

A Systems Approach to Governance for Sustainability

Richard Sanders, Queensland Department of Natural Resources and Mines,
Brisbane, Richard.sanders@nrm.qld.gov.au

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Abstract

Summary

Sustainability is a new challenge for humanity that begs a new paradigm for economics and governance. The ecological economic pre-analytic framework provides a useful paradigm. The sustainability challenge is to adapt social and economic institutions (including governance) so that the human enterprise operates within an ecological and material budget constraint that lies within the carrying capacity of supporting ecosystems. Failure to do so is unsustainable. Sustainability is a complex systems problem that cannot be adequately addressed through the traditional fragmented disciplinary, legislative, departmental and silo approach to governance. This implies the need for a new governance paradigm. This paper explores the current state of knowledge on a systems approach to governance for sustainability and begins to explore a little beyond this frontier.

Challenges

The institutional inertia of traditional (i.e. pre-sustainability) economic imperatives and governance approaches is strong. A systemic problem cannot be addressed in a fragmented way – a systems approach is needed. The key question to discuss is the capacity for bringing about the institutional and structural changes necessary to achieve sustainability through a systems approach. Is it necessary to adopt a systems approach to governance? What are the impediments to making the transition to a systems approach to governance?

Note

This paper is the first stage of a policy analysis examining how the concept of ESD can be mainstreamed into the policy process within the Department of Natural Resources and Mines, Queensland. It is an attempt to define and scope the problem. As such it is an early stage of the analysis and does not necessarily represent departmental policy.

Paper

Governance for sustainability is a field of rapidly emerging issues as society grapples with the challenges of operationalising ecologically sustainable development (ESD) in the face of ecological degradation and breakdown that threatens to undermine the future welfare of humanity. One significant emerging issue is the respective roles of government and the market in governance for sustainability. Another, significant issue is the problem of government trying to deal with the increasing complexity of sustainable natural resource management (NRM). Practitioners are finding that our current approaches to sustainable resource management are becoming increasingly tangled and complicated – increasingly like a tangled bowl of spaghetti. This is largely due to the fact that sustainability is a complex systems problem that cannot be adequately addressed through the traditional fragmented disciplinary, legislative, departmental and silo approach to governance. This implies the need for a new governance paradigm.

The best approach to governance for sustainability will depend on how sustainability is perceived and defined. If sustainability is seen as essentially an economic

problem where most of the externalities can be internalised then the governance model may rely mainly on the market with only the more intractable market failures

being left to government. If perceived as being a collective action problem largely beyond the scope of the market, then governance may rely much more heavily on government.

Sustainability itself as a concept is often not seen from a systems perspective. In policy circles, for example, sustainability has come to be seen as a matter of 'striking a balance between the social, the economic and the environmental'. In other words, these dimensions are seen as separate, and indeed, competing considerations. However, from a systems perspective such as ecological economics, society is a totally dependent sub-system of the planet's ecosystems and the human economy is one of the many sub-systems of society, i.e. the economy is nested within society and society is nested within ecology (Daly, 1996; Hogan, 2003). This different perspective has profound implications for how we understand sustainability and the best form of governance for sustainability.

Need for a Paradigm Shift

The sustainability problem is analogous to that of the early explorers grappling with the problem of ocean navigation. Locating one's position in the ocean could not be solved within the limited pre-Copernican paradigm of a flat earth. The solution could be found only by making the paradigm shift to the realisation that the Earth is spherical.

This paper argues that the current sustainability paradigm of sustainable development based on Brundtland (WCED, 1987) is flawed. The key flaw is to see the current economic system and its material growth imperatives as being consistent with sustainability. Part of this flawed thinking includes the internalisation of sustainability into the economic paradigm. The paper contends that so long as we continue to hold this flawed view, it is not possible to solve the sustainability problem, essentially because the economic system (and its growth imperative) is the sustainability problem.

