

Epistemological Error

A Whole Systems View of Converging Crises



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Gregory Bateson said that we are 'governed by epistemologies that we know to be wrong' back in 1972. In the same book Bateson wrote: 'the organism that destroys its environment destroys itself.' Almost forty years later global ecological systems are in steep decline and converging crises make a deep evaluation of the underlying premises of our philosophical traditions an urgent imperative. This paper will suggest that the roots of the economic crisis are epistemological and that to correct this error whole systems thinking and ecological literacy will become increasingly important in business management as well as in other disciplines. It will also suggest that the economic crisis opened new political space and has provided an opportunity for intervention. If we are brave enough to examine the roots of our problems there is possibility for renewal.

A philosophy for management must reflect transdisciplinary knowledge to stay relevant and capable of adapting to current conditions. The economic crisis of 2007-2009 needs to be understood as feedback from a system that has lost its capacity to understand and manage its own processes. Our failure to think in terms of whole systems and to recognize the ecological basis for prosperity is a consequence of a particular reductive worldview. Management practice must expand the scope of its inquiry to gain insight. This paper will suggest that the roots of the economic crisis are epistemological and that to correct this error ecological literacy will become increasingly important in the practice of business management. Ecological stability is necessary for material wellbeing and economic stability but current management and business practices do not reflect what we know about complex systems or environmental science. Business models follow abstract economic theory based on mechanistic thought but ignore ecology, the basis on which wealth is created. The current trajectory of economic growth creates strains on the ecological system, which in turn weakens our capacity to create economic security. These stresses can only lead to deepening crises within economic and ecological systems, and while economic collapse is painful - ecological collapse is terminal. To avoid this dire scenario, we need to recognize that feedback from the economic system will be significantly faster than feedback from the ecological system, which has evolved over a period of millions of years and has significant inbuilt buffers.

Epistemology defines how we know what we know. Alfred Korzybski said 'the map is not the territory' which reminds us that our ideas about reality are not the same as reality itself. The notion that the dominant epistemological position is a poor reflection of reality has been described in detail by cultural commentators in multiple fields (Bertalanffy 1969, Bateson 1972, Orr 1992, Capra 1997, Sterling 2001, Meadows 2008). Our understanding of reality leads to a particular type of practice in business, finance, culture, education and politics. When our ideas conflict with the way that the world actually works, we make dysfunctional systems. We are now faced with an epistemological tradition that works for building clocks and cars, but not for understanding or managing complex systems. This reductive worldview conflicts with the highly complex ecological systems on which we depend. While this position has been rehashed over the past few decades in progressive circles, whole systems thinking is still marginal. Consequently, the economic system and business practices do not reflect philosophical or geophysical imperatives. The hegemonic reductive position prevents appropriate responses to maintain ecological homeostasis while also damaging economic stability in the shorter term. An ecologically literate epistemological position must start with the recognition of: 1-complexity, 2-limits (i.e. geophysical constraints or carrying capacity) and crucially it must start putting these insights into 3-practice.

1. Complexity

The economic system and the ecosystem are both complex systems that cannot be entirely understood through reductive analysis. Instead we must recognize the hierarchy, dynamics and interdependence at work between these two systems. The economic system needs to be understood as a subsystem of the ecological system. Ecological economist Herman Daly has been describing this relationship for over four decades. It is evident that the ecosystem existed for millions of years before humankind invented the modern economic system and will exist in some form whatever becomes of our civilization. Tragically, mainstream economists have refused to recognize this relationship and our economic system is not designed with respect to this basic fact. We are now hitting ecological limits on many fronts; approximately 60% of the ecosystems are in decline worldwide according to the Millennium Ecosystem Assessment.¹ Our failure to organize the economic system and manage our businesses with respect to

1 Millennium Ecosystem Assessment 'Ecosystems and Human Well-being' Washington, Island Press 2005 p1.

ecological limits is seen by many as a cause of converging environmental, social and economic crises. Herman Daly recently explained in a report to the UK Sustainable Development Commission that ‘the closer the economy approaches the scale of the whole Earth the more it will have to conform to the physical behavior mode of the Earth.’² Our failure to recognize that economic prosperity depends on ecological wellbeing has developed from a reductive habit of mind that is unable to understand the relationships between complex systems. This has led to a state where we are quickly destroying the possibility of long-term prosperity. The myth of endless economic growth within a finite ecological system is a geophysical fallacy.

