

Organizational Extinction and Complex Systems

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The Lost World, Michael Crichton's sequel to the dinosaur adventure *Jurassic Park*, is structured around complexity theory. Briefly defined, complexity theory examines emergent order in large, interactive, adaptive networks, such as neural networks or ecosystems. In *The Lost World*, Crichton's characters investigate the emergent nature of complex ecosystems and seek to understand how extinctions occur in such robust networks. In this article, we ask the same questions about extinction among formal social systems.

The answer that Crichton provided for the extinction question made for good adventure, but was somewhat disappointing from the perspective of a complexity theorist: prions, or mad cow disease, were wiping out the book's genetically replicated dinosaurs. The use of complexity theory to explain the ecosystem in *The Lost World* was a fascinating idea that was intelligently developed throughout most of the book, but one could only wish that he had portrayed the prion as a trigger that sparked a complex interaction among a number of events rather than as the primary, indeed singular, cause of extinction. His Jurassic ecosystem emerged and functioned as a complex system, but its demise was explained by the old Newtonian assumption that outcomes are functionally related to simple causes. This notion argues that events can be isolated from the whole and that the outcome is the local and direct product of specific, identifiable variables. In *The Lost World*, prions were the simple cause, and extinction was the predictable and direct outcome. This is reductionism.

Complexity theory proposes a more sophisticated and involved perspective of dynamics in interactive systems. Complex systems are robust, involving multiple, often redundant chains of interaction and causation; thus they resist simple perturbation. Further, complex systems adapt and adjust, thus can often work around simple threats to their existence. Consequently, complex systems aren't as easily destroyed as Crichton would lead us to believe.

Crichton's original question is tantalizing, however. How do extinctions occur in robust, complex systems? We will examine this question for an "ecosystem" different from that which interested Crichton's characters. We ask the question: "How can one explain the extinction of formal social organizations?" Interest in organizational extinction is not new to organizational theory—there are a number of articles in the social science literature that address just this issue. Our approach differs, however, in that we attempt to understand the dynamics of extinction as a function of complex interaction among multiple organizational actors. We will argue that it is the breakdown of such networks that are ultimately responsible for organizational extinction.

Our arguments are supported by qualitative data collected from key actors in the decline of two nonprofit organizations: a small, county health association, and a large, regional organization devoted to elderly care issues. The dynamics in these organizations are compared to a third nonprofit organization that is strong and active. The choice of nonprofit organizations was based partially on convenience—we have ready access to all the groups studied—but largely because nonprofits are somewhat more readily at risk of decline than are other types of organizations. We argue that the dynamics observed can be generalized to governmental organizations and to nongovernmental, for-profit organizations.

Background studies

In this section we examine conventional literature on the nature and dynamics of organizational extinction, then look at complexity theory literature to determine how it alters perceptions of extinction.

Traditional theory

Organizational extinction is typically studied from one of three perspectives. The first examines the failure of young startup organizations. Such failure is attributed to what Stinchcombe (1965) has called the liability of newness, a self-explanatory term that has been examined by Brüderl and Schüssler, 1990; Freeman, Carroll and Hannan, 1983; Hannan and Freeman, 1989; and Singh, Tucker and House, 1986, among others. The second approach examines failure attributable to significant technological shock or similar catastrophic changes, such as the shift from 8-bit microprocessor technology to 16-bit technology that occurred when IBM entered the microcomputer market in the early 1980s (see, for example, Anderson, 1995; Anderson and Tushman, 1990). The third perspective, the one we focus on here, examines the seemingly inexplicable failure of mature organizations.

Theories of failure in mature organizations can likewise be divided into three general categories (Meyer and Zucker, 1989). The first set of theories assumes a direct, functional relationship between organizational structure and persistence. Organizations whose structures are properly organized to accommodate environmental restraints (degree of environmental ambiguity) and that

organize to manage certain physical contingencies effectively (size, nature of production) will survive, while those that don't will suffer decline. Contingency theory, which is the main example of this perspective, proposes that organizational persistence is a function of efficient relationships between organizational structure and certain contingencies (Blau and Schoenherr, 1971; Hage and Aiken, 1972; Lawrence and Lorsch, 1967). Increased complexity and ambiguity in organizational environments (a contingency), for example, demand increased complexity in organizational structures, and vice versa.

The second perspective of organizational decline comes from the neo-Darwinian organizational ecology theory. Proponents of this perspective maintain that organizational inertia, defined as stable patterns of behavior, can cause organizational failure (Hannan and Freeman, 1984; Miller and Chen, 1994; Satry, 1997). Inertial behavior emerges naturally in organizations; it is a function of the human need for stability and efficiency—standardized routines, for example, are cost efficient. Inertia, however, resists adaptation, thus placing the organization at risk when the environment changes (the differences between this theory and contingency theory are subtle but important; see Donaldson, 1996, for a review).

Meyer and Zucker (1989) offer a third theoretical perspective: organizations may be maintained by preferences that are unrelated to the effective and efficient pursuit of goals, such as power or growth preferences. To wit, non-production factors can cause ineffective organizations to survive or effective organizations to fail. John Freeman and Michael Hannan (1983), for example, argue that some organizations are generalist in nature; that is, their relationship with the environment is rather “mushy,” and they are not tightly linked to environmental whims. These organizations sacrifice efficiency to invest in strategies such as diversification or the accumulation of slack resources (stockpiles that buffer against future environmental changes) that enhance their ability to survive changing environments. These strategies are inefficient in that they are not synchronized with environmental demands, but they do provide long-term stability and survivability.

