EMERGENCE AND PERFORMANCE OF SOCIAL ENTREPRENEURSHIP: 
A COMPLEXITY SCIENCE PERSPECTIVE

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Abstract

A dominant, but contested, view in the literature is that social entrepreneurship should be treated as “market failure,” with related performance measures. This paper suggests that the emergence of social entrepreneurship lies in adaptive tension created via societal disruptions and disequilibria brought on by greenhouse gases, dirty water, polluted air, etc., and that performance measures can range from ROI to performance relative to stakeholder interests. Drawing from complexity theory, and in particular the concept of adaptive tension as the basis of new socioeconomic order creation, we suggest an alternative explanation of how social entrepreneurial firms emerge. Seven 1st Principles of efficacious adaptation are presented. Scale-free theories and causes are reviewed for the purpose of outlining basic elements required for social entrepreneurial firms’ success. Testable propositions are included. Discussion of research and practitioner implications follows, as does a conclusion.

Keywords: emergence, performance, social entrepreneurship, complexity theory
1 INTRODUCTION

Austin, Stevenson, and Wei-Skillern state that the “central driver for social entrepreneurship is the social problem being addressed” (2006: 2; our italics). Alternatively, Tracey and Philips (2007) argue that social entrepreneurs have to achieve both social and financial objectives. Oster, Massarsky and Beinhacker (2004) call this a “double bottom line.” But the past centuries of firms making money at the expense of air, land, and water, suggest that the double bottom line may be oxymoronic. The challenge of making enough money to survive by doing both against competition only aiming to make money is surely problematic. This suggests a follow-on problem: What theory best explains how the seemingly oxymoronic, in fact, becomes possible? To date, we don’t see any useful theory taking on the core problem: How to do both successfully at the same time over the long haul?

Social entrepreneurship is no doubt an increasingly important subject. However, extant literature focuses only on the definition, description or enumeration of social entrepreneurship activities. True, the surge of recent literature on social entrepreneurship illustrates the increasing attention to activities of social entrepreneurs, social enterprises, and collaborative movement of government, private and public entities to improve social welfare. University courses on social entrepreneurship, as well as academic conferences and commercial workshops, are growing in number. However, the key issue of why the forces of social entrepreneurial activities are strong even though they are nonprofit in nature and often run by volunteer organization, is not well researched. Adding to the puzzle, many believe that social impact—as a result of these social entrepreneurial activities—is difficult to measure and, thus, clearly places social and commercial entrepreneurship into easily differentiated classes (Austin et al., 2006). However, is it true that social and financial outcomes are all that difficult to measure? If we leave success measurement
unresolved, will social entrepreneurship theory be even less useful than it already is?

Since theoretical explanation of social entrepreneurship is nascent, with minimal attention on performance outcome measures, we focus our contribution on better explaining how/why entrepreneurs can beat the challenge of the oxymoronic double bottom line. This necessarily calls for explanations of how/why social entrepreneurs emerge in the first place and, then, how/why they survive over the long term. Drawing from complexity theory, we challenge the view of Austin et al. (2006) by offering an alternative explanation, first, about the emergence of social entrepreneurship. We argue that social entrepreneurial activities emerge as a result of adaptive tension created by broader societal disequilibria instead of simply economic “market failure” (2006: 2), or institutional failure (Zahra et al., 2008). Second, we attempt to explain the performance of social entrepreneurs over the long term. Instead of treating the performance measure as simply “the differentiator between social and commercial entrepreneurship” (Austin et al., 2006: 3), we take a proactive stance by arguing—from the perspective of order creation—that double bottom line is also the critical factor determining the survival of the social enterprises.

Based on complexity theory, we argue that the emergence of social entrepreneurship lies in adaptive tension created via societal disequilibria. The key element lies in the chaos of social disequilibria as it inevitably creates adaptive tension among parties involved. Further, we hold that performance measures must be transparent and reasonable for constructive order to emerge.

We elaborate on this core issue of societal disequilibria from the perspective of complexity theory to better theorize about and explain the emergence of social entrepreneurship. Though we recognize that Austin et al. propose that “performance measurement of social impact will remain a fundamental differentiator, complicating accountability and stakeholder relations” (2006: 3),
we address the issues of accountability and stakeholder relations, using complexity lens to argue that social impact maybe measured in the same method for-profit organization measure their performance, for example based on ROI. Stakeholder relations are ever so critical as performance measures in as much as the number of these relations directly affects the long term performance of the social enterprise.

We aim to contribute to theory and practice in several ways. First, ours is one of the first attempts to link complexity theory to the study of social entrepreneurship. Our is a first small step towards adding a theoretical explanation to the body of literature for researchers on emergence and performance of social entrepreneurship. Our model crystallizes the theory and variables involved in the emergence process, its sustainability over time, and in measuring performance. We believe that complexity theory offers relevant theory pertaining to the core issues in studying social entrepreneurship and provides a well rounded view of the criticality to the whole chain of the system. Second, we provide testable propositions for future researchers to examine the robustness and rigor of our propositions. Future research following up with empirical data will enrich our understanding of the importance of performance measure in social entrepreneurial activities and entities.

Third, many social entrepreneurial entities follow the myth of managing organizations on a “hand to mouth” strategy, therefore they focus on daily fund raising activities instead creating social impact over the long term. Our understanding from the complexity theoretical model unearth the key strategic goals to social entrepreneurs to realize that the long term self sustainability, network building and transparency of their operation are critical, as they in turn play a key role to their sustainability. Fourth, we provide a set of relevant strategic tools for practitioners. Our model helps practitioners to understand the link between profit, growth, and
value and the importance of constantly measuring their performance realistically. Finally, our proposed strategic tools helps practitioners to compare and benchmark with other social entrepreneurial activities, thereby improving their ability to obtain future funding support and sustainability.

We review the extant literature on the social entrepreneurship, emergence and performance of social entrepreneurship, then we introduce our developed theoretical model and propositions on complexity science perspective of emergence and performance of social entrepreneurship. We conclude with implications for researchers and practitioners.

2 BACKGROUND

Definition of social entrepreneurship

What is social entrepreneurship? Dees, Emerson, and Economy (2002), state that it is not about starting a business or becoming more commercial, it is about finding new ways to create social value. Social entrepreneurs aim to reconfigure resources in order to achieve social goals and social transformation (Alvord, Brown & Letts, 2004). This emphasis on social value seems to be the key to many social entrepreneurship scholars (Tracey & Jarvis, 2007; Austin, 2000; Wallace, 1999). Most of the academic focus in social entrepreneurship research is on social responsibility in the domain of non-profit firms (Wallace, 1999; Cornwall, 1998) where entrepreneurs seek to satisfy social needs (Leadbeater, 1997), social change (Prabhu, 1998), social rates of return (Canadian Centre for Social Entrepreneurship (CCSE), 2001), specific disadvantaged groups (Hibbert et al., 2001), and social problems in general. The vehicle of such activities often appears as new social organizations (Sullivan Mort et al., 2003; Thompson, 2002; Shaw et al., 2002) or continued innovation via existing ones (Smallbone et al., 2001).

The construct of social entrepreneurship has been conceptualized in various ways. Most
scholars perceive social entrepreneurship as a commitment to collective purpose that builds long term relationships with minimal resources (Waddock & Post, 1991; Leadbeater, 1997), socially oriented private sector activities, or services that the State does not provide (Smallbone et al., 2001; CCSE, 2001), ethical (Shaw et al., 2002) and volunteer support that helps people in need and is driven by social mission (Weerawardena and Mort, 2006; Thompson, 2002; Sullivan Mort et al., 2003; Dees, 1998a,b), sources of innovation (Weerawardena & Mort, 2006; Borins, 2000), and opportunity (Zahra et al., 2008).

