

The Fourth Wave, Management Science and Practice in the
Age of the Anthropocene

Andrew Hoffman

Stephen M. Ross School of Business
University of Michigan

John Ehrenfeld

Massachusetts Institute of Technology

Ross School of Business Working Paper
Working Paper No. 1196
April 2014

This work cannot be used without the author's permission.
This paper can be downloaded without charge from the
Social Sciences Research Network Electronic Paper Collection:
<http://ssrn.com/abstract=2317423>

The Fourth Wave: Management Science and Practice in the Age of the Anthropocene

Andrew J. Hoffman
Holcim (US) Professor of Sustainable Enterprise
Director, Erb Institute for Global Sustainable Enterprise
University of Michigan
701 Tappan Street, R4472
Ann Arbor, MI 48109
Phone: (734) 763-9455
Email: ajhoff@umich.edu

John R. Ehrenfeld
Senior Research Associate and Lecturer (retired)
Massachusetts Institute of Technology
24 Percy Road
Lexington, MA 02421
Phone : (617) 861-0363
Email : john.ehrenfeld@alum.mit.edu

Prepared for The Corporate Stewardship Conference, February 20-21, USC
and *Corporate Stewardship: Organizing for Sustainable Effectiveness*, E. Lawler, S.
Mohrman and J. O'Toole (eds)

Andrew Hoffman is the Holcim (US) Professor of Sustainable Enterprise at the University of Michigan; a position that holds joint appointments at the Stephen M. Ross School of Business and the School of Natural Resources & Environment. Within this role, Professor Hoffman also serves as Director of the Frederick A. and Barbara M. Erb Environmental Management Institute. He holds a PhD from MIT.

John Ehrenfeld retired in 2000 as the Director of the MIT Program on Technology, Business, and Environment, an interdisciplinary educational, research, and policy program. Thereafter he served for 10 years as Executive Director of the International Society for Industrial Ecology. He is author of *Sustainability by Design: A Subversive Strategy for Transforming our Consumer Culture* (2008), and (with Andrew Hoffman) *Flourishing: A Frank Conversation about Sustainability*. He holds a Sc.D. from MIT.

ABSTRACT

Sustainability has become mainstream in both management practice and management research. Firms incorporate sustainability strategies into their core mission. University administrators promote sustainability as central to their curricula. Scholars pursue sustainability as a bona fide field of research inquiry. Given this level of attention and action, the world should be on the road to a sustainable future. But it is not. Environmental and social problems continue to get worse. This paper presents a model for understanding the progression of punctuated social change within the market that has taken us to the present reality, moving through three waves from 1970 to the present. We then present an assessment of where we may be going in the fourth wave, a punctuated shift that is predicated on the notion that we are now living in the Anthropocene, a new geologic epoch in which human activities have a significant impact on the Earth's ecosystems. We present six elements of change within management systems that are reflected in the Anthropocene: systems thinking, which leads to new forms of: partnerships, materials use and supply chains, domains of corporate activity, organizations, and the economic models and metrics that are used to measure them.

“The future is already here; it’s just not very evenly distributed”
William Gibson

Introduction

Over the past 50 years, the notion of corporate environmentalism (later corporate sustainability) was born, grew, and evolved. Though the history of concerns about the state of the natural environment can be traced back more than 300 years, the decade of the 1960s marks the dawn of the “modern” environmental movement. Initially focused on visible forms of air, water, solid and even thermal and aesthetic pollution, attention grew over the next 50 years to include toxic substances, stratospheric ozone, climate change, water scarcity, ecosystem destruction, and species extinction. An even more recent evolution, triggered by the publication of the Brundtland Commission 1987 report on sustainable development, has witnessed a growing concern for income inequality, living wages, fair representation, secure retirement, transparency, and safe working conditions to round out the “triple bottom line” of the sustainability agenda: environment, equity, and economy (profit) (Elkington, 1997).

Today, this expanded notion of sustainability has become commonly accepted within both the academy and the corporate sector. Within the academy, what began as a modest offshoot of management science in the early 1990s has grown into a maturing area of study, one that encompasses a wide range of related disciplines (Hoffman and Bansal, 2012). Within business practice, sustainability has entered most domains of corporate activity. Corporations print annual “Sustainability Reports,” insert the term into press releases and CEO speeches, create new positions such as the Chief Sustainability Officer, and gather for conferences on the “sustainability challenge.” A

survey by Price Waterhouse Coopers (2005) found that 87% of Fortune 1000 CEOs believe sustainability is important to a company's profits.

But, in spite of the myriad of new programs under the rubric of sustainability, problems of social and environmental sustainability continue to worsen. Sustainability activities have been integrated into corporate practice without serious changes in core beliefs that underpin the root cause of the problems, such that the resultant solutions do not actually solve the core problems (Ehrenfeld, 2008; Ehrenfeld & Hoffman, 2013). If progress is to be made, it is important to look critically at the shape of corporate sustainability that is now emerging: what problems it seeks to address, what changes it entails, and what it means for the corporate organization and the market system as a whole. This next iteration in the distinctive waves of management frameworks will redefine the role of the corporation within society.

As a prelude to the coming wave, this chapter will present the evolution of sustainability strategy and practice as a process of "punctuated equilibrium" (Kuhn, 1962) passing through three waves between 1960 and the present. A fourth wave is now emerging, and glimpses of its details are visible. William Gibson's observation that, "the future is here; it's just not very evenly distributed" (Gibson, 1991) is true both for experiencing the problems of sustainability and defining key solutions by forecasting management practice and research.

Evidence of Deterioration: The Initial Sustainability Challenge

The past century has witnessed unprecedented economic growth and human prosperity. World population increased by a factor of four; the world economy increased

by a factor of fourteen ; global per capita income tripled; and average life expectancy increased by almost two-thirds. In the US alone, life expectancy rose from 47.3 to 77.3 between the years 1900 and 2002 (National Center for Health Statistics, 2004).

While these and other advances are notable, widening income disparities mean that more people do not share in the material and economic progress of the past century. According to the United Nations, the richest 20% of the world's population consume 86% of all goods and services while the poorest 20% consume just 1.3%; the richest three people in the world have assets exceeding the combined gross domestic product of the 48 least developed countries; of the 4.4 billion people in the developing world, almost 60% lack access to safe sewers, 33% do not have access to clean water, 25% lack adequate housing, and 30% have no modern health services (Crossette, 1998).