Meyer and Zucker (1989) argue that persistence may even be affected by more personal preferences of organizational actors. Managers and owners, they contend, typically prefer profits; other actors, such as workers and clients, desire continuity of service. When all actors obtain what they desire, no problems of survivability are posed for the organization; but when profits (efficiency) decline, continuity preferences may force the organization to persist despite poor productivity. Worker unions, for example, may block the closing of an unproductive plant to maintain jobs. Arguing from a similar perspective, Gimeno et al. (1997: 750) propose that, in small organizations, “organizational survival is not strictly a function of economic performance but also depends on a firm's own threshold of performance.” Such thresholds can include the entrepreneur's “alternative employment opportunities, psychic income from entrepreneurship, and cost of switching to other occupations.”

Meyer and Zucker (1989) define organizational failure (also referred to herein as decline, lack of persistence, or extinction) as a state in which an organization fails to achieve stated goals. We will adopt their definition in this article. An organization does not have to cease to exist in order to fail. On the other hand, merger or restructured goals (equivalent to, or enhanced from, existing goals) are not considered failure. The downgrading of goals (as when goals are significantly truncated because of retrenchment) is considered failure. “Significantly truncated” requires qualitative judgment, of course, but the organizations evaluated by this analysis will clearly qualify.

Complexity

As noted earlier, our hypotheses are derived from complexity theory, a science of emergent interactive systems that is related to chaos theory. There is no commonly accepted definition of complexity, but there are characteristics of the phenomenon on which most complexity theorists, particularly those from what might be called the Santa Fe school (referring to the Santa Fe Institute for the Study of Complexity) as opposed to the European school, agree.

First, complexly structured, non-additive behavior emerges out of interactive networks. That is, interactive actors unite in an ordered state of sorts, and the behavior of the resulting whole is more than the sum of individual behaviors. Ordered states are the product of what Henri Poincaré has called correlation (see Prigogine, 1997). Correlation occurs when a unit adapts its individual behaviors to accommodate the behaviors of units with which it interacts. Poincaré observed this phenomenon mathematically among colliding particles, which impart some of their resonance to each other leading to a degree of synchronized resonance. Interacting people tend similarly to adjust their behaviors and worldviews to accommodate the worldviews and behaviors of others with whom they interact. Networks of particles or people, with complex chains of interaction, allow large systems to correlate, or self-order.

Second, complex systems exhibit nonlinear behavior, or behavior that is unpredictability related to input, as when someone shouts “fire” and mobilizes an entire theater of people. As we shall see, such nonlinearity may help explain organizational failure.

Third, complex behavior is on the border between predictability and nonpredictability—hence complex dynamics are sometimes referred to as edge-of-chaos behavior (Langston, 1986). Complex systems are somewhat more stable and less active than are the dynamics of chaotic systems, such as weather patterns (Lorenz, 1964, 1993), stock markets (Gilmore, 1995; Marion, 1997), or seasonal fluctuations in the size of insect populations (May, 1976). Complex dynamics cannot be analyzed in the same manner as one would analyze the predictable motion of a pendulum, however. Complex systems possess characteristics of both stable and chaotic systems. On the one hand, they exhibit sufficiently stable behavior to allow the retention of information, to transfer information across different systems and across time, and to reproduce themselves; on the other hand, they are

sufficiently chaotic to permit the creative use of information and to allow change.

Finally, complex systems are robust, or fit. They resist perturbation or invasion by other systems. Complex systems are characterized by a variety of coupling patterns. Karl Weick (1976, 1979) has proposed that organizations are loosely coupled systems; that is, the components of certain systems affect one another weakly. Taking cues from the work of Stuart Kauffman (1993), one of the authors of this article has argued elsewhere that average organizational linkage patterns are somewhat tighter than Weick would lead us to believe, but that practically speaking, organizations possess a range of coupling patterns, from tight to loose (Marion, 1999). These different patterns help organizations survive a variety of environmental conditions. Loosely coupled structures, for example, allow the organization to adjust to environmental drift and, when environmental shocks are particularly severe, loose structures react sluggishly, thus buying the organization some time to recover. Systems that are loosely coupled to stronger meta-aggregates may even have a survival advantage: they can benefit from the larger system when it is strong but are not likely to suffer if the stronger system fails. In the failed organization evaluated below, for example, the area support groups, which were loosely coupled to the chapter office, were able to survive and thrive after the loss of the chapter. Moderate and tightly coupled structures prevent the organization from overresponding to environmental perturbation, even moderately strong perturbation. Coupling patterns, then, allow organizations to maintain relative stability in most environments and protect the system even against severe shocks.

Robust systems are characterized by rich patterns of tight, moderate, and loosely coupled linkages; chains of interdependency branch in complicated patterns among actors, they fold back on themselves, and they embroil nearly every actor in a broad network of interaction. Such complex patterns of interaction protect the organization against environmental shock by providing multiple paths for action. If one pattern of interdependency in a network is disrupted, the dynamic performed by that subsystem can usually be rerouted to other areas of the network. Sometimes this can lead to unintended and unfortunate consequences; a manager who attempts to disrupt unwanted communications among employees, for example, may simply drive the discussions “underground” and give them new life to boot. But more to the point, such robustness makes it difficult to damage or destroy the complex system, for complex interaction lends it amazing resilience.