In the same way that there was strong political resistance by the church to the idea that the Earth is spherical and orbited the Sun, there has been strong political resistance to the idea that our economic system and its material growth imperatives is incompatible with maintaining the ecological and material basis of our existence.

This resistance can be traced from the 1972 Stockholm Conference on the Human Environment that first rejected the 'no growth' philosophy as being "absolutely unacceptable" (UN, 1973), through the 1987 Brundtland Report (WCED, 1987), and through to present sustainable development policies (eg. National Strategy for Ecologically Sustainable Development, COAG, 1992). Consequently, the sustainability research agenda has been conducted within the context of the current economic system and its material growth imperatives, giving rise to the contradictory 'growth within limits' Brundtland model of sustainable development that is currently the dominant paradigm. This model has helped us convince ourselves that we can continue to have economic growth while also living within the ecological and material carrying capacity of the planet.

The Brundtland model argues that sustainability is not just about the ecological impacts of over consumption by the rich but also about the ecological impacts of the poor and that a "five- to ten-fold" growth in the global economy (i.e. sustainable development) is needed to overcome poverty (WCED, 1987). Within this paradigm, sustainability has been interpreted to mean 'striking a balance between the social, the economic and the environmental', the 'triple bottom line', 'getting the prices right', 'dematerialisation', 'eco-efficiency', and so on. These reflect the Brundtland view that

we can have growth within limits. They also reflect the way the sustainability concept has been subsumed into the conventional economic paradigm.

The following analysis is grounded instead in a systems view of sustainability.

A Systems Approach to Sustainability

To an observer on Mars, everything that happens on Earth could be seen as matter and energy either in motion or in transformation and reflecting ecological, climatic, geological and economic processes. We on Earth look at this single but complex reality through the lenses of many disciplines of knowledge. In our intellectual discourse, we abstract a bit of reality out of its broader context and then explore it in very great detail often losing sight of the broader whole of which it is part.

The paradigmatic problem arises because our traditional fragmented reductionist approach to knowledge is inadequate to meaningfully comprehend a complex systems reality such as the sustainability problem. When the problem is considered from a holistic transdisciplinary perspective, the problem and possible solutions often take on different complexions.

Every analysis necessarily begins with a set of assumptions about the thing to be analysed. The great economist Joseph Schumpeter called this the pre-analytic vision. The pre-analytic vision of standard economics assumes that the object of analysis is a circular flow of exchange values between firms and households isolated from the natural environment, which is seen as an externality. This reductionist approach is very useful for economic analysis that does not involve the natural environment. However, it is inadequate to deal with sustainability, which is concerned with the viability of the relationship between the economic system and the natural environment that underpins life and the economy (Daly, 1996).

The ecological economic pre-analytic vision is a systems perspective that views the economy as a dependent subsystem of the larger ecosystem. How big the economic system can grow before it begins to destroy the functioning of the ecological system on which it depends becomes a vitally important question ignored by conventional economic thought. Sustainability is an issue solely because the scale and impact of economic activity is undermining the ecological and material basis of the well-being and existence of future generations. Therefore, the paradigm shift to the ecological economic pre-analytic vision is necessary to help understand and address the sustainability problem.

The "*Getting it Right: Guiding principles for resource management in the 21st century*" conference in Adelaide in March 2002, attended by some 400 academics, government officials and industry representatives, recognised the ecological economic pre-analytic vision as the conference's 'Biggest Idea':

The economy is a subset of society, which is a subset of the environment. If we accept this model, it means we need to envisage an Australia where the economy is a reflection of the social and environmental aspirations we have, rather than accepting a society and environment that is the result of the economy we strive for. Getting this right would be a major nation-building project (Anon, 2002).

When sustainability is considered from this systems perspective, the flaws in the Brundtland model become apparent. They relate to the fact that it is impossible for the physical dimension of economic activity to grow without destroying the ecological life-support systems of the planet. The thrust of the arguments made in this paper is

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that it is not possible to delink economic growth from material growth as the dominant paradigm suggests.