At the same time, the past century has witnessed unprecedented human impacts on the natural environment. The UN Millennium Ecosystem Assessment (2005: 1), a study involving more than 1,360 experts worldwide, concluded that humans have changed the Earth's ecosystems "more rapidly and extensively than in any comparable period of time in human history." Given the rate of industrial pollution to air, land and water, the study found that, of the 24 global ecosystem services analyzed, 60% were already degraded or being used unsustainably through species extinction, over-exploitation and eco-system destruction.

In short, the exploitative relationship between the economy and the natural and social environments—one that was born during the Enlightenment of the 18th century, took shape in the industrial revolution of the 19th century has grown with globalization of industrial production in the 20th century—cannot be sustained.

Sustainability as a Stakeholder Issue Over Time

Looking out from within a corporation, the sustainability problem has been framed as a continuing shift in stakeholder demands (Freeman, 2010). Pressures from a wide range of institutional constituents (governments, consumers, investors, insurance companies, as shown in Figure 1) translate sustainability into frameworks that are familiar and for which ready repertoires are available (Hoffman, 2000). For example, as insurance companies apply pressures on the firm, response becomes an issue of risk management. As competitors apply pressure, sustainability becomes an issue of strategic direction and market growth. With investors, it becomes an issue of capital acquisition, and so on.

Insert Figure 1 about Here

Over time, sustainability has become less and less an isolated business concern. The firm's business channels have been altered to bring environmental and social issues to managerial attention through avenues related to marketing, accounting, finance, product development, etc. For each case, firms have pre-existing models and language that enable them to understand the issue and formulate a response. As these responses have become routinized, ongoing sustainability issues are treated as ordinary strategic concerns, no longer dictated by external social interests or ecosystem constraints, but rather by internal strategic norms. In the process, managers need not understand or recognize concern for the sustainability issues as something unique. This historic process

of internalization and translation has not been a steady linear trend, but instead has been marked by sudden punctuated shifts that have passed through three distinct waves.

Punctuated equilibrium and the three waves of corporate sustainability

Thomas Kuhn (1962) describes the progression of science as a series of transitions from *normal* science to *revolutionary* science. Others have applied Kuhn's model to the progression of institutional thought, describing it as following periods of punctuated equilibrium. A phase of normal science begins when a successful new theory supersedes existing, but inadequate, theories and becomes the "paradigm." Normal science then takes on the role of "mopping-up," as Kuhn calls it, or clarifying the hitherto unexplained facts by applying the paradigmatic theory. Established theories become overtaken when anomalous events arise and challenge the dominant paradigmatic theories (Hoffman & Jennings, 2011). Conflict over the nature, meaning, and response to these events ensues, and the shift ends when a new theory is successful in providing a socially adequate response to the anomaly and becomes the basis of the new paradigm.

Based on this orienting structure, the history of corporate sustainability can be explained as having evolved through three "waves" of revolutionary change, shown in Figure 2 (Hoffman and Bansal, 2012). These waves are periods of dramatic change in values, beliefs, norms and practices regarding the nature of our sustainability challenges. Each begins with a series of anomalous events and concludes with a new conception of the role of the corporation in addressing sustainability issues.

Insert Figure 2 about Here

Wave 1 (1970): Corporate environmentalism as regulatory compliance. The first wave of corporate sustainability activities focuses strictly on early forms of environmental protection and occurred in the late 1960s and early 1970s (Hoffman, 2001). Its origins can be traced to the publication of *Silent Spring* (Carson, 1962), a book that challenged what Samuel Florman (1976) called the “golden age of engineering” and helped bring about a growing awareness that chemicals were damaging the environment and ultimately ourselves. Other triggering events that followed included: the initiation of the International Biological Program (1963); the formation of the Club of Rome (1968); the Santa Barbara oil spill (1969); the Cuyahoga River Fire (1969); and the first Earth Day (1970).

These events created growing public and political concern over the worsening state of the environment and resulted in new regulatory agencies (most notably the Environmental Protection Agency in 1970) to arbitrate environmental rules and norms, negotiating on the one side with industry, and on the other with environmental activists. Within the corporate structure, “Environmental Health and Safety” (EH&S) departments were established whose principal responsibility was maintaining relations with governmental agencies. Separated from the operating core of the company, these departments remained an ancillary role with low organizational power, and focused strictly on legal requirements (Hoffman, 2001).

Wave 2 (1990): Corporate environmentalism as strategic management. The second wave occurred in the late 1980s and early 1990s and was precipitated, in part, by the 1984 accidental release of methyl isocyanate gas from the Union Carbide (UC) pesticide plant in Bhopal, India that resulted in 3,500 deaths and 300,000 injuries. This

event was followed by others that included: the discovery of the Arctic ozone hole (1985); the Chernobyl nuclear disaster (1986); the Brundtland Commission report *Our Common Future* (1987); the Montreal Protocol (1987); the formation of the Intergovernmental Panel on Climate Change (1988); the *Exxon Valdez* oil spill (1990); and the UN Conference on Environment and Development (1992).

In the wake of these events, insurers began to restructure pollution coverage, investors began to consider environmental liabilities in their portfolio, and communities began to create “right-to-know” laws. Within the corporate structure, these pressures elevated the issue to one of strategic concern. The environmental department enjoyed new levels of organizational power, and environmental considerations began to be pushed into line operations. Objectives shifted from regulatory compliance at the end of the pipe to waste minimization in product and process design.

During this second wave, attention to environmentalism (and sustainability) began to emerge within the field of management science. Shown in Figure 3, academic publications in the specialty area of business and the natural environment (B&NE) (Hoffman & Georg, 2013) emerged as a body of literature in the early 1990s, and has been growing at a steady rate ever since.¹ While many early articles appeared within specialized B&NE journals, the number published in mainstream academic (non-specialized) increased over the decade. Overall seventy-three percent of B&NE articles were published in mainstream journals as the issue became a legitimate empirical domain

¹ This emergence is marked by the first gathering of management scholars on the topic in 1989 with the Greening of Industry Network. The Organizations and the Natural Environment special interest group of the Academy of Management was formed in 1994 and specialized academic journals dedicated to the interface between managerial action and environmental protection followed: *Industrial and Environmental Crisis Quarterly* (1987), *Business Strategy & the Environment* (1992), *Organization & Environment* (1997), and the *Journal of Industrial Ecology* (1997).

for testing and applying existing theories in the management sciences: organizational theory, operations, strategy, marketing, accounting, and finance.