Network coevolution and fitness

Complexity theory focuses on holistic system behavior, or the study of organizations as corporate entities, of organizational species (firms with similar technologies), of associations such as cartels, and of markets. The conventional approach to explaining aggregate behavior assumes that if one can understand the part, one can understand any aggregate created by the part. This position, which is strongly reductionist, was championed in the 1960s by noted sociologist James Coleman (1964), who argued that if one can understand the behavior of the individual one can understand the organization. His position on this issue was a reaction to arguments, particularly those of structural-functionalist Talcott Parsons, that social structures as a whole function anthropomorphically. Parsons stated, for example, that systems function to preserve their own integrity, as if systems have a life of their own (see Smith, 1997, for discussion). Complexity theory sides with Parsons, and maintains further that interacting systems not only transcend and modify the behavior of individual actors (nonadditivity), but that interdependency significantly affects individual fitness as well. That is, fitness is a product of individual organizational characteristics and of the characteristics of the network of which the organization is a part.

Complex networks emerge from interactive, coevolutionary processes, and a discussion of this dynamic provides important ambiance for developing our hypotheses. Incipient networks, such as the microcomputer industry in last half of the 1970s, typically have numerous actors vying for position in the emerging market. Each actor seeks to enhance its own fitness, and in so doing, affects the fitness of others in the nascent network. Complexity theorist John Holland (1995) uses the term aggregate to refer to the collection of actors that comprise such things as individual organizations. He further has referred to collections of aggregates as meta-aggregates and metameta-aggregates. We shall adopt a similar convention: aggregates will refer to individual organizations, meta-aggregates will refer to an organization and its direct suppliers and buyers, and meta-meta-aggregates will refer to a loosely connected network of meta-aggregates and related industries.

Stuart Kauffman (1993) visualized this complex evolutionary process with what physicists call a potential energy surface. This is a hypothetical surface with valleys scattered across it: some of these valleys are shallow, some moderately deep, and some quite deep. The depth of a valley is related to fitness, with deeper valleys being more fit than shallow ones. Fitness, or the depth of a valley, is a function of the particular survival strategy chosen by a given system. Further, the depth to which an organization has penetrated its “valley” is also a measure of its fitness.

A potential energy surface has numerous valleys, or possible fitness strategies, of differing depths. The energy surface for a new industry is such that most fitness valleys on this surface are quite shallow, thus it is inevitable that an industry in a new technological field will adopt relatively low fitness strategies (technology is defined broadly as the way an organization transforms its raw material). Without competitive incentive, there is little reason for an industry to climb out of its initially chosen valley, or fitness strategy, to seek a better strategy. The system becomes trapped in a relatively weak fitness valley.

If, however, there exists another, related system on yet another energy surface, and if the two surfaces are linked so that activity on one affects that of the other, then we have the mechanism needed to perturb the respective surfaces and to dislodge

aggregates from shallow fitness strategies. Activities on the first surface affect the depth of valleys on the second, deepening some, making others more shallow, and completely wiping out still others. The response of the second surface in turn perturbs the first surface, and so on. Extend this energy surface metaphor to a number of surfaces, each of which is affected by one or more other surfaces to varying degrees, and one gains an appreciation of the type of issues and questions addressed by complexity theory.

Computer simulations of multiple coevolving systems demonstrate that when the degree (strength or number) of linkages among systems is properly adjusted (the loose coupling issue discussed earlier), a network of surfaces eventually stabilizes as a fit meta-aggregate (Kauffman, 1993, 1995). Organizations pop in and out of fitness strategies (valleys) as the network matures. Many of the initial participants in the fitness race die or are absorbed by other participants; this is necessary because too many competing actors inhibit eventual network fitness (Kauffman, 1993). Eventually the survivors find deep valleys in which to settle—they become increasingly fit and increasingly less likely to seek new fitness strategies.

Eventually, the meta-aggregate settles into a dynamic state of equilibrium. At this point, linkages among actors within the aggregate and metaaggregate are not so tight that change is prohibited, thus adaptation in the network is typically ongoing. Even so, the individual systems within a meta-aggregate are about as fit as they can be given the fitness needs of all other systems. Every constituent compromises something for the good of the whole, but each gains fitness from its interaction with the whole.

There is an even broader dynamic going on at the same time as all this is happening. What we might label a meta-meta-aggregate emerges around the meta-aggregate. This is a network of suppliers, consumers, and related industries, and this network is far more extensive and somewhat more loosely structured than the meta-aggregate. These industries depend in varying ways on the meta-aggregate, and conversely the metaaggregate depends on them. The automobile industry provides an illustration. This meta-meta-aggregate is composed of automobile makers, metal producers, ore mining, plastic technology, the highway industry (highway systems, traffic regulations, police, concrete production, large machinery producers, diesel fuel providers, etc.), oil refineries, gasoline stations, repair shops, financing agencies, computer chip technology, insurance companies—the list can go on for some time. Many of these constituent systems exist only because of the broader network—of what use are gas stations if there are no gasoline engines, for example?—and all derive strength because of their membership in the meta-meta-aggregate.

The mature meta-meta-aggregate resists perturbation, invasion, and damage. Imagine, for example, all the changes that would have to be effected to switch from a gas-driven car to a battery-driven car. The problem is not merely a matter of improved technology: many of the aggregates associated with the gas engine would have to be dismantled or significantly changed. Further, the new industry would inevitably be far less effective than the old while it establishes its own meta-aggregate and meta-meta-aggregate. The task would be rather daunting.