Failure to recognize systemic conditions means that we have designed financial systems with a dangerous lack of resilience. Herman Daly describes the economic crisis as a result of the overgrowth of financial assets relative to growth of real wealth. Referring to Noble Prize winner Frederick Soddy’s 1926 book, *Wealth, Virtual Wealth and Debt: The Solution of the Economic Paradox*, Daly explains that;

Soddy pointed out the fundamental difference between real wealth – buildings, machinery, oil, pigs – and virtual wealth, in the form of money and debt. Soddy wrote that real wealth was subject to the inescapable entropy law of thermodynamics and would rot, rust, or wear out with age, while money and debt – as accounting devices invented by humans – were subject only to the laws of mathematics. Rather than decaying, virtual wealth, in the form of debt, compounding at the rate of interest, actually grows without bounds.³

In the same article Daly describes various reasons that financial assets have become so disconnected from real assets, leading to the absurd pyramiding of wealth that led to the economic crisis.

We should consider the economic crisis of 2007-2009 as a warning. A narrow frame of mind and commitment to economic indicators over all other types of feedback leaves us ill prepared to deal with complex systems. We have created a global financial system focused on profit, financial accumulation, and increasing GNP. Robert Kennedy described the lunacy of the system obsessed with GNP in back in 1968:

Too much and for too long, we seemed to have surrendered personal excellence and community values in the mere accumulation of material things. Our gross national product, now, is over \$800 billion dollars a year, but that gross national product – if we judge the United States of America by that – counts air pollution and cigarette advertising, and ambulances to clear our highways of carnage. It counts special locks for our doors and the jails for the people who break them. It counts the destruction of the redwood and the loss of our natural wonder in chaotic sprawl. It counts napalm and counts nuclear warheads and armored cars for the police to fight the riots in our cities and the television programs that glorify violence in order to sell toys to our children. Yet the gross national product does not allow for the health of our children, the quality of their education or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials. It measures neither our wit nor our courage, neither our wisdom nor our learning, neither our compassion nor our devotion to our country, it measures everything in short, except that which makes life worthwhile.⁴

Forty-two years later GNP is still the dominant economic indicator. Professor Roderick Smith describes the consequences of world GDP growth;

...relatively modest annual percentage growth rates lead to surprisingly short doubling times. Thus, a 3% growth rate, which is typical of the rate of a developed economy, leads to a doubling time of just over 23 years. The 10% rates of rapidly developing economies double the size of the economy in just under 7 years. These figures come as a surprise to many people, but the real surprise is that each successive doubling period consumes as much resource as all the previous doubling periods combined. This little appreciated fact lies at the heart of why our current economic model is unsustainable.⁵

Fritjof Capra and Hasel Henderson explain that GNP was not created to be used in such a simplistic and dangerous fashion; the creator of GDP national accounts, Simon Kuznets ‘warned in 1934 that such a limited, one-dimensional metric should not be used as an index of overall social progress.’⁶ GDP remains one of the most powerful examples of the manner in which reductive thinking creates havoc with complex systems.

2 Sustainable Development Commission ‘A Steady-State Economy’. London, Sustainable Development Commission 2008 p1.

3 Herman Daly and Tom Green ‘Groundbreaking economist, Herman Daly, zeroes in on the root cause of our financial meltdown’ Vancouver, Adbusters 19 Nov 2008.

4 Robert Kennedy quoted in Fritjof Capra and Hasel Henderson ‘Qualitative Growth’ London, The Institute of Chartered Accountants in England and Wales 2009 p4.