Insert Figure 3 about Here

Wave 3 (2010): Corporate environmentalism as sustainability. The third wave began around the first decade of the twenty-first century, propelled by a series of events that followed the creation of a global constituency for sustainable development created by the 1992 Summit of the UN Commission on Commerce and Development. No single issue drove the advent of the third wave more than climate change. The growing scientific consensus that humans have been altering the global climate through the release of greenhouse gas emissions since the Industrial Revolution has focused attention on the need to move the economy away from its foundations on fossil-fuel use and material consumption.

Public and political concern was elevated due to concerns that climate change might create dramatic threats in multiple domains. For example, a 2007 report by the US Military Advisory Board warned “projected climate change poses a serious threat to America’s national security . . . climate change acts as a threat multiplier for instability in some of the most volatile regions of the world” (CNA Corp, 2007). Others began calling for nations to maintain their economic competitiveness by developing the next generation of technologies for creating and conserving energy, food, and water (Friedman, 2007; Chu, 2010). Still others warned that continued demand for increasingly scarce resources would affect previously “free” ecosystem services. The Millennium Ecosystem Assessment (2005) warned, “Higher operating costs or reduced operating flexibility

should be expected due to diminished or degraded resources (such as fresh water) or increased regulation.”.

As a result of these and other stakeholder pressures, the third wave is characterized by the mainstreaming of sustainability. Firms incorporate sustainability strategies into their core mission. University administrators promote sustainability as central to their curricula. Scholars pursue sustainability as a bona fide field of research inquiry. Consumers buy sustainable products, drive sustainable cars, and stay at sustainable hotels. Indeed, sustainability is reaching into all areas of business, politics, and society. Given this level of attention and action, the world should be on the road to a sustainable future. But it is not. Problems continue to get worse.

Contemporary Sustainability: The Problem Statement Revisited

We are today in the throes of a commons tragedy of global proportions. Global annual emissions of CO₂ rose approximately 80% from 1970 to 2004 and 2012 atmospheric concentrations of CO₂ far exceed the natural range of the previous 650,000 years. The first decade of the 21st century was the hottest decade on record. As a result, extreme weather events in the US have become both more frequent and more intense with a large decrease in the number of extreme cold waves and an increase in both extended heat waves and extreme rainfall events. The US, and the Eastern US in particular, has experienced a significant increase in extreme precipitation events, with the greatest number of episodes taking place during the 2000s. During the 20th century, the Northeast saw sea levels rise on average 1.2 inches per decade. By the end of the century, heavy downpour events that occurred every 20 years on the average were happening at a

frequency of every four to 15 years depending on the region. Wetter areas (for example, the Northeast) are expected to get even wetter, increasing the chance of severe flooding (Kunkel, 2013; Karl, Melillo & Peterson, 2009).

“Very few environmental conditions affect our economy, natural resources, or citizens’ lives more than climate. Up to one-third of the US gross domestic product is directly influenced by weather and climate” (Lubchenco, 2011). Already, worldwide natural catastrophes are reaching historic highs (see figure 4). The year 2012 ranks as the second costliest for natural catastrophe insurance payouts since 1980, with a total of more than \$110 billion in damages (NOAA, 2013).² Pollution in some cities in China has already reached levels that are 40 times the level that the World Health Organization deems safe. As a result, the National Academy of Sciences estimates life expectancy to be shortened by five and a half years, and the World Bank estimates a reduction in GDP by 9 percent (Economist, 2013).

Insert Figure 4 about Here

Beyond these environmental issues we are also facing tremendous social problems, most notably in income inequality. US Census data for 2010 show the widest income gap between rich and poor on record. In 1968, the top 20 percent of Americans had about 7 times the income of those living below the poverty line. By 2008, that disparity had grown to about 13. By 2010, it had grown to more than fourteen (Ehrenfeld & Hoffman, 2013). This has contributed to public protests in the name of the Tea Party and the Occupy Wall Street Movement (and globally, the Arab Spring); all borne out of

² The 2012 total damages rank only behind 2005, which incurred \$160 billion in damages due in part to four devastating land-falling hurricanes.

the concern that the institutions of society are no longer adequate or fair for managing society.

Overall, these social and environmental data point to the inescapable conclusion that the third wave has not been able to address the root issues of sustainability.

Whatever Kuhnian shifts have occurred are insufficient to cope with the problems we have been facing for decades. We can identify several reasons why this is so.

First, the central tenet of the economic models used to devise public policy and business strategies in the third wave has been eco-efficiency, which fails to account for or address the root causes of unsustainability. While efficiency can drive both competition and growth, it does not lead to any form of balance with the limits of natural and social systems. Eco-efficiency, in system dynamics terms, is a “fix-that-fails” (Kim, 1994). There simply is not an infinite supply of resources on Earth to allow for continuous growth in material terms; and certainly not if growth adds to, rather than reduces, inequality.

A second issue is that sustainability occurs at the global systems scale but eco-efficiency is an uncoordinated, local strategy. So anything that companies do within their sustainability strategies in the third wave is incremental and uncoordinated. They fit sustainability within their standard repertoires; repertoires that do not actually address the underlying causes of unsustainability. The rules of the game have remained largely unchanged in the face of observations that demand that they change.

This leads to a third and critically important failure in third wave solutions. Corporate sustainability actions thus far have focused on *reducing unsustainability*, which is fundamentally different *creating sustainability* (Ehrenfeld, 2008). The efforts of

the triple bottom line are, in fact, not designed to solve the problem as it really exists. They stand merely as a Band-Aid to deep systemic failures in the market system. Here is an analogous example. The U.S. fought a war in Iraq that eventually stopped. Now we're still there trying to create some kind of stable, lasting peace. Stopping the war and creating peace are different activities. These seemingly related concepts are based on different paradigms. So, while current activities are important for slowing the velocity at which we are approaching a system collapse, they are little more than a call to protect the status quo, that is, maintaining the fundamental paradigm of a liberal, free market economy that sheds the externalities (the unseen, unintended consequences of the economy) tied up with the goods and services that are consumed. Therefore, what goes for sustainability today does not and cannot address the underlying problem context. Without a correction that recognizes that the economy is embedded within complex environmental and social systems, present day sustainability "solutions" will continue to be ineffective.