It is clear that the social entrepreneurship literature is an aligned conceptualization. Indeed, it remains fragmented with little coherent theory (Weerawardena & Mort, 2006). Recently, social entrepreneurship scholars developed a theoretical model to depict the unique characteristics of social entrepreneurs and the context of their operation (Weerawardena & Mort, 2006). The key issue of the emergence of social entrepreneurial activities and why their performance measure is critical to its sustainability is not yet articulated, however.

**Duality of social entrepreneurship**

The earliest literature documenting social entrepreneurial activities maybe in the Holy Bible and in ancient China, India, Persia, and Egypt. To understand the academic meaning of the term, however, it may be best to deconstruct the term and read them as, “social” matters related to the collective concern in a society or “entrepreneurship” matters related to innovation and new business activities that generate economic benefits. Taken together, they denote a special meaning that combines value generated by business organization with value created by solving solution onerous conditions confronting the target population. We extend the Han and McKelvey complexity perspective—which holds that emergent technology-based new ventures “achieve stability through instability” (2008: 4; our italics)—to the context of social entrepreneurship.
Hence, we define social entrepreneurship as *individuals and/or organizations* (hereinafter called agents) *pursuing new order in the form of entrepreneurial activities seeking to reduce potentially disastrous societal states to constructive (healthy) longer-term equilibrium conditions*. Put more succinctly, these are activities that *create equilibrium through disequilibrium*. In other words, social entrepreneurial activities are new order-creation processes that reduce harmful states to long-term equilibrium conditions offering improved social value.

The duality of social entrepreneurship is not from the term itself (social and entrepreneurship), but from the method and result of its activities (commercial and social return). Social entrepreneurship does not mean activities in the non-profit sector alone because non-profit sectors often do not set income and profit generation as one of their priorities; social entrepreneurs do (Tracey & Philips, 2007). In fact, social entrepreneurs have a *double* bottom line, they produce *both* social and commercial objectives (CCSE, 2001; Hansmann, 1987; Oster et al., 2004). These scholars take the view that social entrepreneurs may concurrently pursue social goals as well as profitability—it is important to generate income so an enterprise can reinvest in its social project and sustain the social mission over the long term. Ben & Jerry’s “PartnerShop” initiative is an example where profit is reinvested back into social initiatives. However, the nature of performance measures and why they are critically important to social entrepreneurship’s sustainability has received little attention in literature.

**Opportunity and challenges**

Social entrepreneurship scholar agree in general that (1) social problems create opportunities for social entrepreneurs; at the same time, (2) activities resulting from social entrepreneurship create opportunities for people in need as well as people desiring to give (Neck, Brush, & Allen, 2009; Seelos & Mair, 2005; Predo & McLean, 2006). Harm-based problems and challenges—
whether at the individual, ecological, or planet level—indeed, create opportunities for individuals and organizations to develop innovative methods to overcome these challenges. For example, the growing aging population leads to healthcare needs; the disadvantaged and/or orphans lead to the need for housing (UdayanCare, 2008); rapid economic development and consumption in developing regions such as India, China, Brazil, Russia and the Mid-East substantially increase demands for food, energy, clean water, and construction. Concurrently, however, our planet experiences shrinking natural resources (Neck et al., 2009), increased global warming, and requirements for innovative new technologies. These are examples of problems, inequality, shortages, and disruptions—what we term disequilibrium states in societies. But to entrepreneurs they appear as golden opportunities calling for rapid responses with innovative solution (Yunus, 2008; Drayton, 2008).

What theory and practice in social entrepreneurship currently pay little attention to is the challenge and importance of sustainability. Due to human nature, it may be rather easy to participate in social causes given the urgency or sudden need of dramatic events such as South Asian Tsunami of 2004. However, many disequilibria occur in societies over many years and, therefore, require longer term care and more importantly scalability—from small initial goodwill attempts to dramatic and lengthy responses—to truly combat the core issue. To achieve this, the collective social enterprise needs to uphold a very clear and persistent vision and mission in both social and economic goals for the successful development of social entrepreneurship. Therefore, successfully meeting double bottom line or triple bottom line objectives (Neck et al., 2009; Dees, 1998; CCSE, 2001) in social entrepreneurial firms (SEFs) is a critical issue. In other words, the traditional performance metrics of profit and growth are important and should be tightly observed and employed (Skoll, 2004; Drayton, 2008). But, simultaneously, SEFs need to balance
the tension of managing their social and commercial objectives (Tracey & Philips, 2007).

Stakeholders and donors of SEFs require a clear, transparent picture of the financial health and future strategic plan of an SEF in order to be inspired to continue their support. For example, UdayanCare, a social enterprise in India providing quality care to orphans and women, not only provides annual reports to its donors and stakeholders, but on a monthly and quarterly basis, it gives a “personal progress report” to its donors and stakeholders about each child’s academic and personal advancement. The table below shows how the UdayanCare sets objectives and records achievement by performance measures coupled with its financial reporting.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce the financial burden of the HIV+ parents for better nutrition and education of their affected children along with counseling.</td>
<td>Induction of eight new HIV affected children.</td>
</tr>
<tr>
<td>Ensuring the children a positive future on the wings of education and good health.</td>
<td>Two more children had been shifted to English medium school from government schools.</td>
</tr>
<tr>
<td>Establishing a long-term relationship with the children through counseling and home visits.</td>
<td>Three more parents got employment during the year.</td>
</tr>
<tr>
<td>Providing the children an option of finding a Home in our Udayan Ghars in case of the unfortunate demise of their parent(s).</td>
<td>Wedding bells for our beneficiaries: Rekha Devi and Hari Shankar Singh had lost their spouses to the deadly disease and are now going to tie the knot with each other very soon.</td>
</tr>
</tbody>
</table>


Moreover, UdayanCare also set up clear goals to be achieved by 2010 (see UdayanCare Annual Report). This rigorous reporting method and clear strategic plan into the future is a key ingredient needed for SEMs to be successful. Further defining comparable performance objectives is an important challenge for social entrepreneurship theory and practice (Tracey and Philips, 2007).

2.1 *Extant Literature on Emergence of Social Entrepreneurship*

The extant literature pays little attention to the actual *emergence* of SEFs; rather most focus is on the definition, description, or enumeration of the social entrepreneurial activities by existing entities. Some scholars define social entrepreneurship as *social focused commercial enterprises*.
(Dees & Anderson, 2003); others treat social *entrepreneurship by existing commercial corporations* or *nonprofit organizations creating social value* as social entrepreneurship. These studies imply that social entrepreneurship mostly occurs when existing organizational entities create novel social value using existing strategies, perhaps coupled with innovative methods. Austin et al. (2006) propose that social entrepreneurship exists due to market failure. Therefore, SEFs with a social purpose emerge only when there is a significant gap between demonstrable Demand and lack of Supply. This Demand/Supply inequality may also occur when a public-in-need cannot afford prices charged by the suppliers. For example, HIV patients in Africa cannot pay for their medication at prices charged by firms located developed countries. Therefore, groups of medical-based and pharmaceutical-based SEFs have collectively formed to overcome this supply deficiency by providing medication at affordable prices to African with HIV. However, this explains part of the rationale of SEF emergence.

### 2.2 Extant Literature on Performance of Social Entrepreneurship

The extant literature holds that the performance accountability of SEF’s activities carries greater challenges than does more prosaic commercial entrepreneurship by existing entities, whether commercial or nonprofit (Austin et. al., 2006). They argue that commercial organizations can measure their performance using standard tangible and quantifiable measures such as financial indicators (e.g., ROI or ROA) and market share. But, to make the issue more complicated, the number of stakeholders at social entrepreneurial entities is much more diverse and larger in number when compare to most commercial firms. Therefore, Austin et al. propose that the challenge of measuring social change is complicated due to “nonquantifiability, multicausality, temporal dimensions and perceptive differences of the social impact created” (2006: 3). Alternatively, Dees et al. argue that values of the most non-profit organizations is
defined by “measureable social impact” (2002: 162). It is increasingly important for social enterprises to report their performance; absence of evidence is no longer acceptable.