5 Roderick Smith ‘Carpe Diem: The Dangers of Risk Aversion’ Lloyd’s Register Educational Trust Lecture (29 May 2007) www.raeng.org.uk/news/publications/list/.../Lloyds_Lecture_booklet.pdf p17.

6 Capra and Henderson p6.

We are living with dysfunctional mental maps that do not reflect the complexity of systemic conditions. Our framework focuses narrowly on economic indicators and this is how the system is designed to establish value. An economic system that placed value on ecological stability, resilience, equity, wellbeing or happiness would be designed and managed in a very different manner. A narrow focus on profit excludes a holistic appraisal of values and encourages short-term thinking and waste of ecological and human 'resources'. Even our language becomes distorted around the narrow focus of profit, as we know that neither nature nor people are inherently 'resources' but have value in their own right outside of their function as a source of profit. The nature of the economic system is to grow and consume everything to suit its needs; our language, our values, our ideas about what can and cannot be an economic transaction. The emphasis on profit in an international capitalist system based on infinite growth is that transnational capital will continue to grow and swallow up everything in its wake until there is nothing left to use. Evidence will take the form of lost species, destroyed rainforests and a stable climate system – complex ecological systems that have evolved over millions of years that are being destroyed in a manner of a few decades.

2. Limits

The economic crisis of 2007-2009 provides a unique opportunity to create the kind of economic system and business practice that could plausibly sustain a civilization over the long term. A new model of business practice that acknowledges ecological limits and shifts to qualitative rather than quantitative growth is possible. Presently our ecological footprint exceeded the Earth's biocapacity (the area actually available to produce renewable resources and absorb CO₂) by 50 per cent.⁷ We are shrinking the available bio-capacity on which we depend. Daly describes the need for

a system that permits qualitative development but not aggregate quantitative growth. Growth is more of the same stuff; development is the same amount of better stuff (or at least different stuff). The remaining natural world no longer is able to provide the sources and sinks for the metabolic throughput necessary to sustain the existing oversized economy—much less a growing one.⁸

The new economics foundation's (nef) recent 'Growth Isn't Possible' report explains how economic growth is constrained by the finite nature of the planet's natural resources (biocapacity). The report compares the concept of 'infinite growth' to how growth functions in nature by focusing on the growth of a hamster:

From birth to puberty a hamster doubles its weight each week. If, then, instead of leveling-off in maturity as animals do, the hamster continued to double its weight each week, on its first birthday we would be facing a nine billion tonne hamster. If it kept eating at the same ratio of food to body weight, by then its daily intake would be greater than the total, annual amount of maize produced worldwide. There is a reason that in nature things do not grow indefinitely.⁹

Herman Daly points out that growth's first, literal dictionary definition is 'to spring up and develop to maturity' and 'thus the very notion of growth includes some concept of maturity or sufficiency, beyond which point physical accumulation gives way to physical maintenance.'¹⁰ At maturity growth must give way to 'a state of dynamic equilibrium.' The nef report describes dynamic equilibrium as a term typically found in discussions of population biology and forest ecology but used within the context of economics it refers to a system which exists 'within ecosystem limits but where there is constant change, shifting balances, and evolution.'¹¹

The UK government's Sustainable Development Commission (SDC) published its 'Prosperity without Growth?' report in 2009 which declares that growth was 'always unstable ecologically. It has now proven itself to be unstable economically.'¹² Author Professor Tim Jackson describes the dilemma wherein 'the modern economy is structurally reliant on economic growth for its stability'¹³ but,

The myth of growth has failed us. It has failed the two billion people who still live on less than \$2 a day. It has failed the fragile ecological systems on which we depend for survival. It has failed, spectacularly, in its own terms, to provide economic stability and secure people's livelihoods. Today we find ourselves faced with the imminent end of the era of cheap oil, the prospect (beyond the recent bubble) of steadily rising commodity prices, the degradation of