If we are genuinely committed to the welfare of future generations and solving the sustainability problem then we must make this paradigm shift and take our thinking 'outside the box' of current economic thought that tends to dominate everything we do. Living within ecological limits, rather than economic growth, must become the central organising principle of our civilisation (inspired by Gore, 1993).

I have little doubt that the burden of responsibility to facilitate such a paradigm shift lies squarely on the shoulders of people like those attending this Conference. To continue my metaphor, we must be the Copernicus's and Galileo's who question the received wisdom and thereby make sustainability a possibility. This is, quite literally, a matter of survival.

The flaws and shortcomings in the conventional sustainability model are now considered in more detail. Following that, the insights gained from this analysis are applied to the question of governance for sustainability.

Understanding Sustainability

In order to discuss sustainability, it is necessary to clarify what one means by the concept. This is particularly the case where the terms 'sustainability' and 'sustainable development' have been used so loosely that they have come to mean "all things to all people". Largely, this definitional laxity arises out of the reality of trying to understand a systems reality from a reductionist perspective. This has resulted in many definitions and policies that will not help achieve sustainable outcomes for the simple reason that they defy biophysical reality.

The following discussion is intended to help clarify the issue of what sustainability means. Sustainability is concerned with the welfare of future generations. If their welfare were not at issue then sustainability would not be an issue.

What is it that threatens the welfare of future generations and therefore makes sustainability an issue? Ultimately it is the disappearing ecological and material basis of human existence. This material basis has a special quality that makes it useful to humans, a quality that is central to this argument.

Life, through photosynthesis, (and geological activity) has organised, structured and concentrated matter and energy into forms that are useful to humans. For example: a seed organises matter from the environment into the form of a tree; bacteria concentrate iron over millennia into an iron ore body; coal, oil, natural gas bodies are stores of fossilised sunlight; and ecosystems generate life support (air, water, soil, climate, etc).

Matter and energy that are not organised, structured and concentrated in this way are generally of little use to humans. It is this quality of being organised, structured and concentrated that makes these forms of energy and matter useful to humans (and indeed, to animals generally). I call this quality 'usefulness' (a less confusing term than low entropy). This matter with the quality of 'usefulness' (and the processes that produce it) is also known as natural capital. There are renewable, replenishable and non-renewable forms of natural capital. Life and geological processes generate both flows and stocks of natural capital through the eons of time.

Humans meet their material needs through consuming both flows and stocks of natural capital. Economic activity involves meeting our material and other needs by consuming natural capital.

The thermodynamic reality is that when we use natural capital some or all of the quality of 'usefulness' is lost or dissipated. For example: petrol exhausts its 'usefulness' through combustion; and iron ore is transformed into steel that eventually rusts and dissipates back into the environment in a form that is no longer useful. This 'usefulness' can be regenerated only by ecological processes fuelled by an external source of energy (the Sun). If terrestrial energy is used, the thermodynamic reality is that there will be no net regeneration of 'usefulness' (i.e. more 'usefulness' will be consumed than is produced. For example, industrial agriculture will use up to 10 units of fossilized energy to produce one unit of, say, potato energy, not to mention the greenhouse impact of using the fossil fuel and the land degradation associated with that form of agriculture (Pimental, 1992).

The key point here is that all economic activity uses up or dissipates natural capital. If the economic system consumes natural capital from the biosphere more quickly than it can be regenerated, this is by definition, unsustainable. A fundamental condition for sustainability is that the economic system consumes natural capital from the biosphere no more quickly than it can be regenerated by natural processes that are essentially ecological.

Sustainability, therefore, requires humanity to live within the ecological carrying capacity of the planet. This requires that remaining stocks of renewable and replenishable natural capital be liquidated no further by economic activity so humanity can meet its future material needs from the sustainable flow of natural income these remaining stocks can generate without being further liquidated³. Beyond this, the challenge is to allow the remaining stocks to grow to ensure adequate natural capital for future generations.