3 THEORY DEVELOPMENT FOR SOCIAL ENTREPRENEURSHIP

By way of introduction, the existing literature on SEFs is fragmented; it begs for better theories to explain the process, emergence and eventual performance of SEFs. We draw on complexity theory—and in particular the concept of new order creation induced by adaptive tensions (McKelvey, 2004b)—to articulate the causal relationship of emergence and performance of SEFs. Figure 1, below, depicts the causal relationship, process, and direction of the key variables in the process of achieving equilibrium from disequilibrium.

We propose that social disequilibrium emerges as a result of energy differentials (broadly defined) within a societal population (for example oil-based wealth to politicians vs. an impoverished population in Nigeria; clean water vs. contaminated water; disease outbreaks such as cholera in Zimbabwe vs. health, etc.). Tensions stem from underlying disasters, disruptions—and more broadly, disequilibria—that create adaptive tensions within a society and, then, give rise to structures that dissipate the tensions: i.e., SEFs, and larger pockets of SEF-based new order appear (e.g., groups of activities start to create tensions within a society). When the dissipative energy (tension) reaches a specific level, a phase-transition process begins (changes start to be made); this is when adaptive tension results. It may also happen that tension creates positive feedback effects that further enhance the initial SEF activities). Adaptive tension activates the emergent SEFs, which then leads to self-organization by various agents to create the SEFs. But, this self-organization process cannot meaningfully turn disequilibrium into equilibrium unless scalability dynamics are also set off. Therefore:

**Our core proposition is:** Societal disequilibria create adaptive tensions among disparate
parties; this tension drives the emergence of SEFs, which in turn set in motion a trend toward equilibrium that dissipates the social disequilibrium. Therefore, social entrepreneurship appears as a new order-creation process.

Figure 1: Complexity model of creating equilibrium through disequilibrium

3.1 Toward a Complexity Theory of Emergence of Social Entrepreneurship

Social entrepreneurship firms (SEFs) exist in dynamic, nonequilibrium, nonlinear competitive environments—i.e., *dynamical* environments. Complexity scientists have established that only complex adaptive systems (CAS) are able to adapt, survive, and grow under these conditions (Kauffman, 1993; Holland, 1995; McKelvey, 2004c). SEFs have to transform their firms into high performing CAS. To accomplish this, they have to:

- Fully address the adaptive challenges facing their firms in terms of the first principles of efficacious adaptation (McKelvey, 2004a); this is the adaptive part of CAS;
- Make sure appropriate complexity dynamics operate at all levels, as their firms grow, differentiate, and become multilevel, complex systems; this is the complexity part of CAS;
- Make sure scale-free dynamics foster emergent complexity dynamics at multiple levels; and
- Attain the state of self-organized criticality (Bak, 1996).

We begin by reviewing CAS theory and then set out our propositions regarding the adaptive tension and emergence requirements for enabling CAS dynamics in SEFs. We separate complexity science into three Phases, the first two of which we briefly describe next.
**Phase 1—Tension Dynamics.** Emphasis focuses on critical values and dissipative structures. It’s based on the works of Prigogine (1955, 1997), Haken (1977), Nicolis & Prigogine, 1989), and Mainzer (1994/2007), among many others. It began with the Bénard (1901) process—an energy differential is set up between warmer and cooler surfaces of a container (measured as temperature, $\Delta T$). In between the 1\textsuperscript{st} and 2\textsuperscript{nd} critical values ($R_{c1}$, $R_{c2}$), a region is created where the system undergoes a dramatic phase transition in the nature of fluid flow. For example, increasing the heat under water molecules in a vessel exposed to colder air above leads to geometric patterns of hotter and colder water—the chef’s “rolling boil” emerges; new order appears. The critical values define the “melting zone” (Stauffer, 1987; Kauffman, 1993), within which new structures spontaneously emerge. Prigogine (1955) termed these “dissipative structures” because they are pockets of new order—governed by the 1\textsuperscript{st} Law of Thermodynamics (the energy-conservation Law)—that speed up the dissipation of imposed energy differentials, by creating new intra-system order (Swenson, 1989).

Phase 1 focuses on what sets order-creation dynamics in motion. It draws mostly from the physical sciences and views imposing energy differentials leading to phase transitions as the cause of order creation. A phase transition occurs because an imposing energy differential, what McKelvey (2001, 2008) terms “adaptive tension” exceeds what is called the 1\textsuperscript{st} critical value, $R_{c1}$—which defines the lower bound of the region of emergent complexity.

Elsewhere, McKelvey (2004b) reviews the several theories about causes of emergent order in physics and biology, some of which have been extended into the econosphere and social behavior. Kelso, Ding, and Schöner (1992) offer the best synthesis of Phase 1:

*Control parameters, $R_e$ externally influenced, create $R > R_{c1}$ with the result that a phase transition (instability) approaches, degrees of freedom are enslaved, and order parameters appear, resulting in similar patterns of order emerging even though underlying generative mechanisms show high*
Setting the stage for order-creation-based analysis of entrepreneurial start-ups, Schumpeter, in 1934, quite remarkably wrote about replacing evolution with phase transitions—well before Prigogine (1955) and replacing gradualist evolution with punctuated equilibrium long before Maruyama (1963) or Eldredge and Gould (1972)! Besanko, Dranove and Shanley (2000: 485) summarize Schumpeter’s thesis as follows:

Schumpeter considered capitalism to be an evolutionary process that unfolded in a characteristic pattern. Any market has periods of comparative quite, when firms that have developed superior products, technologies, or organizational capabilities earn positive economic profits. These quiet periods are punctuated by fundamental “shocks” or “discontinuities” that destroy old sources of advantage and replace them with new ones. The entrepreneurs who exploit the opportunities these shocks create achieve positive profits during the next period of comparative quiet. Schumpeter called this evolutionary process creative destruction. (my italics and underlines)

For Prigogine, dissipative structures are pockets of order (governed by the 1st Law) that serve the demands of the 2nd Law of Thermodynamics (the entropy-production Law) by dissipating the difference between high-energy/high-order entities in the environment and the fundamental equilibrium state of randomness or disorder. In short, dissipative structures are disequilibrium states that emerge to speed up the production of equilibrium!, i.e., speed up entropy production. For economists, firms are order creations that reduce the tension between Demand and Supply or reduce differences in prices so as to produce market equilibrium. For Schumpeter, shocks are disequilibria that give rise to entrepreneurial firms that, then, reduce the Supply/Demand or old/new tension in the marketplace. For us, social entrepreneurs create firms to reduce the Demand between green and clean vs. the Supply of environmentally and/or socially harmful and/or destructive products.

For example, a technical or process innovation (Tushman & Anderson, 1986) can set up disequilibrium between the entrepreneur and the current market; these innovations drive the self-
organized emergence of new firms and new industries (Binks & Vale, 1990) and, for us, social entrepreneurship. Slevin and Covin (1997: 56) describe this process by suggesting that “successful entrepreneurial firms act as energy conversion systems.” In a broader managerial context, Anderson (1999: 222) suggests that adaptive tension may be generated by managers:

Those with influence and/or authority turn the heat up…on an organization by recruiting new sources of energy (e.g., members, suppliers, partners, and customers), by motivating stakeholders, by shaking up the organization, and by providing new sets of challenges that cannot be mastered by hewing to existing procedures.