7 WWF Living Planet Report 2010 Switzerland, WWF 2010 p8.

8 Daly and Green p1.

9 Andrew Simms, Dr Victoria Johnson and Peter Chowla 'Growth Isn't Possible' London, new economics foundation 2010 p4.

10 Daly in Simms, Johnson and Chowla p4.

11 Simms, Johnson and Chowla p121.

12 Tim Jackson 'Prosperity Without Growth?' London, Sustainable Development Commission 2009 p5.

13 *Ibid.* p5.

forests, lakes and soils, conflicts over land use, water quality, fishing rights and the momentous challenge of stabilizing concentrations of carbon in the global atmosphere. And we face these tasks with an economy that is fundamentally broken, in desperate need of renewal. In these circumstances, a return to business as usual is not an option. Prosperity for the few founded on ecological destruction and persistent social injustice is no foundation for a civilised society.¹⁴

The report describes the relationship between economic growth and political stability, provides an analysis of the nature of the dilemma and has solid policy recommendations. Unfortunately, the fragmented nature of government departments is such that more powerful wings effectively ignore the warnings of the SDC and quantitative economic growth remains hegemonic within public policy. In 2010 the Sustainable Development Commission (with annual budget of £3 million and the government's only independent environmental watchdog and advisory body) was abolished. Without the SDC there will be even less capacity with the UK government to understand and respond to the complex issues that threaten both social and environmental systems.

The critique of growth in Fritjof Capra and Hazel Henderson's recent report 'Qualitative Growth' for The Institute of Chartered Accountants uses explicit ecological metaphors. Capra and Henderson describe how as living systems mature their growth processes shift from quantitative to qualitative growth. This report draws on the historical reasons that quantities have been prioritized over qualities in the history of Western thought and posits that a new systemic understanding of life makes it possible to formulate a scientific concept of quality. This new ecological literacy is based on the 'development of complexity theory, or nonlinear dynamics, which is a mathematics of patterns and relationships.'¹⁵ The report explains that;

Instead of assessing the state of the economy in terms of the crude quantitative measure of GDP, we need to distinguish between 'good' growth and 'bad' growth and then increase the former at the expense of the latter... From the ecological point of view, the distinction between 'good' and 'bad' economic growth is obvious. Bad growth is growth of production processes and services which externalise social and environmental costs, that are based on fossil fuels, involve toxic substances, deplete our natural resources, and degrade the Earth's ecosystems. Good growth is growth of more efficient production processes and services which fully internalise costs that involve renewable energies, zero emissions, continual recycling of natural resources, and restoration of the Earth's ecosystems.¹⁶

Capra, Henderson, Daly and Jackson recognize that the economic system must exist within the carrying capacity of the ecological system. Daly has a comprehensive model for steady state economic system which is described at length in his books. Jackson recommends policies and practices to address 'the social logic of consumption'¹⁷ and recalibrate the economy to create the possibility for prosperity without quantitative growth. A myriad of policy and practical options have been developed but are well beyond the scope of this paper. The common denominator is that goals on this level will require profound shifts in governance systems¹⁸ and corporate culture.

3. Practice

An integrated ecologically literate epistemological position is now an essential foundation for durable businesses and a stable economic system. Ecological literacy is defined by Fritjof Capra as the understanding of the principles of organization that ecosystems have evolved to sustain the web of life and an essential step on the road to sustainability.¹⁹ The ecological economists quoted above have mapped economic solutions to the current predicament. It is necessary to redesign our management processes so that they function in an ecologically sustainable fashion. Ecological literacy implies whole systems thinking, an engagement with complexity, and recognition of geophysical limits. These and other principles must quickly be learned and put into practice. Yet individuals have known as much for decades so the questions is; 'why has this knowledge remained so marginal?' I will end this paper with a few thoughts on why whole systems thinking and ecological literacy has not yet been adopted, why now might be the time for these ideas to finally make some progress, and contribute some suggestions for embedding ecological literacy into both education and business management.

14 *Ibid.* p5.