Organizational decline, we argue, must be understood not just in terms of the dynamics of an individual organization, but within the context of the meta-aggregate and the meta-meta-aggregate with which a system is associated. If the meta-aggregate and meta-meta-aggregate are effective at establishing fitness for their constituents, how could organizations ever experience extinction? The answer is not merely an issue of an organization's efficiency; it clearly must be formulated within the context of aggregation.

Complex failure

Several hypotheses about extinction can be derived from the literature on complex systems. All are based, in one way or another, on the assumption that complex systems are poised at the edge of chaos.

The first hypothesis we present postulates that failure occurs when meta-aggregates and meta-meta-aggregates are poorly developed. In other words, the system's network never reaches maturity, or the system is so small that it can be relatively easily deflected from its goals. A poorly developed network can offer little protection for its constituents, and we propose that leadership can best serve such systems by promoting the development of effective networks.

The second hypothesis suggested by complexity theory is directly related to the edge of chaos notion and to nonlinearity. The edge of chaos is a poised state between order and disorder (Bak, 1996; Kauffman, 1993, 1995; Langston, 1990, 1992; Wolfram, 1986). This is a dynamic equilibrium state or, more colloquially, a state of uneasy stability. As we observed earlier, constituent actors in a mature network have achieved an optimal level of fitness given the fitness needs of other actors and are stable relative to one another. Actors are not so tightly locked into their roles, however, that they are incapable of self-determinism, creativity, and innovation—the system is dynamic. Bak, Tang and Wiesenfeld (1989; see also Bak, 1996) has labeled this poised state criticality.

Such networks are characterized by numerous small changes—the stock market, with its hundreds of monthly fluctuations, exemplifies this. The poised and nonlinear nature of complex systems is such that larger fluctuations are entirely possible, however. Nonlinearity means simply that complex dynamics are capable of surprises, some of them quite dramatic. Cause and effect are not always directly related; small inputs can cause disproportionately large outputs, for example. Such systems—

poised and nonlinear—are capable of stepping over the edge with little or no warning. Innocuous activities can launch a chain of interactive events that result in significant systemic disruption.

A third hypothesis is related to the criticality phenomenon: decline occurs, and is fed by, the deterioration of supporting networks. Network deterioration can be triggered and fed by internal or external perturbations. Internal perturbations include serious inertia (in combination with environmental change), decline in product quality, deteriorated worker morale, strikes or other conflicts, and pervasive leadership errors. External perturbations include market decline, debilitating legal restraints, and negative public opinion. Many of these perturbations, interestingly, are themselves products of network dynamics; public opinion, for example, or market dynamics, is rarely attributable to simple causes. However one stacks it, organizational decline is typically associated with network changes.

Research design

The research for this article seeks to understand the nature of the networks that support strong, healthy nonprofit organizations and those of weak or failed organizations. It presumes that strong organizations will have strong, vibrant networks and that weak organizations will have correspondingly weak networks of interaction and interdependency. Three nonprofit organizations were examined: the first is a strong regional organization devoted to health issues among the elderly. This organization has eight employees and three offices; its annual budget is about half a million dollars. Two employees in this nonprofit were formally interviewed and incidental information was obtained from three other employees. The second focal organization was also devoted to support for the elderly. At its peak, it was similar in size, scope of operations, and budget to the fit organization described above, but it precipitously declined and died in the late 1990s. Two former directors were interviewed; incidental information was obtained from newspaper accounts of the failure, from an employee of the national organization to which this organization belonged, and from employees in other nonprofit agencies who worked with the now defunct organization. The third organization examined is a regional nonprofit devoted to health issues. It was fittest in the 1960s and 1970s when there was strong leadership from the federal government for the health issues that this nonprofit advocated, but it has since struggled to achieve its goals. Two persons with this organization, a former director and a current board member, were interviewed and incidental information was obtained from employees of other nonprofits with which the target organization has worked. All three of the nonprofit organizations are, or were, chapter affiliates of large, national movements. All three have had paid staff members and community boards of directors, and all have been responsible for raising their own funding.

Interviews were structured around goals that each interviewee agreed were their organization's goals. Interviews were conducted individually, and respondents were told generally what the research was about when the interviews began. Data was recorded and transcribed, then each statement was coded for meaning. Interviewee observations that were corroborated by two or more respondents were given particular credence in the analysis. Two general questions were asked in the analysis: (1) to what degree was each of the organization's goals being met at different points in its history, and (2) what activities were occurring that support claims of goal success.

Findings

We found, almost uniformly, that goal attainment, as determined by the activities identified in question (2) above, is a function of interactive and interdependent networks, and that dynamics such as leadership and board activity served to promote or deter such interaction; but we're getting ahead of the story.

The fit organization

The fittest of the organizations examined had eight employees and three offices: employees included an executive director, a program director, a grant writer, a bookkeeper, two branch office coordinators, an assistant at one of the branches, and an advocacy director. The chapter is dedicated to providing support services for health-impaired elderly people and their families, to providing education for families and elder service providers in their region, to advocating the welfare of the people they serve, to soliciting funds for elder services, and to raising awareness of the problems experienced by those they serve. This organization is successful in attaining each of these goals, thus, by the definition of success offered earlier, this organization is "fit."