The application of the 0th law in socioeconomics rests with Haken’s control parameters, the first two words in the Kelso et al.’s statement. The $R_i$ adaptive tensions (McKelvey 2001, 2008) can appear in many different forms, from Jack Welch’s famous phrase, “Be #1 or 2 in your industry [in better than average growth] or you will be fixed, sold, or closed” (Tichy & Sherman, 1994: 108; paraphrased), to narrower tension statements aimed at technology, market, cost, or other adaptive inadequacies. Schumpeter observes (quote above) that entrepreneurs are particularly apt at uncovering tensions in the marketplace. The applied implication of the 0th law is that new order-creation activities are functions of (1) control parameters, (2) adaptive tension, and (3) phase transitions motivating (4) agents’ self-organization. Take away any of these and order creation stops.

**Phase 2—emergent order via self-organization.** Emphasizes agent1 self-organization absent outside guidance or control (Holland, 1988). It consists largely of scholars associated with the Santa Fe Institute (Pines, 1988; Cowan et al., 1994; Arthur et al., 1997). While Phase 1 focuses mostly on dramatic phase transitions at $R_{c1}$,—the edge of order, Phase 2 complexity scientists focus mostly on $R_{c2}$—the “edge of chaos” (Lewin, 1992/1999; Kauffman, 1993). The “edge of

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1 “Agent” is a term broadly used to refer to cells, organisms, species, conversation elements, people, employees, groups, firms, industries, and societies, among many other more specific definitions.
chaos,” long a Santa Fe reference point (Lewin, 1992), is now in disrepute, however (Horgan, 1996: 197)—it is better to just think of $R_c^2$ as the 2$^{nd}$ critical value—the upper energy boundary of the melting zone. Focusing on living systems (Gell-Mann, 2002), Phase 2 emphasizes the spontaneous co-evolution of entities (i.e., the agents) in a CAS. Agents restructure themselves continuously, leading to new forms of emergent order consisting of patterns of evolved agent attributes and hierarchical structures displaying both upward and downward causal influences.

Considerable evidence of self-organized, emergent, coevolutionary behavior in organizations exists. The earliest discoveries date back to Roethlisberger and Dixon (1939) and Homans (1950)—both dealing with the mutual influence of agents (members of informal groups), the subsequent development of groups, and the emergence of strong group norms that feed back to sanction agent behavior (reviewed in Scott, 1998). Several of the articles in the Organization Science special issue on coevolution (Lewin & Volberda, 1999) report out evidence of microcoevolutionary behavior in organizations. Finally, a number of recent studies of organization change show much evidence of coevolution between organization and environment and within organizations as well (Meyer & Gaba, 2002; Siggelkow, 2002; Murmann, 2004).

In his classic paper, Maruyama (1963) discusses mutual causal processes mostly with respect to biological coevolution. He also distinguishes between the “deviation-counteracting” negative feedback most familiar to general systems theorists (Buckley, 1968) and “deviation-amplifying” positive feedback processes (Milsum, 1968). Boulding (1968) and Arthur (1990, 2000) focus on “positive feedbacks” in economies. Negative feedback control systems such as thermostats are most familiar to us. Positive feedback effects emerge when a microphone is placed near a speaker, resulting in a high-pitched squeal. Mutual causal or coevolutionary processes are inherently nonlinear—as noted by Maruyama (1963), Gleick (1987), and Ormerod (1998).
Large-scale outcomes may be instigated by what Holland, 1995) calls “tags” (“very small initiating events”). Lorenz (1972) referred to them when he asked “Does the Flap of a Butterfly’s Wings in Brazil Set Off a Tornado in Texas?” We refer to them as butterfly events.

Bak (1996) extends this treatment in his discovery of “self-organized criticality”, a process in which butterfly events can lead to complexity cascades of avalanche proportions best described as an inverse power law (more on this later). The signature elements within the melting zone are self-organization, emergence and nonlinearity. Kauffman’s “spontaneous order creation” begins when three elements are present: (1) heterogeneous agents; (2) connections among them; and (3) motives to connect — such as mating, improved fitness, performance, learning, etc. Remove any one element and nothing happens. According to Holland (2002) we recognize emergent phenomena as multiple level hierarchies, bottom-up and top-down causal effects, and nonlinearities. Nonlinearity often stems from scalability reflected as power laws.

Both Phases are important. Phase transitions are often required to overcome the threshold-gate effects characteristic of most human agents — so that there is a broader coevolutionary dynamic set in motion once the tag occurs. This requires the adaptive tension driver to rise above $R_{c1}$. Once the adaptive tension force is strong enough to overcome the threshold gates, and given that a tag occurs, and assuming the other requirements are present (heterogeneous, adaptive learning agents, and so forth), coevolution then starts. Neither $R > R_{c1}$ nor tag-plus-coevolution seems both “necessary and sufficient” by itself, especially in social settings. This is why phase transition and coevolution are “co-producers” (Churchman & Ackoff’s 1950 term). It seems clear that (entrepreneurial) order-creation via adaptive tension, $R > R_{c1}$, and phase transition, as Schumpeter figured out sixty years ago, fits with the Phase 1’s view of what causes self-organization and subsequent nonlinearity. This approach, has been used to explain a broad range
of organizational, sociological, and economic phenomena (e.g., Schieve & Allen, 1982; Smith & Gemmill, 1991; Lesouer & Orlean, 1998; Lichtenstein, Dooley, and Lumpkin, 2006).

**Proposition 1:** Within the same community (society), if there is an energy differential (e.g., wealth or health differences), there will be social disequilibrium. This disequilibrium is likely to lead to tensions (Prigogine, 1955) within the community.

**Proposition 1a:** When tension generated from social disequilibria increases within a community (dissipative energy becomes strong), pockets of new order will form (i.e., dissipative structures), changes will begin and phrase transitions emerge. This occurs when adaptive tension results morphs into positive feedbacks of constructive forms, such as SEF activities (McKelvey, 2004b,c).

**Proposition 2:** Adaptive tension activates the agents such that emergent self-organization of individual entrepreneurs into SEFs appears. This positive energy/tension effect sets off the self-organization process in the form of SEF formation(s).

### 3.2 1st Principles of Efficaciously Adaptive SEF Performance

We formulate our complexity-based theory explaining the emergence and performance of SEFs from four concepts. We propose that vigorous provision creation of transparent and responsible financial and social impact-based performance criteria/standards is critical to the longevity and scalability of SEFs because: (1) positive feedback is provided and spirals up to further stimulate strategic formulation of the kinds of strategies that are the determinants of long term success (Burgelman & Grove, 2007); (2) positive-feedback effects form the basis of scalability and transformation of the SEFs (Skoll, 2004); (3) results in the form of effective performance reporting helps improve decision making and generate innovative solutions and derivative stakeholder support (Levy, 1994); and finally, (4) even short-term performance measures often lead to unpredictable long-term outcomes since SEFs are “living systems” (Gell-Mann, 2002) existing in dynamical—i.e., unpredictable—CAS environments (Stacey, 1995).

Because they are living CASs, SEFs have to adapt to changing environments if they are to
survive and grow, and/or they must co-evolve with competitors in stable niches (Kauffman, 1993; McKelvey, 1999). But what demands does adapting to changing environments impose on an SEF? What does it actually have to do? How would one know whether an SEF has adaptive structures and processes in place? In this section we briefly define seven ‘First Principles of Efficacious Adaptation’ defined in the literature some 40 to 70 years ago (McKelvey, 2004a). A first principle is defined as one logic step up from basic self-evident axioms, such as $F = ma$. In this axiom, force, mass, and acceleration are self-evident—just stand in front of a bus or speeding sports car and you will feel the effect of its truth! Each has been discussed in the literature for decades and has survived without challenge. Collectively, they are multiplicative in that a system that is ‘zero’ on any one of them won’t survive, whereas the effects of two or more have a multiplicative adaptive effect.