The Fourth Wave: Managing in the Anthropocene

To fully capture the severity of the impact that market economy is having on the natural environment, we must come to terms with the notion that we are now living in the Anthropocene, a new geologic epoch in which we cannot talk about the Earth's ecosystems without recognizing the human role in altering them (Crutzen & Stoermer, 2000). Becoming more and more widely used, the notion forces us to acknowledge that we, as a species, have grown to such numbers, and our technology has grown to such power, that we are altering the ecosystem on a planetary scale. The Anthropocene began

with the industrial revolution of the 18th century, but became more acute in what is called the Great Acceleration around 1950 onwards (Steffen et al., 2007). The epoch is marked by the reality that “Human activity has transformed between a third and a half of the land surface of the planet; Many of the world’s major rivers have been dammed or diverted; Fertilizer plants produce more nitrogen than is fixed naturally by all terrestrial ecosystems; Humans use more than half of the world’s readily accessible freshwater runoff” (Crutzen, 2002). We can even measure our impact on the environment through the pervasive presence of man-made chemicals – there are measureable levels of ibuprofen in the Mediterranean Sea, and scientists worry about the impact of growing levels of birth control pills and anti-depressants on aquatic ecosystems and municipal drinking water supplies. Recognizing our dominant role in the Earth’s systems forces a change in societal views of both the ecosystem and the human place within it (Hoffman, 2012) leading to the fourth wave; a cultural shift akin to the Enlightenment of the 17th and 18th centuries.

The Enlightenment marked a period in which knowledge was advanced through the scientific method rather than tradition, superstition, and religion. The Enlightenment, following the work of Adam Smith, created the concept of the market that has served as the fundamental organizing principle of the liberal economy and continues to be the foundational framework for business. Today, this framework has brought us the economy that was described at the beginning of this chapter and the problems that were similarly described. Sustainability in the Anthropocene is a fundamentally different challenge than pollution control of the 1970s, 80s and 90s. And that challenge forces an alteration in both the market, which acts as our collective institution for engaging with the

environment, and the idea of corporate management within it. In the face of such change, the idea of the market will survive, but the rules that govern the underlying social contract that legitimates the business sector will change.

The fourth wave is a departure from that dominant model, recognizing that we are dealing with an impact on the environment that goes far beyond our standard notions of environmental insults and differentiated social impacts. Using the “full world” metaphor of Herman Daly (2005), we cannot any longer ignore our connections to the Earth and to all life on the Planet. Climate change, droughts, increasing food prices, water scarcity, social unrest, income inequality; these are all the emergent cultural anomalies of the Anthropocene that are driving changes in the market, the primary linkage between humans and the environment. Overall, management in the Anthropocene requires a breakdown of the dichotomy between humans and nature at the functional level with consideration for its scientific, social, economic and ethical dimensions (Oldfield et al., 2013).

We have become crowded to the extent that the notion of the autonomous invisible hand can no longer be completely relied upon; we must acknowledge that we are actors within a highly interconnected system. Our actions always have unpredictable effects outside of their intended target. Our cultural, including business management, models need to be reconfigured to reflect these consequences. We must begin to employ systems and pragmatic thinking, create relational and cooperative institutional arrangements, and embed a strongly (eco-) ethical foundation as a dominant norm, one that goes beyond the reactive corporate social responsibility of the third wave. The next section presents examples of these processes in what we believe will be a distinctive

fourth wave of sustainability management. We have picked examples to illustrate each of three framing categories, though the boundaries among them are not completely distinct: Systems Framing, Cooperation Framing and Organizational Framing.

Systems Framing.

Sustainability is a property of the system as a whole; not of just one firm. The impact and action of each firm is realized through its network connections to other organizations that include suppliers, buyers, customers, regulators, banks, etc. No single firm, however large and powerful, can control the behavior of the system. It can neither prevent deterioration nor create solutions to social and environmental problems such as the reduction of greenhouse gases or the elimination of poverty and inequality.

Systems-thinking requires an emergent set of practices to manage a firm's actions in conjunction with others within a network (Wasserman & Faust, 1994) to create outcomes with a minimum of unwanted unintended consequences. Several components of such thinking include complexity, pragmatism, and participatory decision-making. Complexity recognizes that our emergent understanding of this system cannot be described by our existing sets of closed analytic expressions. Pragmatism helps managers to understand and interact with these complex systems in ways that lie in opposition to the ideology of scientific reasoning and can be described simply as learning how something works by observing it in action, not through some isolated laboratory, academic theory or computer modeling exercise. Such experiential learning presumes that there is no positively true answer to our questions about how the world works and,

consequently, what is the right way to go. It legitimates non-expert local knowledge that can be discovered through participatory decision-making.

For example, the notion of a sustainable energy company in isolation from the system of which it is a part makes no empirical sense. One firm installing windmills is not sustainability. A more sustainable energy system incorporates renewable energy sources with distributed energy production, smart grid technologies, demand management, and energy efficiency for both grid and mobility energy consumption. Lacking system-wide coordination, energy systems are redundant, built to over capacity (to meet peak loads) and extremely inefficient. But, by properly networking the system, the energy grid can become a much effective organism. For example, by a simple change in the timing of refrigerator defrost cycles or allowing smart grid interfaces to initiate dryer or dishwasher start times, there is a potential of 300 GW of daily peak demand reduction (Catania, 2013). To create such a systems-wide approach, policy must be developed to synchronize and incentivize cross-sector coordination.

Enhanced supply chain management and materials management. The design and optimization of product life-cycle systems requires integrated information from a multitude of organizations. An entire new field, industrial ecology, has grown around the need to develop methodologies to measure life cycle impacts and to design minimally impactful systems (Ayres & Ayres, 2002). Based on the highly interconnected, closed-loop structure found in sustainable ecological systems, industrial ecology argues for similar closed-loops in industrial systems from in-plant and household recycling to regional, even national, loop-closing systems (Ehrenfeld, 1997). The participatory decision-making schemes mentioned above are well fitted in these enhanced supply

chains. The just-in-time supply chains of the Japanese automakers depend on close and cooperative relationships with parts suppliers (Liker, 2004). These innovations can come from such corporative relationships or may also be driven by the most powerful organization in the supply chain. For example, Wal-Mart, the world's largest retailer, announced in 2008 that it would require suppliers to make major appliances that use 25 percent less energy within three years.

New forms of valuation metrics. All of these changes in corporate practice occur in tandem with alterations in the existing metrics and models by which firms measure organizational success, both individually and as a collective. Systems change must be accompanied by new metrics that reexamine traditional underlying values. For example, some have begun to question the time frames on which corporate activity is measured. Paul Pollman, CEO of Unilever, has said that the concept of shareholder value has passed its "sell-by date" and that his company will no longer provide quarterly profit updates to shareholders. Others have begun to question whether applying a discount rate to calculate public benefits in standard benefit/cost formulations is inherently immoral, especially when applied to intergenerational issue like climate change (Stern, 2009). With a discount rate of 5 percent, for example, benefits beyond 20 years become worthless in net present value calculations. Is it legitimate and moral to ignore the interests of the next generation because standard economic metrics of today do not recognize their worth?