The organization attains these goals because of its broad interactive and interdependent network of elderly clients, family members of clients, other nonprofit organizations, policy makers, community agencies, college and university collaborators, volunteers, medical personnel, nursing home representatives, hospital professionals, media personalities, professional organizations, law enforcement officials, social clubs, students in health-related training, public schools, recreational businesses, pharmaceutical representatives, businesspeople, and legislators. Some of these agents provide raw material or use the products of the organization, thus they are directly related to this nonprofit (together with the organization itself, they comprise the meta-aggregate). Health-afflicted elderly clients, for example, directly use their services, as do the families of these elderly clients. They also constitute the raw materials that the organization processes.

Other agents are crucial to a system's fitness, agents that are less directly interdependent with the focal system. For example, the agency does not need public schools or law enforcement to satisfy its immediate survival needs, for they provide neither raw materials nor primary consumers. Its long-term fitness, however, and indeed its continued supply of raw materials and users, is intimately dependent on a rich network of such systems. The interdependencies, inter-influence, inter-sharing, information exchange, and exchanges of resources that such meta-metaaggregates promote are, we argue, the real source of a system's strength. Without these relationships, a system cannot successfully compete for resources, cannot achieve its goals, and often cannot survive.

We can illustrate this by looking at the activities the respondents from this organization talked about when asked about their goals. Fundraising, for example, is dependent on a network of supportive family members, support groups in the counties it serves, sponsoring businesses, granting agencies, public school service clubs, community service clubs, recreational facilities (who provide free or reduced-cost services for fundraising events), churches (which may advertise fundraising events to their membership or provide contributions), and radio, television and newspapers, who provide space for announcements or who provide coverage for given events. The nonprofit carries such support with, among other means, a bi-monthly newsletter, a telephone hotline for family members and elderly clients, by offering free or low-cost training programs for pastors, police officers, nursing home personnel, public school students, and others, by recruiting representatives from other groups to serve on its board of directors, by sending regular announcements to mass media outlets and developing relationships with media personalities, by maintaining close contact with its support groups (helping with programs, recruiting members and leaders, and the like), by providing a wealth of free or low-cost literature on its cause, by providing speakers for church groups, civic clubs, school groups and others, and by becoming involved in professional groups (the Association of Volunteer Administrators, for example). This regular exchange with numerous other groups creates a fabric of support that helps insure its fundraising success.

The goal of advocacy is achieved in like manner, and indeed many of the activities that ultimately support the fundraising initiatives are related to advocacy. Advocacy occurs when members of this organization speak to school groups (public schools and universities), when they provide inservice programs for pastors, police, nursing home employees and others, and when they support their cause in their newsletter and with their other literature. These same activities contribute to fundraising success. Not only are various groups (nonprofits, civic clubs, educational institutions) interactive and interdependent in a vibrant network, but the various activities (such as fundraising and advocacy) of a given organization are interactive and interdependent as well.

For the most part, no two organizations in this network of interdependency are intimately dependent on one another; rather, they contribute in small ways to each other. The net effect of interdependencies across the network, however, adds up to an important source of support for every agency in the network. To paraphrase the open systems theory literature from the 1960s and 1970s, the network adds up to more than the sum of its parts. A complex network (referring to it in the complexity theory sense) is somewhat like a mob, in that the individual members feed off of one another and, in a way, constitute something of a living entity that transcends, but lends enhanced viability to, its parts.

The failed eldercare organization

The second eldercare nonprofit examined, the one that failed, apparently did so because many of its interdependencies were disrupted. The disruption spread rather extensively and involved both internal (staff, board) and external disruption. The failure itself was precipitous and unexpected. The events that set the stage for failure occurred within a mere one- to two-year span of time, and it was not evident that the organization was in trouble until the last few months of its life. Like the sudden demise of the USSR in 1989 or the sudden decline of the Democratic Party in the US Congress in 1994, the failure of this nonprofit organization is a classic study in complexity dynamics.

As we noted earlier, this organization once had a profile that was quite similar to the fit organization just discussed. Its budget at the time of its demise was similar to that of the benchmark organization, its staffing pattern was similar, it had similar boards of directors, its goals were the same, and the activities by which it achieved those goals were similar.

The organization served eleven counties with two offices and was one of four such organizations in its state. Its board was composed of professionals from various fields (medicine, law, counseling, finances, etc.), many of whom had served for a number of years. The organization employed an executive director, a director of education, a family service director, two administrative assistants, a branch office director and assistant, and a director of its thrift store. It had a budget of more than

\$300,000, which it raised through fundraising events, grants, governmental allocations, contributions, conferences, and thrift store sales. Its network of support was extensive and, in many ways, similar to that of the first nonprofit discussed above.

In the mid-1990s, the chapter's long-time executive director resigned for non-work-related reasons and was replaced by a person with significant experience with nonprofit administration in other parts of the nation. As he put it himself, the new administrator was charged with building the program; or as his predecessor stated, they expected him to take the organization to the "next level."

The organizational philosophy that this new director brought to the organization reflected not only this call for change by the local board of directors, it reflected changes in the philosophy of the national organization that chartered this chapter as well. This new philosophy calls for a more businesslike approach to chapter management. The national organization decided to decharter small chapters and to move their responsibilities to larger chapters in the respective states. It has released a number of the long-time employees in its national office and replaced them with younger, more business-minded workers, and it is requiring that all chapters meet a long list of newly implemented standards, most of which deal with management issues. It is evident from the new director's comments in our interview with him, and from his actions, that he was aware of this new philosophy and was sympathetic to it.