Each of these first principles is a generative force driving efficacious adaptation in organisms and organizations. The seven principles are Adaptive Tension, Variation Rates, Requisite Variety, Near Decomposability, Causal Complexity, Coevolution (scalability), and Causal Rhythms. We hold that these seven generative forces drive SEF development. The ability of any SEF entrepreneur to create viable emergent structures—emergent requisite complexity—capable of efficacious adaptation in changing environments comprising scarce resources and aggressive competitors is pursued within the confluence of these forces.

1) Prigogine’s phase-transition theory. One of the origins of order creation is a disequilibrium between two adjacent systems or ‘fields’, where one field enjoys a high concentration of resources (e.g., information, knowledge, capital, market potential) compared to an adjacent other field (Prigogine, 1997). The disequilibrium sets up an adaptive tension, defined as a contextually imposed energy differential (McKelvey, 2001, 2008). The energy disparity
causes a phase transition; that is, new order creation. Since tension seeks resolution, this energy
differential induces a creative response that generates new order within the system as a whole
(Barney & Arikan, 2001).

The concept of adaptive tension is particularly relevant in social entrepreneurship. This type
of “social” innovation largely results from an entrepreneur’s perception of disequilibrium relative
to a firm’s competitive environment (Eisenhardt & Schoonhoven, 1990). Such disequilibria drive
the process of opportunity identification and then innovation (Stevenson, 1999). This process
allows social entrepreneurs to identify new markets, industries, products, and services that can be
capitalized on via the value-creating activities within a new venture. Long ago Schumpeter
(1934) turned our attention to the critical effect that phase transitions and disequilibria have on
the creation of new economic order. He called it “creative destruction” as a result of
environmental shocks.

(2) Ashby’s law of requisite variety. In order to remain viable, a system needs to generate the
same degree of internal variety as the external variety it faces in the environment. Essentially,
external variety—including ‘disturbances’ or uncertainty—can be managed or ‘destroyed’ by
matching it with a similar degree of internal variety: ‘Only variety can destroy variety’ (Ashby,
there is a cost to matching internal and external variety. The more external complexity, the
higher the internal costs of adapting, in terms of time and capital.

This principle easily applies to SEF adaptation. Effective strategic management requires that a
firm’s structure, strategy, and mindset be aligned, both internally and externally (Eisenhardt &
Schoonhoven, 1990). Entrepreneurial and managerial cognition is bounded (March & Simon,
1958/1993); thus, when firms encounter new phenomena, they have to (1) expand requisite
variety as required (Wiklund, 1999); (2) adapt to environmental changes (Zajac & Kraatz, 1993); (3) limit their perception of reality to foster effective schema development [what Gell-Mann (1988, 2002) calls “effective complexity”] to fully appreciate and interpret the external complexity—firms can’t respond to every degree of freedom in their environment (Boisot & McKelvey, 2006); and/or (4) deny the conflicting information as irrelevant.

(3) Fisher’s change rate theorem. Fisher (1930) made the connection between variation and adaptation, a link that is now all but axiomatic in the biological and social sciences. His basic theorem states: “The rate of evolution of a character at any time is proportional to its additive genetic variance at that time” (quoted in Depew & Weber, 1995: 251). In other words, adaptation to a changing environment speeds up the rate that usable genetic variation becomes available.

Fisher’s theorem is especially relevant to research on innovation in high-velocity environments where knowledge creation provides the key to ongoing variations within products and product lines (Eisenhardt, 1989). As product life cycles shorten (Poza, 2004) and hypercompetition increases (D’Aveni, 1994), rapidly creating new knowledge becomes a key competitive advantage (Leonard-Barton, 1995). As Prusak (1996: 6) says:

The only thing that gives an organization a competitive edge—the only thing that is sustainable—is what it knows, how it uses what it knows, and how fast it can know something new!

The speed of knowing something new is critical to SEFs, but the speed of shaping a new entity such as an SEF is even more advantageous (Tushman & O’Reilly, 1997). The more disequilibrium, the more phrase transition, and then the more new order creation. In the context of SEFs, this means more changes and transitions and more opportunities to create even more new SEF structures and processes.

(4) Simon’s principle of near decomposability. Simon’s (1962) classic essay on the architecture of complexity articulates his design principle for modular systems. Complex systems
consisting of nearly decomposable subunits (i.e., mostly independent from top-down control or interdependencies with other subunits) tend to evolve faster and toward stable, self-generating configurations. Simon’s idea re-emerged as Weick’s (1976) loose-coupling concept and more recently as modular production and product design (Sanchez & Mahoney, 1996). Schilling (2000) suggests that modularity is a continuum describing the degree to which a system's components can be separated and recombined.

New venture creation is studied in terms of elemental behaviors or tasks that systemically integrate to drive organizational emergence (Carter et al., 1996). The early development of companies has long been framed in terms of increasing degrees and levels of structure and control (Chandler & Hanks, 1994). The need to continuously increase internal levels of differentiation and specialization has been seen as a driving force in the evolution of new organizational forms for decades (Lawrence & Lorsch, 1967; Miles et al., 1999).

(5) Lindblom’s principle of causal complexity. Lindblom (1959) introduced the processes of parallel interaction, mutual adjustment, and coordination that characterize social units facing complex and uncertain choice and action situations. Lindblom’s principle is the foundation of Buchler’s (1966) “interactional complexity” that arises once near decomposability is achieved. Groups of various kinds may be interconnected; each group has an agenda; each agenda pushes policies and organizational action forward. In Lindblom’s work we have early, if not the first, recognition of multiple causal influences in CASs.²

Cohen, March, and Olsen (1972) observe that emergent, differentiated, semi-autonomous subunits generate the need to integrate “organized anarchy.” The latter leads to added hierarchical levels and emergent integration processes among them (Galbraith, 1973). The task
here is to solve key problems that can limit order creation and emergence. The principle issue of organized anarchy is one of top-down directing versus bottom-up emergent organizing—a causal duality. If this problem isn’t solved, the unit loses its adaptive capability.

(6) Maruyama’s principle of coevolution via positive feedback. Mutual causality via deviation amplification was initiated by Maruyama (1963). He suggests that a relationship that is mutually causal and that amplifies an insignificant or accidental start is likely to spiral into a different type of relationship depending on different (insignificant) initial conditions. Maruyama anticipates the coining of the term coevolution by biologists Ehrlich and Raven (1964).

Kauffman (1993) states that organisms not only evolve, they coevolve. The more connections among modules, the higher the possibility of mutual causal dynamics (Okes, 2003), which magnify the emergence of order creation in biology (Goerner, 1994) and economics (Arthur, 1990; Ormerod, 1998).

In organizations, the defining issue is mutual learning by both the firm and the individuals within it (March, 1991). A variety of organization scientists have studied coevolutionary dynamics relevant to entrepreneurial settings (Meyer and Gaba, 2002; Siggelkow, 2002; Murmann, 2004). In the context of SEFs, learning via coevolutionary processes comes at a price. It is important for SEFs to coevolve with customer needs and competitor positioning. For example, Microsoft tends to customer needs by developing user-friendly platforms; it also connects with users by developing a system that locks users in such that their usage coevolves with Microsoft’s products. In the context of technological competitiveness, users or products that don’t coevolve will very likely lag behind and fail. Given limited time and capital resources, and the fast rate at which market, customers, and competitors change, the optimal rate for SEF

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2 This is one principle that does not originate in biology. In a personal note (August 8th, 2004), Salthe notes that several authors made forays into causal intricacy prior to his 1985 book, but they were not picked up by mainstream
coevolution is necessarily faster.