15 Capra and Henderson p8.

16 *Ibid.* p9.

17 Jackson p157.

18 *Ibid.* p158.

19 Fritjof Capra *The Hidden Connections*. London, Flamingo 2003 p201.

Significant barriers to change plague the field of sustainability. In *States of Denial* Stanley Cohen describes how a capacity to deny disturbing facts is the normal state of affairs for people in an information-saturated society. Furthermore, people will often accept a proposition without accepting the implications. For example we accept that climate change is happening and we might also accept that each of us needs to reduce our personal carbon emissions, but we do not accept the implications that traveling on a plane is no longer an ethically benign activity. In the complex fields of ecological sciences and sustainability, we are locked into collective patterns of behavior and have adapted strategies to avoid accepting the implications of climate change and other environmental threats. There is evidence that increasing information may actually intensify denial strategies. Climate communications specialist George Marshall explains that the idea that “if only people knew, they would act” is a relic of Enlightenment faith in the power of knowledge.²⁰ The value / action gap describes the gulf between our values and the way that behave. For many researchers interested in behavioral change the problem lies in crossing the gap that divides our awareness of environmental threats from our capacity to take appropriate action. Fortunately educators and researchers concerned with sustainability have made progress. There is historical precedence that saw deep-seated attitudes change dramatically, i.e. the women’s and the civil right’s movements. Our society has witnessed radical social change in the past when we evolved new moral codes and changed power dynamics, laws and institutions accordingly. The historical lessons from both these major social movements have much to teach us today and the similar critical strategies and organizing methods can be used towards changing our relationship with the natural world. The types of actions that will make a difference on a systemic level involve the creation of both massive popular education projects and new social and political institutions that will not only create opportunities for fundamental change, but resist deeply unsustainable and unjust industrial and financial practices, policies and institutions.

An approach with the potential to transcend the notorious value/action gap is transformative learning. Developed during the feminist movement in the 1970s, transformative learning has been documented by over 150 doctoral dissertations, hundreds of scholarly papers and dozens of books over the past four decades.²¹ Although transformational learning was not developed explicitly to deal with environmental education, it provides relevant conceptual tools to inform a learning process for ecological literacy. What transformational learning offers is the potential to help individuals with deeper learning processes than are traditionally engaged in formal education. Communications theorist and anthropologist Gregory Bateson first described learning levels in ‘The Logical Categories of Learning and Communication.’²² Sustainability educator Dr. Stephen Sterling’s interpretation of Bateson’s work maps the trajectory from no learning to deep learning levels and transformation:

- Level A- No change (no learning: ignorance, denial, tokenism)
- Level B- Accommodation (1st order - adaptation and maintenance)
- Level C- Reformation (2nd order learning - critically reflective adaptation)
- Level D- Transformation (3rd order learning - creative re-visioning)²³

Sterling maintains that learning for sustainability must transcend the transmissive learning approach because information alone does not necessarily lead to change. He explains that ‘not only does it not work, but too much environmental information (particularly relating to the various global crises) can be disempowering, without a deeper and broader learning processes taking place.’²⁴ Sterling maintains that most education aims to replicate current worldviews; ‘mainstream discourse on education, operating within the dominant social paradigm, takes place within certain parameters of validity: that is, within Learning 1.’²⁵ Research in this field demonstrates that epistemic learning or 3rd order learning is necessary to address the epistemological error of the current paradigm.

In an attempt to move from theory to practice, our institutions, organizations and businesses must be managed from an ecologically literate perspective. The university is central to the practical understanding of the triple crises of ecological, social and economic sustainability and has a responsibility to create ecologically literate professionals. Management practice could be transformed through these insights. Professor Peter Reason in an inaugural lecture described the role for managers:

Ecological thinking, systemic thinking, placing our work in its wider context must be at the heart of our practice. Management is an important discipline, for without good management practices of all kinds we will not be able to manage the hugely complex ecological-industrial system we will need to create. Living sustainability at the edge of our biosphere’s limits will

20 George Marshall ‘Denial and the Psychology of Climate Apathy’ *The Ecologist* November 2001.

21 Andrew Kitchenham ‘The Evolution of John Mezirow’s Transformative Learning Theory’ *Journal of Transformative Education* Vol 6 No 2 April 2008 p120.