Moving to the systems-scale, some have suggested alterations in traditional national accounting formulae. Rather than measuring only the quantity of economic activity, new measures may augment GDP to measure the quality of economic activity (Kubiszewski et al, 2013). French ex-president Nicolas Sarkozy, for example, created a

commission, headed by two Nobelists, Joseph Stiglitz and Amartya Sen, that was charged to come up with alternatives to GDP. The resultant report recommended a shift in economic emphasis from simply the production of goods to a broader measure of overall well-being, which would include measures for categories like health, education, and security. It also called for greater focus on the societal effects of income inequality, new ways to measure the economic impact of sustainability (climate change and the like), and recommended ways to include the value of wealth to be passed on to the next generation in today's economic conversations. Similarly, the King of Bhutan has developed another interesting example called Gross National Happiness, which is a composite of indicators that are much more directly related to human well-being than monetary measures.

Cooperation Framing

Cross-sector coordination for systems-wide change requires new forms of competition and collaboration to recognize the interconnected and interdependent nature of industry. Co-opetition, as both a corporate and political strategy, (Brandenburger & Nalebuff, 1996) is not just a strategy of choice, but an essential framework for sustainability. A recent study by IBM found that 69% of CEOs see external partnering as being critical to the company's future success and 46% are using partnerships to enter new markets (IBM, 2012).

In capitalizing on systems-wide opportunities, partnerships will be of new and unusual forms, linking firms in multiple sectors. For example, Eaton, Whirlpool, SunPower and Ford have begun a new partnership called MyEnergi Lifestyle that is designed to help the average single family home reduce energy costs by as much as 60

percent by programming dishwashers and water heaters to do most of their high energy tasks at night. Another involves Ford's vehicle charging stations but uses a cloud database to schedule hybrid or electric vehicles recharging when utility rates are lowest or when integrated renewable energy sources are active (Buckley, 2013). Similarly, Chesapeake Energy is partnering with General Electric and Whirlpool to develop an appliance that will allow natural gas powered vehicles to be refueled at owner's homes (Lefebvre & Bennett, 2012).

New forms of partnerships between for-profit organizations will not be the only kind. Non-profit organizations also play new, emergent, and influential roles in the global marketplace. They act as policy advisers to governments; strategy advisers to corporations; thought leaders for public opinion; and catalysts for action by bankers, investors, suppliers, customers, and even religious organizations. The Environmental Defense Fund (EDF), for example, participated in the 2007 leveraged buyout of the energy company TXU and hired Perella Weinberg Partners, a boutique investment bank, to advise it on using Wall Street tactics in negotiating mergers and acquisitions.

New forms of provisioning. At the local level, there is also movement to re-conceptualize corporate activity by re-localizing the economy. In Western Massachusetts, for example, a number of neighboring towns are using their own currency, Berkshares, for locally sourced goods and services. Time banking, a form of barter, uses the time spent working on projects for others in place of currency. The time spent goes into a "bank," and may be redeemed by the barterer as equivalent services by another participant. Time banking is strong in England and northern Europe (Seyfang, 2009) where people are building an economy within an economy. The primary structure is still

capitalism, using money in most cases, barter in others, and time banking in still others but focuses on reintroducing local relationships to market activities. This complements the primary economy and begins to rebuild connections and community, both of which are absolutely critical to the idea of sustainability. All such alternate means tend to convert impersonal transactions into more relational, cooperative processes.

Organizational Framing

As corporate activity expands into new domains, with linkages to complex systems of actors through broader networks and supply chains, new forms of organization also emerge. Already, data show that the vertically integrated, shareholder-owned corporation is in rapid decline as a corporate model, with half as many public corporations in 2012 as there were in 1997 as they are superseded by alternative forms of organizing (Davis, 2013). Though not new, other forms, such as Cooperatives, or Employee-Owned Companies are part of a growing movement, particularly in Europe, that consider more than the shareholder in defining the actions of a corporation (Davis, 2013). One of the oldest examples of a Cooperative, for example, is Mondragon, a large Spanish firm with over 14 billion Euros annual revenue. Mondragon is a federation of some 250 separate entities operating under an umbrella set of principles and management structure. Mondragon's four corporate values resonate with sustainability: co-operation between management and workers, participation in decisions through an elaborate committee structure, social responsibility reflected in a very flat salary structure, and innovation focused in all the many business areas (Whyte, 1991). Mondragon, like other European enterprises, has been impacted by the lengthy recession, but continues to maintain its cooperative structure.

Going further, hybrid organizations are emerging at the intervening space between the for-profit and non-profit sectors and strive to merge the institutional logics of each domain (Battilana & Dorado, 2010). Alternatively described as Fourth Sector, Blended Value, For-Benefit, Values-Driven, Mission-Driven, or B-Corporations (Boyd et al., 2009), hybrid organizations present a bridge between two ends of a dichotomy previously seen as incommensurable; economic profit and social and environmental mission (Hoffman & Haigh, 2011). For example, Ten Thousand Villages is a volunteer-run 501(c)(3) non-profit organization that operates a for-profit retail operation to provide fair income to artisans from more than 30 countries by selling their fair-trade goods. Similarly, Stonyfield Farms is a for-profit agricultural company, but it also takes sustainability seriously in the development of its organic dairy products. As hybrids, these organizations are “both market-oriented and mission-centered” (Boyd et al., 2009: 1). Indicative of its increasing prevalence and importance, as of July 2013, nineteen States have passed laws creating a legal class of company, called “benefit corporations (B-corps),” and granted such hybrid organizations greater protection from shareholder lawsuits demanding management put profits above social and environmental missions (Gilbert, Houlihan & Kasso, 2013). To qualify as a benefit corporation, a company must define its nonfinancial goals in its charter and obtain approval of two-thirds of the shareholders.

New domains of corporate activity. Beyond the optimization of supply chains and their related environmental impacts, firms are adopting new kinds of activities that would have been previously considered outside the domain of traditional capitalism. For example, the Anglo-American Corporation engages in a comprehensive program that

covers HIV/AIDS prevention and care for its employees and local communities in its African operations. Coca-Cola has reconceptualized itself as a water company, devoting significant resources to understanding and managing this precious and diminishing resource. Patagonia has set up a new exchange called Common Threads that encourages people to buy used Patagonia products on eBay before going to the store to buy it new. This represents a new story, a new way of thinking, one that has business school professors scratching their heads and looking for some market-based, utilitarian rationality to explain.