In economic terms, sustainability requires humanity to live off the relatively limited and fixed sustainable flow of 'interest' or natural income generated by each type of natural capital so the stock of each critical type does not diminish through time. This ensures that each successive generation, indefinitely into the future, will have no less natural capital to meet their material needs than each preceding generation (intergenerational equity). In other words, there is a finite rate beyond which it is unsustainable to consume natural capital or 'usefulness'. Policy-wise, sustainability requires humanity to live within an ecological and material 'budget constraint' limited to the sustainable flow of each critical type of natural capital.

How the Situation became Unsustainable

Humans evolved from hunting/gathering through agriculture to the industrial society. Each phase has reflected increasing social and technological complexity in our quest to extract natural capital from the environment. This has resulted in increasing scales of impact on the ecological systems that generate flows of natural capital and the using up of stocks of non-renewable natural capital. Tainter (1990) also argues that increasing social and technological complexity is the prime factor leading to the collapse of 24 previous civilizations as diminishing and then negative returns to complexity have forced them to outstrip their natural resource base.

Prior to the Industrial Revolution, the human ecological impact was limited to that of muscle power fuelled by flows of solar energy (i.e. through food consumed by humans and working animals). The discovery of how to use immense stocks of

fossilised sunlight (e.g. coal, oil, gas) to drive our economic system has allowed both population and economic activity to explode exponentially (Bennett, 1976).

Currently, humanity is living beyond the carrying capacity of the planet. Global consumption of natural capital is now so great that ecosystems are declining and producing ever-diminishing flows of natural capital. Stocks of natural capital are also being rapidly depleted. Humanity is witnessing the accelerating depletion of renewable, replenishable and non-renewable forms of natural capital (UNEP, 2002; UNDP, 2002). In other words, the ecological and material basis of future generations of human existence is being liquidated. This liquidation of natural capital is the sustainability problem. The sustainability challenge is to constrain the total human demand for natural capital to within the carrying capacity of the planet.

Why the Current Paradigm is Flawed

This paper argues that the sustainability problem cannot be meaningfully addressed within the current sustainability paradigm that takes the current economic system, firstly, at the macro level, because the financial system and the market structurally lock us into depleting the ecological and material basis of our continued existence whether we like it or not.

It further argues that the sustainability problem cannot be meaningfully addressed by internalising the natural environment (ecological and material basis of existence) into the conventional economic paradigm. This is because of inconsistencies between the abstract world of neoclassical economic theory and the thermodynamic and biophysical realities and laws of nature. Furthermore, it argues why the conventional policy prescription of balancing the economic, social and environmental factors cannot solve the problem. The balancing issue is considered first.

The Balance Problem

Operationalising sustainability is largely seen as a matter of balancing economic, social and environmental considerations. These are seen as competing considerations of equal importance and decisions should be based on striking a balance between these (i.e. a compromise between economic growth and sustainability). The market is a tool that facilitates such trade-offs in a way that is seen to be efficient. This view also adds weight to the idea that the market is a useful tool for achieving sustainable outcomes.

There are a number of problems with seeing the social, the economic and the ecological as being of equal importance although this is an improvement on the prevailing view that sees the economy as everything, society as secondary and ecology (the environment) as an afterthought.

The key problem is that neither view reflects the current reality humanity finds itself in. As discussed previously, society is a totally dependent sub-system of the planet's ecosystems and the human economy is one of the many sub-systems of society, i.e. the economy is nested within society and society is nested within ecology.

The following logic explains why the balance approach fails. The over-riding concern of sustainability is the long-term welfare of society. A necessary precondition for this is to ensure that the ecological and material basis of society is sustained in perpetuity. Otherwise, the material basis of economic activity dwindles and society eventually disappears, as was the case with the people of Easter Island (Ponting, 1991). So maintaining ecological integrity is the highest priority to ensure the long-term welfare of society. The next priority is to maximise the welfare of society within what may be thought of as an ecological budget constraint. This requires an

economy that meets human material needs while maintaining ecological integrity and the stock of natural capital. The sustainability challenge is to design such an economy.