22 Gregory Bateson *Steps to an Ecology of Mind* Chicago, University of Chicago Press 1972 p279.

23 Stephen Sterling *Sustainable Education* Dartington, Schumacher Society/Green Books 2001 p78.

24 *Ibid.* p19.

25 Stephen Sterling ‘Whole Systems Thinking as a Basis for Paradigm Change in Education’, Doctoral thesis, University of Bath 2003 p110.

demand a quality management beyond any we can imagine. But let us never forget that management, like all human disciplines, is an extension of ecology (Berry, 1999:84). Do we teach our students the basic principles of ecology, about carrying capacity, the laws of thermodynamics, limits to growth, appropriate scale, steady state economics? Do we ask them to consider the impact—for better and for worse—of so called world class business on the less fortunate global citizens? Do we ask them to think creatively about the nature of management as a discipline in these conditions? One of my final year undergraduate students writes that she is astonished that she has reached this stage in her career without having been taught about any of these ecological issues.²⁶

While business management is just one facet of much larger transition to ecological sustainability, the struggle by concerned citizens to stop ecological and socially destructive industrial practice is often mediated to by those in corporate management positions. An understanding of the nature of the problems we face is essential for managers. Educator David Orr explains that education now requires a 'fundamental transformation of our concept of learning relative to the health of the biosphere.'²⁷ For learning institutions willing to rise to the challenge there is an opportunity. In the same way universities nurtured the women's movement in the 1970s, universities could now create space for transformational learning for ecological literacy. This movement in universities and in management will be just fragment of a much larger cultural and political transformation if this civilization intends to stop the devastating ecological damage that is now business as usual. Changes ahead will not necessarily be positive, but there is little hope for positive change if we are not willing to encounter problems with more intellectual and moral honesty along with whole systems analysis. Social and political transformation will result from a plethora of sites of struggle as humankind redefines our relationship with the ecological system on which we depend. Learning institutions can now offer new styles of thinking and practice, supporting communities as part of a positive transition – or we can cling to business as usual and continue to dig ourselves more deeply into ecological-social-economic crises.

Conclusion

Communications theorist and anthropologist Gregory Bateson stated that we are 'governed by epistemologies that we know to be wrong' back in 1972.²⁸ In the same book Bateson wrote: 'the organism that destroys its environment destroys itself.'²⁹ Almost forty years later global ecological systems are in steep decline and converging crises make a deep evaluation of the underlying premises of our philosophical traditions an urgent imperative. We have continued to plunder global environmental systems despite the fact that we knew that we were destroying our resource base for well over five decades. Collapse of historical civilizations is well documented (Tainter 1988, Diamond 2005, Homer-Dixon 2007). Within popular culture, cataclysmic collapse has even developed into a perverse voyeurism meme, now a theme used to sell designer clothes and a new genre of disaster movies. It is not an idea to be handled blithely, yet it is a possibility that must be confronted to build the will and the resolution to enable the transformation that is now urgently needed.

The economic crisis opened new political space and has provided an opportunity for evaluation and intervention into assumptions that maintain the status quo. This 'new political space' is situated within shattered illusions of stability. The banking crisis and the subsequent government budget cuts revealed the deep structural crises within the economic system, as well the political system which created conditions for such dangerous financial practices. An asset transfer of unprecedented scale from the public purse to financial institutions has created debilitating national debt. The UK government is responding with the largest assault on public services and education in modern history. Governing institutions have consequently lost a great deal of legitimacy. New social movements are quickly politicizing a new generation who are organizing resistance. Within this space we avoid disaster by working to shift our understanding of our relationship with the natural world and the role of the economy as a means to prosperity within limits of the ecological system.