Management Science in the Fourth Wave.

Recognition of the Anthropocene is a step change, one for which management research and teaching is ill-prepared. At a time when sustainability has gone mainstream in both the market and business school education/research, the fourth wave presents a period of “revolutionary science” (Kuhn, 1962) in which the norms of management science and practice are in flux. Today, with little sustained attention to critical sustainability issues like poverty, climate change, species extinction, social unrest, equity, and fairness in a rapidly globalized world (Khurana, 2007), some have begun to question whether business schools are falling out of step and irrelevant to the world of practice (Podolny, 2009) and whether the modern business school must fundamentally alter its teaching and research in order to respond to the environmental and social challenges of the twenty-first century. Indeed, some direct resentment towards MBA education for training graduates that played central roles in scandals such as Enron, Worldcom and the financial crisis (Podolny, 2009).

Rather than merely fitting within existing management theories and models, sustainability in the fourth wave challenges those theories to adapt to an emerging reality. For example, recognition of the Anthropocene forces theories of social organization to consider the role humans within the context of the natural environment, not separate or independent from it (Whiteman, Walker & Perego, 2012). Many scholars have begun this work, developing vibrant research streams that move beyond standard management theory. For example, new models of operations must consider closed-loop models that are bounded by the resource source and sink limitations of a finite environment (Caro, Corbett, Tan & Zuidwijk, 2013). Growing concerns for climate change challenge supply chain logistics and force consideration of more local options on material delivery with implications for accounting and finance (Ascui & Lovell, 2011), organizational design (Valente, 2012) and strategy (Ansari, Wijen & Gray, 2013) . Overall, the growing environmental and social ills that we presently face challenge the dominant organizing models of business education, such as agency theory and investor capitalism (Khurana, 2007; Ghoshal, 2005).

Conclusion

The solutions to sustainability will, indeed they must, come from organizations within the market. The market is the most powerful organizing institution on earth, and corporations are the most powerful organizations within it. Without business, there will be no solutions. Business will design the next buildings we live and work in, the next drivetrain under your car's hood, the next source of energy to propel it, the food we eat, the clothes we wear, and so on. But the solutions to the root problems that are inhibiting

the emergence of sustainability go far beyond innovations in housing, automobiles, energy supply, food production, or clothing. Technical fixes arising from our existing knowledge base can only, at best, slow the advances of unsustainability. The root problems arise from outmoded beliefs deeply embedded in our political economy and most of our societal institutions. As our consciousness of the errors in our beliefs increases, the anomalies that signal the coming of a new paradigm will become more frequent and larger in scope. The challenges we face with the Anthropocene represent challenges for which our species has never before addressed. But as Stephen Jay Gould (1987) reminds us, “We have become, by the power of a glorious evolutionary accident called intelligence, the stewards of life's continuity on earth. We did not ask for this role, but we cannot abjure it. We may not be suited to it, but here we are.”

FIGURE 1

Environmental Strategy as a Composite of Existing Business Interests (Hoffman, 2000)

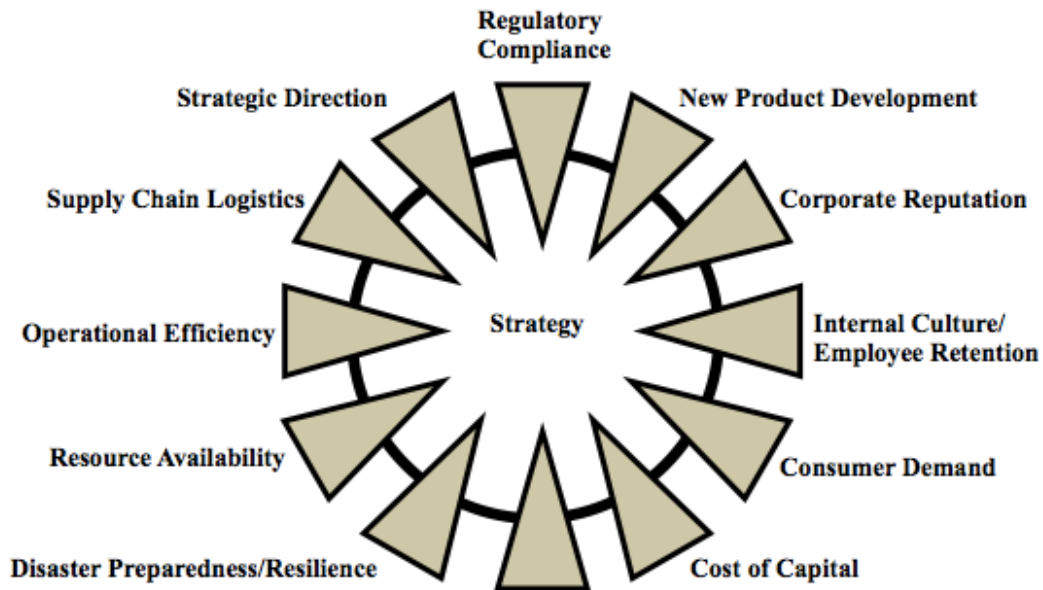


FIGURE 2

The Three “Waves” of Environmental Management (Hoffman & Bansal, 2012)



FIGURE 3
Articles per year on B&NE, 1975-2010 (Hoffman & Georg, 2013)