The problem with seeking to strike a balance between social, economic and ecological considerations is that there is no more room left to move (i.e. to trade-off) on the ecological front. We have almost certainly already exceeded ecological limits (Rees, 1990; Vitousek, 1986) and sustainability will require us to claw our way back through ecological rehabilitation. Ecologically, we need to draw a line in the sand now, and go no further. Otherwise, we will go the way of the Easter Islanders. The implication of this ecological bottom line is that social and economic reality must adapt and innovate to operate within ecological and material limits.

Structurally Locked into an Unsustainable Trajectory

For three centuries the imperatives of the financial system and the market have structurally locked humanity into extracting material wealth from the planet at an exponentially growing rate. Once useful, these institutions now threaten the survival of humanity by depleting the ecological and material basis of our existence.

All money in the world's financial system for the past 3 centuries (fractional reserve banking) exists as interest-bearing debt so the money supply in each country grows exponentially at around 6% compounding based on the empirical data (Blain, 1987). This locks the economy into exponential growth so the interest on debt can be paid – otherwise the economy collapses.

The absurdity of this system is such that if one cent were compounded at 6% for 1992 years it would grow to $\$2.5 \times 10^{48}$ in 1992 years (the year calculated) - equivalent in value to 100 000 galaxies, each of 1 billion stars made of pure gold at \$328 US an ounce!

Money (i.e. debt) is not wealth but simply a claim on wealth. Wealth is the natural capital of our planet. In the simplest analysis the root of the sustainability problem is an exponentially growing set of claims (money) on a finite (and indeed diminishing) pool of natural capital.

In 1926 Frederick Soddy explained the delusion on which our economic system is based: “The ruling passion of the age is to convert wealth into debt in order to derive a permanent future income from it” in the illusion “people can live of the interest of their mutual indebtedness” (Daly, 1996).

The market enables people (with money) to demand (and receive) natural capital embodied in goods and services they consume. The only limitation on the size of this demand is the availability of money. As the world's money supply grows, as people's incomes rise (particularly in less developed countries), and as markets become more free and global, the total human demand for natural capital continues to grow far beyond the carrying capacity of the planet. The only way to meet this level of demand currently is to liquidate natural capital. Together, the financial system and the increasingly free market lock us into this unsustainable path.

The standard environmental economic response is to see this problem as a market failure to be corrected by ‘getting the prices right’ to ‘internalise the externalities’. Sustainability demands that the ‘right price’ will have to be sufficiently high to exclude some people from the market so the total demand of the remaining population is no more than the sustainable level. The proportion of poorer people excluded depends

on how much demand the richer proportion chooses to exercise with its money. The market is highly inequitable and unsustainable given that equity (within and between generations) is fundamental to sustainability. In other words, the market fails.

Ecological economists propose another solution. First, impose a sustainability constraint to limit the supply to the sustainable level. Then ensure an equitable (not equal) distribution of money amongst the world's population. Finally, let the market efficiently allocate this constrained supply of natural capital. Again, because demand will exceed supply, only the wealthier, those who pool their money or those who get in first will have their material needs met to the exclusion of the rest. Again, the market fails.

Within the market context, the only way to ensure that the needs of all can be met is to liquidate natural capital. The only way to ensure the needs of all can be met sustainably is through some form of sharing or rationing to prevent the wealthier from cornering the supply.

The Development Issue

The sustainability problem is primarily a problem of too much consumer demand for natural capital (embodied in the goods and services people consume). The wealthiest 20% of the world's population are responsible for 80% of human demand. Simple maths shows that if the wealthiest 20% reduced their average per capita consumption to the average level of the remaining 80% then aggregate global consumption of natural capital would be a quarter of the current level. Such a level is arguably sustainable so long as it is done in a low impact way.