Changes became evident shortly after he took office, particularly in the area of finances. He was particularly interested in increasing the chapter's budget, and in the interviews seemed focused on a target of a half million dollars. He initiated several new funding initiatives and had high expectations for their financial productivity. He continued previous work with other nonprofits in the state to lobby the state legislature for funding support.

Interpersonal difficulties with staff began to manifest themselves within a few months of his arrival, and by about his fourteenth month with the organization, all but the director of the thrift shop had resigned or had been fired. They were replaced for a while by "temp" workers provided by a personnel agency. The former director stayed on for about a year under the new administrator as director of education and support, and disagreements between the two may have contributed to the staff difficulties.

Further, the new director deliberately (by his own admission) set about to reconstitute and restructure the board of directors. By the time he left, according to one interviewee, only one board member had two years of experience with the chapter; the remaining members had served for one year or less (the scope of this change was not independently confirmed, however). About three months after he left the chapter for personal reasons (he served for about 18 months), there was a mass exodus from the board, and only about seven people (of the 30 members at the time the director left) remained to shut the doors of the chapter.

Other parts of the story are a little unclear, simply because different people had different perspectives on the events. What we deduced about these events was claimed by at least one of the interviewees and is, at minimum, consistent with themes developed by two or more sources. Before the new director came, the chapter had, at any given time, about 100 volunteers serving in various capacities (this number includes the 30 board members). About 60 of these volunteers served the organization on a regular basis as office helpers, thrift shop workers, fundraising coordinators, support group leaders, and the like. Apparently, a number of these volunteers were disenchanted by changes and perceived problems that came with the new director and cut back on their amount of service time with the chapter.

It was claimed by one interviewee that the new director was not as attentive to interactions with other organizations as he should have been. The networking activities of the director, according to this source, were initially more intense than they had been before he came, but cooperative efforts dwindled significantly as time went on. Evidence from several sources indicates that the three other chapters on this national organization in the state were somewhat divided in their support of the new director, thus reinforcing this claim. The source further claimed that other organizations that depended on, or otherwise had cooperated with, this organization in the past became disenchanted with its services. This is credible given the dramatic loss of experienced, well-connected staff suffered by the chapter. As one person put it, the temporary staff couldn't even give callers the phone number of the national office.

Apparently the chapter's advocacy and educational activities were reasonably strong until the end. The major annual conference that the organization sponsored was planned before the education coordinator was asked to leave, so it went forward as planned. The first director said that public policy advocacy had never been particularly strong under her administration, although she had participated, along with personnel from other nonprofits, in successfully lobbying the state legislature for funding support. The new director reported only that "public policy was a big thing that was coming together very well." The support groups were relatively unaffected and remained largely intact after the breakup of the chapter; this is probably attributable to a relatively loose connection to the chapter office.

All parties attributed the failure of the organization to financial losses, and indeed the chapter's books were at least \$100,000 in the red when it shut down. The question one should ask, however, is why did it get in this condition? The last director claimed that the organization was financially solvent when he left, which was four months before it closed. The organization had only about a month's worth of working capital at that time, but several fundraisers were planned that should have carried the chapter until a new director could be hired. The fundraisers apparently came off poorly, and one, which should have raised several thousand dollars, was not even conducted.

The new director argued that the failure of the board to conduct these events properly (with the resulting loss of income) was the reason for the failure. The problem ran much deeper, however. We concede, for lack of substantive contradicting evidence, that finances may well have been the proximate cause of the organization's demise, but feel that the underlying cause was the deterioration of crucial elements of the system's supporting network. The loss of all the original staff members in so short a period of time and the dramatic restructuring of the board of directors had a domino effect that weakened and disrupted the broader network of relationships. The resulting enfeebled state left the organization without the resources needed to ensure continued income. The staff that was left after the new director resigned was inexperienced, as was the board of directors. The staff members would not have had the level of "connectedness" with the broader service community enjoyed by the previous staff, since this takes time to develop. The reformulated board would not have had the commitment that accrues to a long-term relationship, the experience needed to provide logistical leadership, or the knowledge of broader network structure needed to mobilize that network. There was evidence that a number of volunteers, people who are crucial to the success of fundraising events, were disenchanted by the direction in which the chapter was going.

All this would have inevitably limited the organization's access to traditional elements of its meta-meta-aggregate such as businesses, community contacts, and schools. On top of that, the chapter had apparently lost some measure of influence and impact in the nonprofit community, and the inexperienced board and staff would have had difficulty regaining the momentum that gave it purpose and credibility. Under such conditions, it is not surprising that the fundraisers that had been planned were not sufficiently successful to keep the organization afloat. The organization failed because it no longer had the infrastructure needed to muster sufficient finances and because it didn't have the collective and established support system sufficient to give it the drive to survive.

It is tempting to attribute the failure of this organization to the actions of the new director, but that would be something of an oversimplification. Certainly, the new director's actions contributed to the breakup of the meta-meta aggregate that had formerly supported the association. He fired most of the original staff, reorganized the board, and must take some responsibility for the alienation of volunteers. However, he was under a management mandate from the national association that chartered this organization, and many of his actions can be related to that mandate. Further, the actions of the former director, who remained with the organization under the new director, seem to have contributed to the staff problems. There was no corroborating evidence that he alone was responsible for the extensive reorganization of the board, and many of those changes may have been due to unrelated, coincidental factors. Even if we were to assume that the new director was the immediate cause of the decline, however, we cannot argue that he single-handedly engineered the failure—indeed, the closing of the doors was as much a surprise to him as to anyone. Rather, at worst he simply pushed over the first few dominos; like Per Bak's sandpile, fairly simple events can initiate major landslides in complex systems.