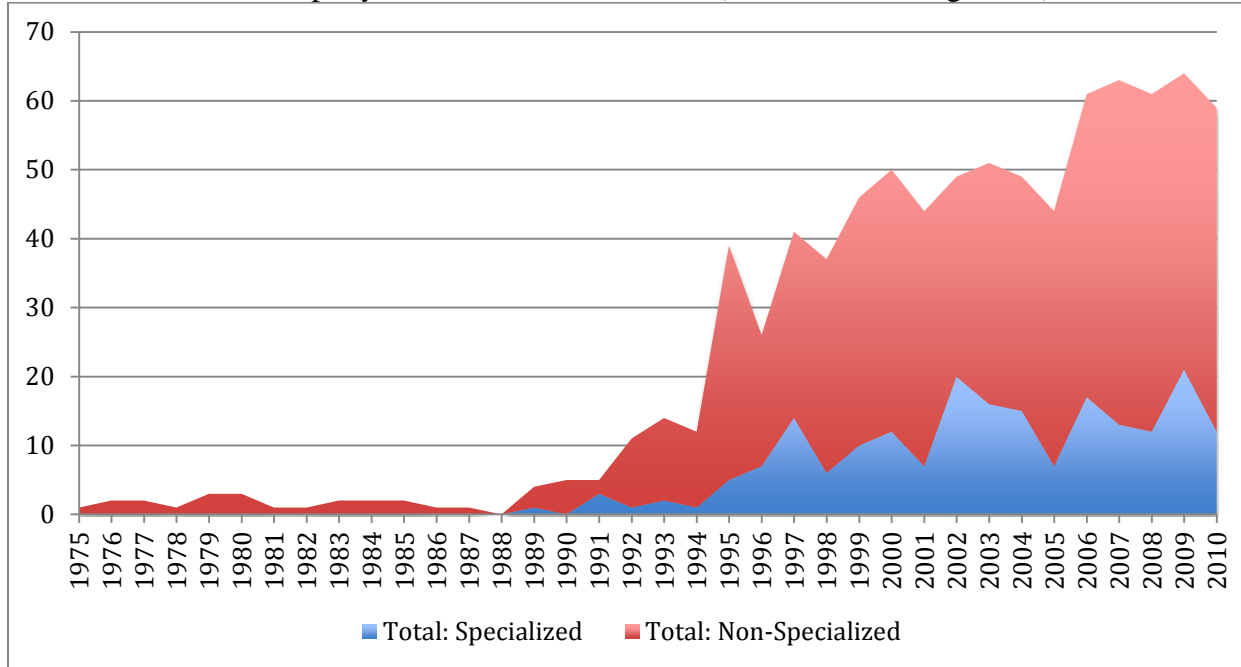
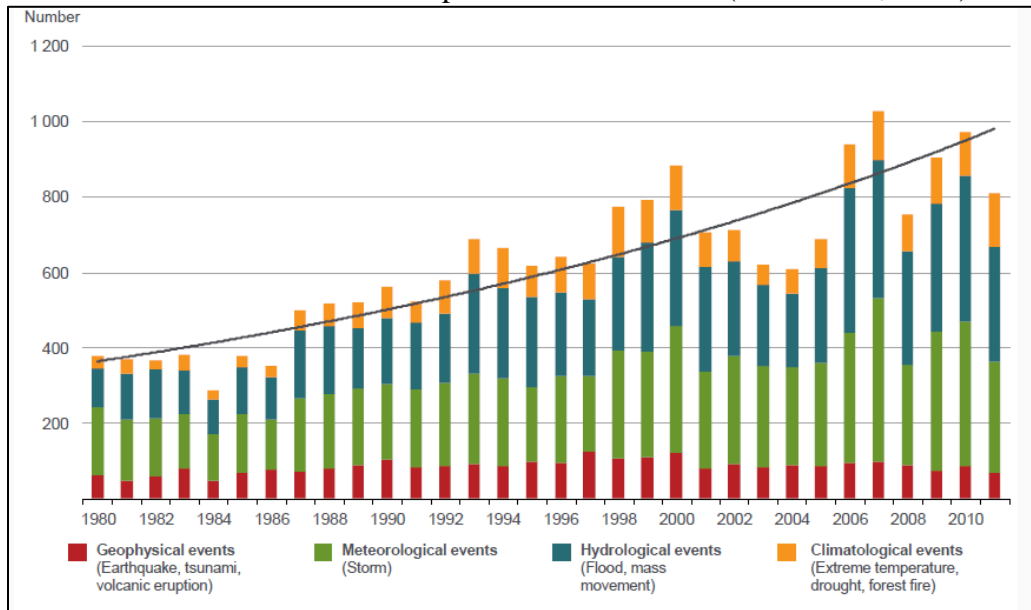


FIGURE 4
Worldwide Natural Catastrophes from 1980-2011 (Munich Re, 2011)



References

- Ansari, S., F. Wijen & B. Gray (2013) "Constructing a climate change logic: An institutional perspective on the 'tragedy of the commons,'" *Organization Science*, 24(4): 1014-1040.
- Ascuí, F. & H. Lovell, (2011) "As frames collide: Making sense of carbon accounting", *Accounting, Auditing & Accountability Journal*, 24(8): 978-999.
- Ayres, R. & L. Ayres (eds.) (2002) *Handbook of Industrial Ecology* (Northampton, MA: Edward Elgar Publishing, Inc.).
- Battilana, J. & Dorado, S. (2010). "Building sustainable hybrid organizations: The case of commercial microfinance organizations." *Academy of Management Journal* 53(6): 1419-1440.
- Boyd, B., Henning, N., Reyna, E., Wang, D., & Welch, M. (2009) *Hybrid Organizations: New Business Models for Environmental Leadership* (Sheffield: Greenleaf Publishing).
- Brandenburger, A. & B. Nalebuff (1996) *Co-Opetition : A Revolution Mindset That Combines Competition and Cooperation* (New York: Doubleday Business).
- Buckley, S. (2013) "Ford teams up with Eaton, Whirlpool and SunPower to create MyEnergi Lifestyle, hopes to reduce everyone's CO2 footprint," *Engadget*.
- Carson, R. (1962), *Silent Spring*. Boston: Houghton Mifflin Co.
- Catania, T. (2013) "Innovative utility system resources" in *How Will 'Disruptive Challenges' in the Electric Market Impact Michigan Energy Decisions?* (Ann Arbor, MI: Erb Institute Summary Report No. 136.)
- Chu, S. (2010) *China's Clean Energy Successes Represent a New 'Sputnik Moment' for America*, Speech before the National Press Club, November 29.
- CNA Corporation (2007) *National Security and the Threat of Climate Change*. (Alexandria: VAL CAN Corporation).
- Crossette, B. (1998) "Kofi Annan's astonishing facts." *New York Times* (September 27), 4-16.
- Crutzen, P. & E. Stoermer (2000). "The 'Anthropocene'". *Global Change Newsletter*, 41: 17-18.
- Crutzen, P. (2002) "Geology of mankind," *Nature*, 415: 23.
- Daly, H. (2005) "Economics in a full world," *Scientific American*, 203: 100-107.
- Davis, G. (2013) "After the corporation." *Politics & Society*, 41(2): 283-308.
- Economist* (2013) "The east is grey," *The Economist*, August 10.
- Ehrenfeld, J. (1997) "Industrial ecology: A new framework for product and process design," *Journal of Cleaner Production*, 5 (1-2): 87-95.
- Ehrenfeld, J. (2008) *Sustainability by Design*. (New Haven: Yale University Press).
- Ehrenfeld, J. and A. Hoffman (2013) *Flourishing: A Frank Conversation on Sustainability* (Palo Alto, CA: Stanford University Press).
- Elkington, J. (1997) *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*. (Oxford: Capstone).
- Florman, S. (1976), *The Existential Pleasures of Engineering*, (New York, NY: St. Martin's Press).
- Freeman, R.E. (2010) *Strategic Management: A Stakeholder Approach* (Cambridge: Cambridge University Press).