As discussed previously, the Brundtland sustainable development paradigm seeks to lift the incomes (and therefore, natural capital consumption) towards the level of the wealthiest 20% by calling for a five- to ten-fold increase in economic growth.

The current sustainability paradigm argues that the poorer 80% are wreaking huge ecological damage through their impoverishment (and that they need to become wealthier to reduce their impact). However, the reverse appears to be largely the case. Most of the ecological and material exploitation in the less developed countries is to meet the needs of the wealthy 20% of the world's population. The empirical reality is that there is a net flow of ecological, material and monetary wealth out of these countries.

Sustainability demands a drastic reduction in the consumption of natural capital by the wealthy 20% of the world's population. There is no option but to achieve such a material reduction to a level within the long-term carrying capacity of the planet, as this is the fundamental condition for sustainability. Having said this, it is pertinent to point out that such a reduction in natural capital consumption need not translate into a lower quality of life for the wealthiest 20%. However, it would require a new approach to how our quality of life is achieved. It also means that this new approach would greatly increase the quality of life for the poorer 80% while not increasing their consumption of natural capital.

The forgoing discussion focuses on the material rather than monetary picture of the sustainability problem. This is because the problem is at heart a material one and an economic or monetary analysis is very loosely, at best, related to the material reality. Therefore, it is necessary to grapple directly with the problem by focusing on physical or material outcomes rather than indirectly through an economic or monetary approach.

Misplaced Faith in the Market

Sustainability is an economic problem in that it is about how people meet their material needs including those needs provided by ecological systems such as ecosystem services. However, the sustainability problem is much broader than that addressed by the market. The market is limited to dealing with one aspect of the economic problem, the efficient allocation of resources. Beyond this, the market cannot deal with the two fundamental sustainability conditions of living within ecological limits (i.e. equity between generations) and equity within each generation.

Sustainability as Efficiency

Reliance on the market is the major flaw with the Brundtland model of sustainability. This flaw derives from the environmental economic school of thought that sees environmental problems, including unsustainability generally, as cases of market failure. Because air and water and other environmental factors are unpriced or underpriced, they get over-used resulting in environmental problems. The way to fix the market failure is said to be to 'get the prices right' on those things that are unpriced or underpriced and then the market will solve the problem. Under ideal conditions, the market gives rise to something called economic efficiency. When you fix a market failure in this way, the outcome is economic efficiency, which is not the same thing as sustainability.

Some ecological economists argue that the answer is to set ecological/material constraints and then allow the market to achieve economic efficiency within those constraints. But as we saw previously, if the sustainable supply of natural capital is less than the demand, as it surely will be, some will miss out.

Aggregation Problem

Economic efficiency has two dimensions – efficient production and efficient allocation. Efficient production means maximising the dollar value of economic output from a given dollar value of inputs. Allocative efficiency ensures that resources are channelled into producing what is demanded in proportion to the price signals in the market. Putting efficient production and allocation together, what the market does is ensure that what people want is produced at the cheapest price.

In other words, economic efficiency is about people getting whatever they want (so long as they have the money) at the cheapest possible price. However, while it may be rational for individuals to want a particular thing, the impact of millions of people wanting that thing may be socially and /or ecologically irrational. For example, the private car is an individually rational form of transport while public transport is socially rational; and visiting a wilderness is meaningless if thousands are doing it together. As we saw previously, the essence of the sustainability problem is that in the aggregate, humanity is able to demand natural capital via the market at volumes far beyond the carrying capacity of the planet. As we have seen, there is no way within a market context to stay within the carrying capacity of the planet.