*(7) Dumont/Dupuy’s causal rhythms.* The rhythm principle stems from Dumont’s (1966) initiating study of Hindu society. He found that dominance oscillates between Brahmin and Rajah (religion vs. secular forces) as the need for warfare comes and goes. In organizations, we see dualities such as centralization-decentralization and exploitation-exploration (March, 1991). Most academics propose balancing these; March (1999) says balance is impossible. Dupuy (1992) adds the idea of fast or slow oscillation.

The dynamic rhythm idea, termed “circular organizing,” also appears in studies by Ackoff (1981), Endenburg (1988), Nonaka, 1988; and Romme (1999). Interestingly, the biologist, Kelso (1995) also writes about coordination rhythms across various biological levels of analysis, from cells to fingers to brains. Further, he notes that these rhythms operate at different time scales (1995: 247). Thomas, Kaminska-Labbé and McKelvey (2005) find that oscillation dynamics also operate at different rhythms in firms, with profitability at stake. Thus:

*Proposition 3: Double bottom line financial and social impact-based performance reporting that is, valid, transparent, and responsible is critical to the longevity and scalability of SEFs.*

*Proposition 3a: Long term success is positively related to continuous reception of feedback from performance reporting so that strategies can be modified. (Burgelman & Grove, 2007)*

*Proposition 3b: Innovative solutions are positively related to the continuous development of valid and timely performance reporting so that improved decision processes can be generated (Levy, 1994)*

*Proposition 3c: Short-term performance measures are positively related to long-term outcomes (Stacey, 1995).*

### 3.3 Scale-free Performance for SEFs: Lessons from Econophysics

For any commercial or social entity, stability often leads to organizational inertia and may lead to termination by adaptive tensions imposed by market change or competitor dynamics.
Consequently, we argue that SEFs aimed at translating disequilibrium-based tensions into equilibrium conditions may require initiating scalability dynamics so as to achieve long-term viability and success. We base our argument on the concept of multilevel scale-free regularities and fractal dynamics—as described next. For example, scalability may be needed and employed with respect to projects, locations, markets, target beneficiaries, caregivers, and methods of fund raising. This multilevel focus of scalability opens up the possibility that these fractal dynamics may often lead to significant positive energy and subsequent impact. For example, an initial idea for a new SEF, focusing for example on better water management, that is first communicated to a couple of friends, and then to a broader network of contacts, and eventually to an extensive networks of possible stakeholders and other concerned non-government organizations, may then blossom into a viable and significant SEF.

**Introduction to Scale-free Theory**

*Phase 3, Econophysics,* is the most recent development in complexity science. Its focus is on how order creation actually unfolds once the forces of emergent order creation by self-organizing agents—such as biomolecules, organisms, people, or social systems—are set in motion. Key parts of this third phase are fractal structures, power laws, and scale-free theory. In his opening remarks at the founding of the Santa Fe Institute, Gell-Mann (1988) emphasized the search for scale-free theories—simple ideas that explain complex, multi-level phenomena. Brock (2000) goes so far as to say that “scalability” is the core of the Santa Fe vision—no matter what the scale of measurement, the phenomena appear the same and result from the same causal dynamics. Gell-Mann (2002) concludes his chapter, “*What is Complexity?*” with a focus on scalability and power laws.

*Gell-Mann* (2002) defines “*effective complexity*” as regularities or schema that are found or
judged to be useful—they are neither too simple nor overly complex. Like Goldilocks’ porridge, they are “just right.” SEF entrepreneurs develop these schemas by separating the external complexity dynamics they can cope with, from random noise. Gell-Mann notes that regularities appear as equations (in physics), genotypes (in biology), laws and traditions (in cultures), and best practices (in management). What is new is that he recognizes the chaos-derived regularities in CASs, which he defines by separating out the pink, brown, and black portion of Schroeder’s (1991) colored noise from white noise (see also Dooley and Van de Ven, 1999). In doing so, he sets forth two regularities: Type 1: the old simplicity of reductionism, equations, linearity, and predictions of classical physics; and Type 2: the new simplicity of “tiny initiating events” (Holland, 2002)—what we call “butterfly-events”—that initiate causal dynamics leading to nonlinearity, similar causal dynamics at multiple levels, power laws, and scale-free theory. We describe Gell-Mann’s regularities in more detail below.

- **Type 1 law-like regularities** are the reductionist causal processes of normal science, which are predictable and easily represented by equations. Their data and information are much preferred in classical physics and neoclassical economics (Gell-Mann, 2002: 19). These regularities are the point attractors of chaos theory—defined by forces, equilibrium, and energy conservation. These regularities characterize existing empirical organization and management research. These may be confidently described via Gaussian statistics and allow predictions that become the basis of schemata and prescriptive solutions.

- **Type 2 multilevel scale-free regularities** are outcomes over time that result from an accumulation of random tiny initiating events [Holland (1995) also calls them “tags”] that have lasting effects, are compounded by positive feedback effects over time, and become ‘frozen accidents’ (Gell-Mann, 2002: 20). These are the strange attractors of chaos theory—never repeating, fostering indeterminacy, offering a different kind of regularity. They are the bifurcation points of chaos theory. The butterfly-events of chaotic histories are never repeated, are not predictable, and can produce significant nonlinear outcomes that may become extreme events. Consequently, describing these systems is at best problematic and easily outside the explanatory/scientific traditions of normal, reductionist science. Gell-Mann concludes by noting that when butterfly-events spiral up such that their effects are magnified at multiple levels, we see self-similarity, scalability, and power laws—all elements studied
by econophysicists.

**Fractals.** Consider the cauliflower. Cut off a “floret”; cut a smaller floret from the first floret; then an even smaller one; and then even another, and so on. Despite increasingly small size, each lower-level component performs the same function and has essentially the same design as the floret above and below it in size. This feature defines it as fractal. Fractals can result from mathematical formulas—the very colorful ones figuring in Mandelbrot’s “Fractal Geometry” (1982). We are more interested in fractal structures that stem from adaptive processes—like the cauliflower—in biological and social contexts. In fractal structures the same adaptation dynamics appear at multiple levels. McKelvey, Lichtenstein, and Andriani (2009) list 19 studies showing fractal structures in predator/prey relationships.

**Power laws.** If plotted on a double-log graph, the Pareto-distributed progression of increasing numbers of connections from, say, small airports to giant ones like Heathrow and Atlanta, appears as a negatively-sloping straight line. This is the now famous power law “signature” dating back to Auerbach (1913) and Zipf (1949). Formally, it appears thus: \( F \sim N^{-\beta} \), where \( F \) is frequency, \( N \) is rank (the variable) and \( \beta \), the exponent, is constant (in exponential functions the exponent is the variable and \( N \) is constant). Stanley et al. (1996) find that manufacturing firms in the U.S. show a fractal structure, as does Axtell (2001). Andriani and McKelvey (2007, 2009) list over 120 kinds of power laws—which are good indicators of fractal geometry—in social, and organizational phenomena. The econophysicist Barabási (2002) connects scalability, fractal structure, and power law findings to social networks. He shows how networks in the physical, biological and social worlds, are fractally structured such that there is a “rank/frequency” effect—an underlying Pareto distribution showing many sparsely connected nodes at one end and one very well connected node at the other. See also Newman (2005) and Newman, Barabási, and Watts (2006).
Scale-free theories explain why fractals appear as they do and behave as they do. Though scalability may have been at the core of the Santa Fe vision, scale-free theories have only recently begun to be consolidated and featured collectively by the econophysicists (West & Deering, 1995; Mantegna & Stanley, 2000; Newman, 2005). The key feature that sets scale-free theories apart from most social science theories is that they use a single cause to explain fractal dynamics at multiple levels. The earliest dates back to 1638—Galileo’s Square-Cube Law; the cauliflower keeps subdividing to keep its surface area at a constant ratio to its growing volume; Stephen (1983) applies this Law to organizations. Explanations for why some structures have adaptive success while others do not, range from biology to social science. If the same theory or principle applies to microbes and to organizations, it is assuredly scale-free. Andriani and McKelvey (2009) describe 15 scale-free theories applying to firms.