The weak health association

The third organization examined for this study was a health-related nonprofit that dealt with a different clientele than the first two. Nonetheless, its goals and organizational structure were generally the same as those of the eldercare nonprofits. This organization began in the 1960s with significant encouragement and rhetorical support from the federal government. At one point in its life it had a full-time executive director. It was run by a board of directors and depended on volunteers for support.

This organization differs from the other two in that it is only weakly successful—successful in that it has persisted and has at least partially addressed some of its goals. With this organization we ask whether its relative weakness as an organization is connected with a correspondingly weak infrastructure of interdependencies and support.

According to its interview representatives, this organization was strongest shortly after its inauguration, in the late 1960s and 1970s. Probing revealed, however, that the strength derived less from its activities and more from the momentum of the general movement it represented. Two events from that era, events that were told almost as if they were folklore, illustrate the nature of this organization. In the first story, the local county manager decided back in the 1970s to exclude the organization from an upcoming county budget (it had been included for several years). Members of the board of directors collected 8000 signatures on a petition and got that decision reversed. In the second story, the organization found housing for two clients and was able to help them achieve a measure of independence for a while; this nonprofit was apparently one of the first such groups to do so.

These are one-time events, however; neither served to establish a permanent and broadly influential presence (ongoing support groups, for example, have more lasting and wide-ranging impact). Despite our probing, the respondents provided no evidence that suggested the group had established much infrastructure in the community. There were no support groups, no newsletters or other outreach educational programs, no major fundraisers, some interaction with other organizations, a limited cadre of

volunteers (primarily the 20 or so board members), and limited educational initiatives (the organization has had annual meetings with notable speakers, but little else). Its principal strength lay, at that time, in its fairly robust membership numbers; with the fees from those memberships, it was able to raise an operating budget of \$2000 to \$3000.

In the late 1980s or early 1990s, the organization received a small state grant to hire a full-time executive director. This was seed money, and within a few years the group had to solicit money from the United Way fund to maintain the position. This formalized leadership was not particularly productive for the association, however, and may even have been detrimental. As one respondent put it, members of the group shifted its dependence from themselves to this director and largely ceased taking responsibility for the organization.

The board became more of a social club than a volunteer service organization under the new director. Members would not rotate off at the end of their membership period partially because they felt an ownership for the movement, partially because there was some sense of prestige associated with board membership, and partially because they enjoyed one another's company. The group gave periodic parties for the populations it served, and provided Christmas gifts for a group of hospitalized clients. It did continue its annual seminar and invited health professionals and teachers to attend. However, its fundraising efforts were weak (limited largely to periodic garage sales and membership fees). It sponsored no support groups or newsletter. It did relatively little collaboration with other groups (although the director was broadly visible in the community and at the meetings of their state organization), it did less with advocacy than it had been doing in the early 1980s, it had a weak volunteer support structure (limited largely to the board membership), and despite the relatively credible professional credentials of board members (counselors, college professors, health workers, etc.), it was doing little to engage the support of professionals and businesses in the community.

The director did solicit a small contribution from a local women's club because of her active involvement as a member of that club. The association maintained relationships with a local healthcare agency that served the population advocated by the group. It sponsored a helpline telephone service that was rather successful. The director initiated a business partnership with a local middle school and engaged in activities with youth-oriented groups. Finally, the group participated in an annual screening fair at a local shopping mall.

These activities failed to produce any significant infrastructure, however—not the extensive network of interdependencies and interactions that is requisite to an organization's fitness. One interviewee stated that the organization was at its weakest during the period with a paid director, and the director herself lamented that it was difficult to get anyone engaged in substantive activities.

At the peak of the executive director period, the local United Way was providing the organization with \$18,000 in operating funds. The United Way, however, expected the organization to be productive with the funding, to use it to generate additional moneys from granting agencies and donors and to provide services in the community. United Way directors were dissatisfied with the group's productivity and, in the 1990s, funding from that source began to decline. Within about four years it dried up. The full-time director became a part-time director, and in the last few months of her tenure she served without pay. After she left, the board hired another part-time director, but after a few months of lackluster productivity this person was likewise released.

Since then, the association has become somewhat more productive. The group succeeded in obtaining a state and federal grant to fund a low-income housing unit to serve the association's target population. Respondents attribute this success to strong leadership from the board president, but interestingly the initiative was born out of contacts made by this president and the previous full-time director at a meeting of state association (part of the organization's infrastructure, such as it was). The association continues to organize its annual speaker's meeting, but is still doing little to raise local funds or to foster interdependencies and interactions with other groups (indeed, this effort has declined with the loss of the directorship). The helpline is no longer in service, there is no association office, and the organization does little (outside of its annual meeting) to educate the public.