Discounting – Biased to the Present

Markets devalue or discount future values. Markets are inherently biased to maximising present day values due to the phenomenon of discounting. Discounting exists because we have interest rates and essentially, the discount rate equals the interest rate. If the interest rate is 10% then \$100 invested today is worth \$110 in one year's time. Conversely, \$110 worth of value in one year's time is considered to be worth only \$100 in present value terms. Even at low discount rates, values 30 years into the future have almost no value in present day terms.

In other words, markets place no value in the values of the next generation, let alone, the values of generations further into the future. This is the opposite of sustainability, which is primarily about the values of future generations. How markets deal with the issue of time is to define an 'optimal depletion path' for all resources. This path is such that present values are maximised. According to this approach, as a particular resource gets scarcer its price will rise until an economic substitute is found. This logic is such that it is economically rational to harvest whales as fast as possible (as opposed to at a 'sustainable' rate) until it becomes uneconomic and then invest the proceeds in harvesting something else (say forests), and so on. Eventually, there is nothing left to harvest and future generations are deprived of these things. The philosophical position of conventional economists is the assumption that the future will take care of itself - that rising prices, resource substitution, technological progress and human ingenuity will solve the problems of future generations. The error of this view is signalled by the fact that resource substitution and technological progress themselves depend on fossilised energy, a non-renewable and declining natural resource.

Exclusion of Poor and Future Generations

The poor are excluded from the market to the extent that their purchasing power is limited. If their purchasing power were increased then demand for natural capital would increase even further beyond the current unsustainable levels. Future generations are excluded from signalling their needs in the marketplace, simply because they do not exist. Nothing can be done about that other than to ensure that each generation inherits a stock of natural capital no less than each previous generation.

The Growth with Limits Flaw - Dematerialisation

A variation on the idea of sustainability as efficiency is the idea of eco-efficiency. It begins with the valid observation that sustainability requires the dematerialisation of the economy. Brundtland's model proposes a new kind of economic growth - growth that is less material and energy intensive in its impact - as the way of getting around the problem of living within ecological and material limits while maintaining economic growth. The dematerialisation argument is that if we can decrease the energy and material content of each unit of growth at the same rate as the economy grows, then the total material and energy content of the economy will remain constant (Jacobs, 1991; von Weizsaecker, 1997).

The key flaw with this argument is that economic growth, being a percentage per annum is an exponential function, which means a doubling every so many years. Whether the doubling period 15 years or 70 years, the economy will grow in the following pattern: 1, 2, 4, 8, 16, 32, 64, etc. To be sustainable, the material and energy content of each unit of growth must decrease in the following way: $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}, \frac{1}{64},$ etc. The logic of this is to move towards a spiritual economy in which each unit of economic activity will ultimately have no material or energy content (Sanders, 1993).

Genuine Progress?

Since the 1950s the primary organising principle of society has been economic growth. Unfortunately, indicators of economic growth such as GDP are poor indicators of the welfare of society because expenditures on events such as car accidents, natural disasters and resource depletion that reflect a cost to society are added to those that reflect a benefit rather than being subtracted.

Cost-benefit analyses that subtract economic, social and environmental costs from

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benefits show a very different picture. For the many economies where such analyses have been conducted, the evidence strongly suggests that net welfare has been in gradual decline since the 1970' s and that the costs of growth ave slightly outweighed the benefits.

Two completely independent analyses of this kind for Australia (Lawn and Sanders, 199x; Hamilton and Saddler, 1997) show very similar declines in net welfare since the early 1970' s.

What these graphs tell us is that economic growth is actually taking us backwards when you take all factors into account. This is not surprising when one considers the rapid degradation of the planets ecosystems which provide free services of far greater value than that of the whole global economy (Arrow, et.al. 1995).

This section has argued that at the macro level, there is a fundamental contradiction between the combined effect of the financial system and sustainability imperative of humanity living within the ecological carrying capacity of the planet. At a micro level, it has shown the many ways in which conventional economic analysis is unable to deal with the sustainability problem. The key flaw in these arguments is to equate sustainability with economic efficiency when they are, in fact, very different things. Finally, the empirical evidence is that the costs of economic growth have outweighed the benefits since the mid 1970s.