How scale-free dynamics help Social Entrepreneurs satisfy the 1st Principles

The seven 1st Principles apply even to the smallest element of a system (even a few people working in a garage—e.g., the emergence and growth of GE and Hewlett-Packard!)—they apply to all levels of any firm, including SEFs. Likewise, scalability becomes increasingly important, complex in their interaction, and difficult to enable as an SEF becomes larger with more people, modules, and levels. Gell-Mann’s second regularity takes on an ever more crucial role as the number of levels in the firm increases and it attempts to make more and more small-to-large changes. Only in recently do we begin to see the relation between system change, scalability, and power laws. In short, the adaptive dynamics defined by each principle have to be effectively enabled at each level of a multilevel SEF if it is to survive and grow in a changing competitive environment. Entrepreneurs who only focus on one level, or do not succeed in enabling scale-free dynamics at multiple levels, will own SEFs with dubious survival capabilities.
How to assure each principle operates at each level of an SEF? Our argument is very clear. An SEF, as a CAS, needs to meet specific adaptive demands—which we have defined in terms of the 1st Principles. SEFs also need to assure that they have adaptive CAS dynamics operating at each level of their organizations. Otherwise there is an adaptive “scalability” gap, which acts as a barrier to efficacious adaptation from top to bottom. It follows that an SEF entrepreneur must assure that each of the following scale-free dynamics is operating in his/her firm at multiple levels—with no level where the scalability dynamic is inactive—so as to assure the activation of each 1st Principle. We now define seven scale-free theories from the longer list put together by Andriani and McKelvey (2009), and show how they relate to specific first principles.

(1) Least effort. Zipf (1949) originally suggested that “least effort” best explained Zipf’s Law. This is the power law of word usage known to apply to English, French, and Spanish. Least-effort theory is now confirmed (Ferrer i Cancho & Solé, 2003); but it appears limited to changing languages (Dahui, Menghui & Zengru, 2005). Applied to new venture creation, Zipf’s law holds that efficient and effective interactive transactions are similar to conversation or purchasing activities. Zipf’s least-effort theory now seems best applied to changing situations. Thus, we now know that least effort theory applies to organizations (Andriani and McKelvey, 2009) and economies that are in transition (Podobnik et al., 2006). In management contexts, Zipf’s law holds true in firms that are changing and have high growth rates (Ishikawa, 2006), but does not hold true for large firms with slow growth rates (Dahui, Li, & Zengru, 2006).

(2) External tension. We have already shown that tension is essential for adaptation. Since tension can apply to any and all levels, it is scale-free. A good example of this kind of tension in the organizational world is Welch’s famous phrase to his division presidents, ‘Be #1 or #2 in your industry…or you will be fixed, sold, or closed’ (Tichy & Sherman, 1994, p. 108,
paraphrased). See also Collins’s (2001) “face the brutal facts” element in his explanation of “good to great” firms.

(3) Spontaneous order creation. In Kauffman’s (1993) biological theory, all that is needed to stimulate emergent structure in the form of connections are heterogeneous agents (DNA, cells, organisms, etc.) stimulated by the need to improve fitness of some kind—adaptive tension and positive feedback are implicit. Carley has applied this basic idea to organizations, learning, and cognition, and emergent structure over many years (Carley, 1999; Carley & Hill, 2001). Kauffman’s approach is now widely applied to organizations; indeed, Maguire, McKelvey, Mirabeau, and Öztas (2006) list over twenty applications.

(4) Contagion bursts. Incidents and theories about epidemics and pandemics have been with us for years. What Watts (2003) and Andriani and McKelvey (2009) focus on is the reality that random interactions among people, such as spreading a virus via coughing, are quickly speeded up if the coughing occurs in a confined space or, as on an airplane, they are sitting near each other for some length of time. Thus the change-rate advantages stemming from Fisher’s law come when heterogeneous agents work in physical proximity or have easy networking capabilities. Whereas lengthy contacts may lead to groupthink (Janis, 1972), the idea here is that managers need to enable bursts of intense short-term tie development at moderate levels of connection here-and-there and now-and-then in their firms. This is what leads to bursts of communication, bursts of idea spreading, bursts of creativity, bursts of new product ideas, etc.

(5) Square-cube law. This law, dating back to Galileo, defines the nature of the cauliflower. It holds that as the volume of an entity increases (dictated by survival advantages stemming from increased size), its existing surfaces (means of absorbing energy) do not increase so as to maintain the required ratio between energy use and energy absorption. Hence, fission takes
place—as with the cauliflower—to keep the surface area large enough to supply energy to the increasing volume. This law has been applied to firms as far back as Haire (1959). More recently, it has been used to describe the difference between surface employees (those who directly bring in resources), and volume employees (everyone else in a firm) (Stephan, 1983). Carneiro (1987) applies the law to explain the upper bounds of a village. The law limits a village’s size unless it develops what he terms “structural complexity,” where complexity grows at 2/3 power of the village population. Only by doing this does the village avoid splitting in two.

(6) Connection costs. Simon’s near decomposability principle is brought to life at any level by balancing square-cube, fission-created modules with another scale-free theory—the cost of inter-module connections. Absent anarchy, as modules (each having a few connections with various other modules) increase in number, the number of their inter-module connections (and connection time and energy costs) increase at an exponential rate (Bykoski, 2003). At some point it is more efficient to recombine modules to lower communication costs.

(7) Preferential attachment. This scale-free theory rests on a positive feedback process in which existing resources accrue even more resources—or as the saying goes, “the rich get richer.” This theory underlies the logic of increasing returns to scale (Arthur, 1990), in which firms making profits invest in other areas and thereby make even greater profits. It is obvious that high-tech firms and firms that focus on standardized products often benefit from preferential attachment. The key is to have the first significant means of requisite variety. Take the example of Apple: A creative software engineer designed the iPod; the firm aligned its strategy with the new competitive context (content fits with context—Stevenson, 1999); internal variety matched external variety; and explosive and increasing returns were the end result.

Proposition 4: The activities of SEFs cannot meaningfully turn disequilibrium into equilibrium unless scalability dynamics emerge and function at all hierarchical levels. In other
words, an SEF’s social entrepreneurial activities have to show evidence that one or more of the foregoing scale-free dynamics are active across several levels, and/or one scale-free dynamic(s) spreads across a hierarchical dead spot in the range of some other scale-free dynamic(s).

Proposition 4a: Scalability and transformation of an SEF is positively related to measurable impact (Skoll, 2004)

4 IMPLICATIONS

Implications for Research.

This paper contributes to the increasing body of literature and research drawing from complexity science to examine managerial issues in several ways. First, our research is analytically based and builds theory in the under-theorized social entrepreneurship literature. Our premise forms a baseline for future research linking complexity theory and social entrepreneurship. Understanding of societal disequilibrium and how it creates tension among parties involved is an important new theoretical development. Many social issues are not resolved because the root problem is not understood. It is not merely a market failure or a system’s failure—these failures can be remedied. Nevertheless, tension stemming from disequilibrium can be costly and impact a society explosively if not resolved early on. Further, we clarify the link between adaptive tension and the emergence of social entrepreneurial activities—specifically social entrepreneurial firms (SEFs). This key understanding forms the baseline for future research in adaptive tension—the study of tensions that can create both positive and negative outcomes. Research is especially useful if where negative outcomes already exist or are more likely. If so, in what ways does do adaptive tensions of various kinds cause further deterioration in societal disequilibrium.