- Friedman, T. (2007) "The power of green; What does America need to regain its global stature?" *New York Times Magazine*, 15 April, 41–67, 71–72.
- Ghoshal, S. (2005) "Bad management theories are destroying good management practices," *Academy of Management Learning and Education*, 4(1): 75–91.
- Gibson, W. (1991) "The science in science fiction," National Public Radio, Talk of the Nation, November 30.
- Gilbert, J., B. Houlahan, & A. Kassoy (2013) "Today marks a tipping point in the evolution of capitalism," *Forbes*, July 17.
- Gould, S. (1987) *The Flamingo's Smile: Reflections in Natural History*, (New York: WW Norton).
- Hoffman, A. & P. Bansal (2012) "Retrospective, perspective and prospective: Introduction," in Pratima Bansal and Andrew Hoffman (eds.) *The Oxford Handbook on Business and the Natural Environment* (Oxford, UK: Oxford University Press): 3-28.
- Hoffman, A. & P.D. Jennings (2011) "The BP oil spill as a cultural anomaly? Institutional context, conflict and change," *Journal of Management Inquiry*. 20 (2): 100-112.
- Hoffman, A. & S. Georg (2013) "A history of research on business and the natural environment: Conversations from the field," in S. Georg and A. Hoffman (eds.) *Business and the Environment: Critical Perspectives in Business and Management*, Volume I (Oxford, UK: Routledge): 1-58.
- Hoffman, A. (2000) *Competitive Environmental Strategy: A Guide to the Changing Business Landscape* (Washington DC: Island Press).
- Hoffman, A. (2001) *Heresy to Dogma: An Institutional History of Corporate Environmentalism* (Stanford, CA: Stanford University Press).
- Hoffman, A. (2012) "Climate science as culture war," *Stanford Social Innovation Review*, 10(4): 30-37.
- Hoffman, A. and N. Haigh (2011) "Positive deviance for a sustainable world: Linking sustainability and positive organizational scholarship," in Kim Cameron and Gretchen Spreitzer (eds) *Handbook of Positive Organizational Scholarship* (Oxford, UK: Oxford University Press): 953-964.
- IBM (2012) *Leading Through Connections: Insights from the Global Chief Executive Officer Study* (Somers, NY: IBM Global Business Services).
- Karl, T., J. Melillo, & T. Peterson, (eds.) (2009) *Global Climate Change Impacts in the United States*, (Cambridge University Press).
- Khurana, R. (2007) *From Higher Aims to Hired Hands: The Social Transformation of American Business Schools and the Unfulfilled Promise of Management as a Profession*. (Princeton, NJ: Princeton University Press).
- Kim, D. H. (1994) *Systems Archetypes I*. (Cambridge, MA, Pegasus Communications, Inc.)
- Kubiszewski, I., R. Costanza, C. Franco, P. Lawn, J. Talberth, T. Jackson & C. Aylmer (2013) "Beyond GDP: Measuring and achieving global genuine progress," *Ecological Economics*, 93: 57-68.
- Kuhn, T. (1962) *The Structure of Scientific Revolutions* (Chicago, IL: Chicago University Press).

- Kunkel, K. (2013) "Regional Climate Trends and Scenarios for the U.S. National Climate Assessment. Part 9. Climate of the Contiguous United States." NOAA Technical Report.
- Lefebvre, B. & J. Bennett (2012) "Drivers may soon fuel their natural-gas cars at home," *Wall Street Journal*, November 14.
- Liker, J. (2004) *The Toyota Way, 14 Management Principles from the World's Greatest Manufacturer* (New York: McGraw-Hill Book Company).
- Lubchenco, J. (2011) Opening remarks at the first meeting of the National Climate Assessment Federal Advisory Committee. 4 April 2011.
- Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well-Being: Synthesis Report*. (Washington DC: Island Press).
- Munich Re (2011) Münchener Rückversicherungs-Gesellschaft, Geo Risks Research, NatCatSERVICE, http://www.munichre.com/app_pages/www/@res/pdf/media_relations/comp-any_news/2011/2011_11_11_app1_en.pdf viewed 8/14/2013.
- National Center for Health Statistics (2004) *Health, United States, 2004*. (Washington DC: Department of Health and Human Services).
- NOAA (2013) *NCDC Releases 2012 Billion-Dollar Weather and Climate Disasters Information* (Washington DC: National Oceanic and Atmospheric Administration).
- Oldfield, F., A. Barnosky, J. Dearing, M. Fischer-Kowalski, J. McNeill, W. Steffen & J. Zalasiewicz (2013) "The Anthropocene Review: Its significance, implications and the rationale for a new transdisciplinary journal," *The Anthropocene Review*, 0(0): 1-5.
- Podolny, J. (2009) "The buck stops (and starts) at business school," *Harvard Business Review*, June, 62-67.
- Price Waterhouse Coopers (2005) *Davos CEO Study* (New York: PWC)
- Redfield, J. (2013) "Keynote" in *How Will 'Disruptive Challenges' in the Electric Market Impact Michigan Energy Decisions?* Erb Institute Summary Report No. 136.
- Seyfang, G. (2009) *The New Economics of Sustainable Consumption: Seeds of Change* (London: Palgrave MacMillan).
- Steffen, W., P. Crutzen and J. McNeil (2007) "The Anthropocene: Are humans overwhelming the great forces of nature?" *AMBIO*, 36(8): 614-621.
- Stern, N. (2009) *The Global Deal: Climate Change and the Creation of a New Era of Progress and Prosperity*, (New York: Public Affairs).
- Valente, M. (2012) "Theorizing firm adoption of sustaincentrism," *Organization Studies*, 33(4): 563-591.
- Wasserman, S., & Faust, K. (1994) *Social Network Analysis: Methods and Applications*. (Cambridge University Press, Cambridge).
- Whiteman, G., B. Walker & P. Perego (2012) "Planetary boundaries: Ecological foundations for corporate sustainability," *Journal of Management Studies*,
- Whyte, W. (1991) *Making Mondragón: The Growth and Dynamics of the Worker Cooperative Complex* (Ithaca, NY: ILR Press).