, and initiative.

At TCG, employees also have financial ownership, which reinforces the psychological contract that they can make a difference, that they are personally competent and valued. TCG's employees take responsibility because they are trusted and because the reward system reinforces initiative taking; all the technical professionals are contributors, and there are no obstacles to good performance because of organization design or bureaucratic controls.

The cellular structure is based on the concept of "small within big" and capitalizes on the informality of personal relationships made possible by small units. Employees are empowered when they are treated as whole individuals with dignity. Even such a performance-oriented manager as Jack Welch, chief executive officer at General Electric, believes in informality and the power of self-motivation in people (Byrne, 1998). Self-organization in businesses is not, at its root, an abstract concept of systems, but rather a process of human motivation enabled by empowerment practices. Without trust and informality of relationships, bureaucratic controls choke off creativity.

Self-organizing behavior is enabled by boundarylessness, "a matter of cooperation across all the artificial barriers that can separate people with common interests" (Tichy and Sherman, 1993, p. 285). The idea is to encourage:

teamwork on a grand scale, making cooperation an essential characteristic of organizational success. Given the right kind of people and clearly understood goals, intricate webs of informal networks among employees can accomplish much more than any rigid, traditional organization, producing tangible competitive advantages. (Tichy and Sherman, 1993, p. 286)

*A CONCEPT IN COMMON: ADAPTATION TO CHANGE*

Complexity theory and organization studies find some common ground in the concept of adaptation to change. Increasing interconnectedness between people both accelerates customers' demands for innovation and enables self-organizing behavior in response to produce new offerings. Major issues that require the concepts of both complexity theory and organization studies to resolve are whether change in the external environment is perceived to be continuous or discontinuous, and whether the response is reactive or proactive.

If the change is reactive to a performance crisis, an overhaul to a new mission, strategy, and structure is called for:

Typically, discontinuous changes require dramatic changes in strategy and abrupt departures from traditional work, structures, job requirements, and cultures, which in turn necessitate a complete overhaul of the organization. (Nadler, 1998, p. 51)

On the other hand, if the organization has been operating in a continuous entrepreneurial mode, change otherwise perceived as discontinuous may be anticipated by boundary-spanning units and the response may be proactive on the edge of chaos. An organization may “flip” to a new identity in response to new attractors in any case, but its success is more likely when there is a proactive entrepreneurial decision rather than one reactive for mere survival.

With organic flexibility in the logical fit of cells and an entrepreneurial culture focusing on the external environment, cellular firms like TCG are designed for continuous, proactive adaptation; and member ownership reinforces principles of responsibility and initiative. Empowerment practices based on loose-tight controls and a sense of “stretch” (Ghoshal and Bartlett, 1997) derived from the natural ambition to excel in lead employees, especially knowledge workers, to continue learning and searching for new entrepreneurial opportunities. Consequently, it is less likely that organizations designed to coevolve with their environments will

be forced into performance crises by discontinuous change than if there were the rigidities of bureaucracy in their structures.

As Baskin (1998) points out, models of organization that are based on living systems are naturally organic and adaptive. This is in contrast to the mechanistic models of bureaucracy, where discontinuous change requires a complete overhaul of the organization if it is to survive (Nadler, 1998). Put another way, adaptive change by organic systems rarely needs to be radical, even when

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there is discontinuous change in the environment, because the interface between the organization and its environment is on the edge of chaos. Cellular organizations tend to mirror the complexity of the environment with requisite variety, as individual cells

sense new entrepreneurial opportunities and self-organize in response to change.

Consequently, it may no longer be appropriate in the age of innovation to use the change model of “unfreezing, transition, and refreezing.” The increasing interconnectedness of diverse voices provides enough new ideas and perspectives to keep many organizations on the edge of chaos and to keep them from refreezing. There may not be a defined future state, as change may be continuous and seen as incremental because the organization and its environment are always in a state of flux (Morgan, 1996). There may be no future disequilibrium to anticipate because the current state is *always* one of disequilibrium. This does not mean that equilibrium is necessarily good; rather, the point is that we may have to learn to live and work in disequilibrium.

*POSSIBLE CHANGES IN THE FUTURE*

Although the cellular organization design facilitates adaptation to complex, changing environments, if the paradigm of market demand shifts, radical change may be required. For example, we are currently in the age of innovation fueled by customers’

increasing demands for better customized solutions to their diverse problems (Miles *et al.*, 1998) and of responsiveness enabled by the increasing interconnectedness of people through information technology. If markets in the developed world become saturated, the demand paradigm could shift to an age of dissemination; specifically, a focus on customers in the developing world who seek a better standard of living.

In such a case, firms' tasks become more focused on reducing the prices and costs of both manufacturing and distribution than on developing innovative products and services. Then, effective organization design would aim for utilization of existing knowledge and streamlining the supply chain, rather than for speed in constructing new knowledge for innovative outputs. The process of self-organization might well cause cellular firms to flip back to more hierarchical designs in order to maximize efficiency.

With respect to such a reversal of power sharing, a question is whether the genie can be put back in the bottle. Once firms transform themselves in terms of empowerment, partnership, and as a team-based organization without bureaucratic controls, will employees accept an increase in hierarchical relationships? In the same way that hierarchical power structures inhibit self-organization, does empowerment cause resistance to change toward more bureaucracy even in the quest for efficiency required by the marketplace; or, does self-organizing behavior mean that employees maintain open minds toward hierarchy and organize on a case-by-case basis?

## CONCLUSION

The current concepts of complexity theory provide some explanations of what causes self-organizing behavior in human systems. Although some theorists approach the subject by discussing "complex adaptive systems" as a whole, the concepts of attractors and agents begin to deal with motivated activity, such that attractors "pull" agents toward opportunities. Thus, the question is which attractors arise and when they do so.

Our understanding of self-organizing behavior is enhanced by considering variables in organization theory and organizational behavior such as organization design and control, human need satisfaction, and employee empowerment. The combination of enabling organizational context and purposive human behavior helps to “explain” complexity theory in practical terms. Emerging forms of organization designed to “manage” knowledge operate in a self-organizing mode through building trust, responsibility, and reward systems that reinforce a culture of entrepreneurial initiative freed from bureaucratic constraints.

Finally, in today’s global economy, the concepts of complexity and organization studies need to be combined to explain the evolution of the knowledge/network era environment and self-organizing adaptation to it. Similarly, in the future global economy, the concepts of organization studies will combine with complexity theory to anticipate the possibility of radical organizational change in response to a shift in the paradigm of market demands.

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*EMERGENCE*

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