Second, comparison may be made between adaptive tension in existing technology and new technology and subsequent firm-level strategic actions towards success; adaptive tension
between societal disequilibrium and equilibrium, and the subsequent emerging SEF activities leading toward new order creation. This carries important implications as it may demonstrate increased need for taking social entrepreneurship to higher level of importance—even treating it as a new discipline, field, or area of scholarship. Are we examining social issues, managerial issues, or entrepreneurial issues, or all three? Or, if we are examining strategic issues, should we place these studies under the overarching theme of strategy, or not?

**Third,** future research may also extend the order-creation process, the timing, and other moderators of the process. Here, we treat social entrepreneurial activities as mediators of the order-creation process, but interesting points may be drawn about when SEF activities are subject to moderating effects by either government, individual, church missionary work, and/or private or public collaboration. Comparison of the effects carried out by different stakeholders may be interesting and effective for future policy makers in this area. Social entrepreneurship is no longer a locally focused and bounded activity; SEFs often are internationally based, receive funding from multiple sources around the globe. And, needless to say, the factors that moderate performance in one country may not work the same way or be equally effective in another.

**Fourth,** understanding the critical importance of performance by existing SEFs, encourages further research in how to best to measure short-term and long-term performance is one of the contributions in this research. Although some of the current SEFs show rather transparent linking of rewards to performance, and some literature has stress the issue of performance measures to be applied to SEFs, it is nevertheless true that treating transparent performance measurement as critically important to the sustainability of the social enterprise is not yet fully appreciated. Our research stresses this stance and argues that (1) although measuring performance is difficult, (2) given the multiple stakeholders with their diverse interests and that (3) rating the success of SEFs
is being done in a different ways so as to compare the success of SEF performance against the performance of commercial entrepreneurship, even so it must be done and done right. If performance is not properly measured and reported, a particular SEF itself may become another disequilibrium, tension will arise, and replacement SEF action will be needed to taken to create relevant new disequilibrium dissipative structures.

Finally, our testable propositions serve as guidelines for future research that may be conducted to collect data-bases useful for longitudinal, international, and multiple units of analysis, as well as bases for formulating more interview questionnaires to obtain more enriched data. After the emergence of SEFs, the importance of community, social network, and resource management emerges. Complexity science offers important theoretical implications for these issues. SEF activities often are being conducted in either small or large communities or societies. The success of managing a community-wide disruption—like cholera in Zimbabwe and given its resource deficiencies—lies in the ability to find resources within other complex adaptive systems and generating requisite scalability so appropriate resources become available. This calls for future research of SEF resource-related issues to be conducted via the lens of complexity science.

Implications for Practice.

Our theoretical approach and its overarching model have importance implications for practice in several ways. Our model draws from the complexity science perspective to explain the rationale of emergence and the criticality of performance measures relating to SEFs. Ours is a first attempt in the literature of social entrepreneurship and the practice of social enterprise to provide a meaningful explanation. Our model and theoretical explanation help to provide an insightful, useful, and relevant framework that social entrepreneurs can use to achieve their
social goals, overcome social issues in innovative ways, and become more alert, accountable, and efficient in managing their resources. Important implications from our application of complexity theory lead to relevant social management approaches in several ways.

**First, management by tension.** That chaotic tensions exist within society due to energy, health, and resource disruptions offers social entrepreneurs the opportunity to create SEFs as dissipative structures create positive opportunities for social entrepreneurs. Entrepreneurs often chase tensions instead of trying to escape from them since they perceive them as opportunities. What is more interesting is the power of self-organization emerging in the form of social entrepreneurship activities as pockets of new order form (groups or individual or firms working on social issues). Thus, social disequilibrium can be an engine of innovation, creativity, and newness. Disequilibria may initially create small perturbations, but they can spiral up via positive feedback and other scalability dynamics so as to have highly consequential and positive impacts on a system or society. We argue that scalability dynamics lie at the core of socially relevant engines of exploration (March, 1991) if managed successfully.

**Second, creating scalability conditions.** SEFs need to put scalability dynamics into play so as to meet performance measures in the form of traditional financial reporting as well as social-impact measuring and reporting. More specifically, we suggest that SEFs need to take advantage of scalability (often via positive feedback) by (1) maximizing scalability dynamics so as to achieve their long-run viability and growth so as to sustain social value over the long term; (2) realize the importance of effective management, network building, and transparency of operations, as these feed back to enhance sustainability; (3) comparing strategic tools and benchmarks with comparable SEF activities and performance, thereby improving their ability to obtain
future funding support—which enhances sustainability, and (4) use a set of relevant strategic tools to set goals and realistically measure their performance.

**Finally, working toward multilevel scale-free regularities and fractal dynamics.** Complexity theorists demonstrate that the future is unknowable and that it is impossible to determine what “will be relevant for more than a rather short time period” (Stacey, 1995: 492). We suggest that SEFs focus on the constant scalability of the social entity that emerges from chaotic dynamics and systemic feedback loops. This approach may also help SEFs to maximize already constrained resources without wasting valuable resources simply to maintain the status quo. As organizational inertia sets in, changes in the marketplace and rapid change in need-based requirement will tilt SEFs toward failure—thereby adding to disequilibrium and adaptive tension rather than ameliorating it. Even tiny initiating events (e.g., providing training, employee benefits, exchange programs for caregivers, key individuals in an SEF, updates of project methods, and accomplishments, etc.) can enhance positive outcomes and significant impact to the beneficiaries. These can help SEFs avoid the organizational and cognitive inertia that develops when long-term stability creates homogeneity over time.

5 **CONCLUSION**

Drawing on complexity science, we develop a conceptual framework that links the concept of energy differential, phrase transition, adaptive tension, self organization, and scale-free theory to inform and explain SEF’s emergence and the criticality of their performance as it leads to their scalability and sustainability. We argue, *first*, that social disequilibrium emerges from disruptive energy differentials within a society (for example poor vs. rich; clean water vs. contaminated water), and that this imposed energy creates disruption-based tensions within the community. When the disruptive energy becomes strong enough (tension increases within the community),
phrase transition processes begin (changes starts to be made); this is when adaptive tension result (tension turns into positive feedback in a constructive form such as social entrepreneurial activities). At this point dissipative structures—i.e., pockets of new order—appear. Adaptive tension causes the agents (i.e., individual, group, or organizational members of the community) to self-organize so as to give rise to emergent (dissipative) structures, i.e., new social entrepreneurship in the form of SEFs. Second, SEFs have to rigorously provide transparent, valid, and responsible financial and social impact performance criteria, since these are essential for the longevity and impact of any social enterprise. And third, SEFs aiming to translate disruptive tensions into long-term equilibria need to be able to draw in scalability dynamics at all organizational levels. The self-organization process cannot meaningfully translate disequilibrium into equilibrium unless scalability spirals up in useful proportions and appears at all levels of an organization.

The primary contribution of this article is to explicate the linking of social entrepreneurial activities to complexity theory so as to achieve meaningful theoretical legitimacy in our understanding of the emergence and performance issues. Social entrepreneurship is becoming popular in the body of literature and in the international entrepreneurship movement. Unfortunately, key theorists hold countervailing opinions of how social entrepreneurship works, the literature is fragmented, and approaches toward measuring performance are unclear and debated. It appears increasing important to understand the rationale of SEF emergence and the criticality of their performance toward achieving sustainability over the long term. We hope our work has established a baseline for further work applying complexity science to social entrepreneurial theorizing and empirical research. Especially, research is required that examines optimal strategies for achieving superior SEF performance in different cultures worldwide.
Theorizing on these new trends in the literature in ways that serve academic rigor and social economic relevance is critical if forward progress is to be accomplished.

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