Both interviewees pointed to the failure of leadership as the source of the organization's weakness. This is, at least partially, an accurate assessment, but the problem has not been so much a lack of leadership effort or commitment as a matter of how the leadership role was defined. Leadership, to them, means achieving the dramatic, one-time successes. Once achieved, the success enters the group's folklore to provide inspiration and a model against which future activity is gauged. Herein lies the problem: the association's history is marked by sporadic, dramatic events—the petition drive to maintain county funding, providing housing for two clients, the state grant for a full-time director, and the housing grant—but none of these events has been converted into lasting infrastructure and consistent community impact. The organization is proud of these accomplishments, but they are intermittent, one-time events with little follow-up impact.

Effective leadership, by contrast, builds lasting and strong infrastructures, the meta- and meta-meta-aggregates that we defined earlier. The difference between effective leadership and that of the focal organization is roughly akin to what Max Weber was alluding to when he defined charismatic authority and rational-legal authority. Charismatic authority fosters the one-time dramatic events, while rational-legal leadership fosters the institutionalization of successes (Weber, 1947). Complexity theory could relate this rational-legal notion to the extensive networks of interdependency and interaction that characterize a strong system. Weber thought in terms of stable bureaucracies and rules; complexity theory refers to customers and raw material sources, service providers and service users, related organizations, collaborators, confidants, communication flow within and

across organizations, supporters, sources of new ideas, advocates, and staff. From the complexity perspective, dramatic events become the product of such infrastructure rather than the singular goal of the organization. Effective leaders focus first on building those networks and then on wringing successes from them.

This association had things backwards. The mistake was in part attributable to its early history with all the hype from the federal government and its focus on form over substance. The rhetoric should have fostered the emergence of stable infrastructures, however, but for this association it didn't happen. They continue to survive in part because the members are still under the sway of the original glory, but largely because of inertia. Population ecology theory attributes organizational decline to inertia, or failure to adjust and change with a changing environment. In actuality, inertia often lends an organization sufficient stability to persist. Inertia without dynamic environmental adjustment does not foster growth, but it need not follow that inertia leads to demise. Indeed, non-adaptive inertia can help organizations survive periods in which environmental resources are scarce. The board members of this association have established stable relationships with one another, and they periodically achieve successes to add to their cultural folklore; that is enough to keep them going. They are unlikely to grow and thrive, however, until they learn to develop their complex infrastructure.

Conclusions

Earlier we defined the science of complexity as a study of the emergence of aggregates and meta-aggregates among adaptive, interactive systems, and we embedded extinction within the context of those aggregates. Three hypotheses of extinction were offered: extinction or decline (defined as failure to achieve stated or assumed goals) can occur when meta- and meta-meta-aggregates are poorly developed, they can occur because complex systems are, by definition, poised on the brink of disaster, and they occur when networks deteriorate. We found evidence in our investigation to support the first and third of these hypotheses; the second was neither supported nor discredited (although one might argue that the evidence was suggestive for this hypothesis).

The fit organization that we investigated had built a strong meta- and meta-meta-aggregate through interaction and collaboration with, service to, and dependence on multiple, diverse organizations. The history of its development is marked by competition and interaction; it experienced the many adjustments, changes, and compromises that, as we discussed earlier, characterize the development of aggregates and meta-aggregates. The organization has established stable relationships with its network of clients, family members, businesses, schools, policy makers, and others, but that relationship is dynamic and changing. Some of the network constituents are rather tightly involved with the chapter—the support groups, clients, and family members particularly. Others, such as nursing home, and other client service businesses, board members and the organizations they represent, volunteers, and the national office of this organization, are moderately involved with, and interdependent with, the chapter. Many of its network constituents are loosely coupled with the chapter; these include policy makers, schools, recreational facilities, business supporters, other nonprofits, professional organizations, mass media, and the like. All of the constituents are important elements of the organization's fitness, however. In many cases, their individual contributions to its wellbeing are small, but taken together they are the source of the organization's vibrancy and fitness. This organization receives strength and support from this infrastructure, thus it can resist perturbation and decline.

The second eldercare organization had a similar infrastructure in the mid-1990s, but that infrastructure suffered significant disruption starting about 1996. As the third hypothesis predicted, its failure occurred because of failures at the various aggregate levels. The board structure was disrupted, volunteers became disenchanting, inexperienced and unconnected staff members replaced experienced and connected ones, the new director was himself unconnected in the service region, and relationships with other organizations in the area deteriorated. These disruptions made it difficult for the organization to maintain its relationships with supporters, businesses, contributors, and others who constitute the loosely coupled bulk of an organization's infrastructure. When the chapter got behind in its financing, there was insufficient infrastructure to support it and the organization became extinct.

One could argue that, in this second organization, the new director's actions launched the interactive activity that led to the ultimate failure of this association. If true, then it lends support to our "edge of disaster" hypothesis. There is evidence that the director's actions may have been pivotal in launching the cascading events that led to failure; however other factors were involved, such as the national office's management plan, so we lean more towards the third hypothesis on this one.

The third nonprofit organization examined simply failed to develop a strong meta- and meta-meta-aggregate (the first hypothesis). It depended too heavily on leadership-inspired, sporadic successes and failed to nurture contacts with the multiple constituents that are required for a robust infrastructure. It didn't so much lack leadership, as interviewees charged, as it lacked an effective leadership focus.

As we argued at the beginning of this article, complexity theory is holistic rather than reductionistic. Fitness is not the result of a few, simple, localized causes, and neither is decline. The failures observed in this chapter resulted from multiple interactive events and involved multiple chains of interaction. Success and failure are a function of the dynamics of complex, interactive wholes.

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