A transformation depends our capacity now to reconfigure systems capable of sustaining economic, social and ecological systems over the longer term. If we are brave enough to examine of the roots of our problems there is possibility for renewal. This imperative will require new social and political institutions that can challenge deep-rooted epistemological errors embedded within old institutions. Communications consultancy Smartmeme describe the moment when 'seismic events can trigger mass physic breaks:

26 Peter Reason 'Justice, Sustainability, and Participation. Inaugural Professorial Lecture' School of Management University of Bath Published in *Concepts and Transformations* Vol 7(1), 7-29, 2002 p14.

27 David Orr *Down to the Wire* Oxford, Oxford University Press 2009 p176.

28 Bateson p493.

29 *Ibid*, p457.

moments when status quo stories no longer hold true, and a critical mass of people can't deny that what is happening in the world is out of alignment with their values.³⁰ An ecological epistemology and ethic will problematise corporate power relative to its social function – and work towards creating the types of social institutions that will challenge structural failures. This paper addresses this intellectual territory as well as practical necessities and actions that emerge out of deep-rooted contemporary crisis conditions.

In sharp contrast to industrial culture's epistemological error, the core values of *Indigeneity*³¹ offers ecological epistemologies, practices and beliefs that supported thousands of sustainable indigenous societies over 40,000 years. Contemporary industrial society may have many impressive attributes, but what it does not have is a single example of a sustainable industrial society.³² While indigenous traditions have been historically maligned and suffered great injustices over the course of growth of Western civilization; the surviving traditions are examples of societies who embrace interconnection between humans as well as with all non-human creation. *Indigeneity* offers not only pathways for ecological sustainability, but addresses psychological well-being. It defines mental health as a balanced, reciprocal relationship with one's habitat: 'You tend to the natural world, and in turn empowers you and gives you energy and health.'³³ The 'indigenous idea of reciprocity is based on very long relational dynamics in which we are all seen as "kin" to each other.'³⁴ An ecological epistemology is necessary to re-conceive both human wellbeing and functional relationships with larger ecological systems.

It is possible to build sustainable futures; scores of research documents and practical projects demonstrate how to address some of the most intractable problems within our economic model and business practice. Ecological understanding benefits from contemporary holistic science; insights from contemporary biology such as autopoiesis describe how living systems self-organize and evolve in response to environmental conditions.³⁵ This paper posits that the reason that business and hegemonic institutions continually perpetuate dangerous business practice is because they persist in following an outdated and thoroughly inadequate reductive epistemological position. Fortunately there have been thousands of other epistemological traditions outside of the Western industrial scientific tradition that offer models for sustainable social and economic organization. Those who practiced traditional ecological knowledge (TEK) left us the benefits of clean air and water, and a stable climate. The tragic *hubris* of contemporary civilization will mean that our own descendents will never have the same ecological stability or abundance that we inherited (due to the now irreversible effects of at least moderate climate change). It is still possible to start to learn from cultures with embedded ecological epistemologies. The very first thing we need to do is acknowledge we have a problem – a problem deep enough to warrant profound epistemic shift. The 2007-2009 crisis will be the first of many in a long spiral if we are unable to address this fundamental philosophical problem.

30 Doyle Canning and Patrick Reinsborough *Re:Imagining Change* San Francisco, PM Press 2010 p105.

31 La Donna Harris, and Jacqueline Wasilewski (Indigeneity, an Alternative Worldview: Four R's (Relationship, Responsibility, Reciprocity, Redistribution) vs 2 P's (Power and Profit). *Systems Research and Behavioral Science*, 21 2004 p489.

32 Leslie Gray "Shamanic Counselling and Ecopsychology" in *Ecopsychology*. ed. Roszak, T., Gomes, M. and Kanner, A., San Francisco, Sierra Club Books, (1995) p182.

33 *Ibid.* p181.

34 Harris and Wasilewski p493.

35 Fritjof Capra *The Web of Life* London, Harper Collins 1997 p95.

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