There is strong evidence that the sustainability agenda can no longer be driven by economic imperatives – indeed that it is inconsistent with these imperatives. Rather, it must be driven by the ecological imperatives of survival. Therefore, the sustainability challenge is to adapt our social and economic (i.e. how we meet our material needs) institutions to become consistent with living within a quite severe material/ecological budget constraint. In this context, such a budget constraint would be the driver of innovation towards true sustainability.

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The need for governance

Returning to our celestial metaphor, the relationship of the Earth to the Sun is instructive regarding the problem of governance for sustainability. The Ptolemaic model with the Earth at the centre of the solar system requires extremely complex epicycles within epicycles to roughly describe planetary orbits. This terribly complex, tangled and impractical view transforms into simple and elegant concentric elliptical orbits simply by shifting the frame of reference from the Earth at the centre to the Sun being at the centre.

Similarly when we grapple with trying to manage natural resources and the environment in a sustainable way, we find we get an increasingly complex, tangled and ineffective managerial regime. This is because under prevailing thinking, we are trying to deal with a complex systems reality through a fragmented approach. Legislation, departments, silos within departments all reflect our fragmented approach.

Basically there are two complementary means by which society governs its behaviour, the market and government. The market is a mechanism that operates via individual actions whereas government is the mechanism through which collective action is mediated. The primary role for government is in those circumstances where the market fails to enhance the welfare of society. As we have seen, when it comes to sustainability, the market fails in a wide range of respects.

The reality is that the sustainability problem is largely one of a public good nature requiring collective action and therefore, the primary governance role must lie with government.

Toward a Systems Approach to Governance

As discussed previously, looking at the world in the traditional fragmented way makes the world very complicated to understand. The world and its apparent complexity actually becomes easier to understand when we view it from a systems perspective.

A quick literature search on a systems approach to governance revealed a few promising approaches (Keyes). Complex systems theory portrays biophysical systems as Self Organizing Holarctic Open (SOHO) systems. This perspective derives from the work of Koestler (1978).

Koestler's concept of holons in holarchies is particularly useful. Each relatively self-contained system, such as a cell, an organism, a family or an ecosystem, is a holon, while holarchy refers to the interdependent embeddedness of holons within each other. The term 'holarchy' was intentionally coined to distinguish it from the term hierarchy to avoid its value implications of relative superiority. The ecological economic pre-analytic vision of the economy nested within society and society nested within ecology is holarchic.

Stafford Beer's Viable System Model (VSM) is a cybernetic approach to complex systems that has been also used as a conceptual tool for dealing with the complexity of organisations.

A key concept in Beer's approach is recursivity. This concept is based on the premise that all living systems are composed of a series of sub-systems (i.e. holons), each having self-organizing and self-regulatory characteristics. The sub-systems each contain further sub-systems, and so on right down to the level of the cell. This nesting of systems within systems is what Beer means by recursivity (Beer, 1966). In other words, Beer's concept for dealing with organisational complexity is also holarchic. According to Herbert Simon (1962) in his lecture on the Architecture of Complexity, holons provide the most efficient way to manage complexity.

Beer identifies five essential functions for the viability of an enterprise: Implementation; Co-ordination; Control; Intelligence; and Policy. The viability, cohesion and self-organization of an enterprise depend upon these functions being recursively present at all levels of the organization. A recursive structure comprises autonomous units within autonomous units.

Evidence that some serious thought is being put into this line of thinking is the recent work by Reeve (2003) who discuss a nested approach to governance and have generated some principles for this approach. Other work in a similar vein includes McKean's (2001) 'Nesting institutions for complex common-pool resources'.

Drawing on the discussion so far, it would appear that governance for sustainability would have to reside primarily in the public sector. In technical sense, it would involve setting ecological and material constraints across a wide range of critical elements and then progressively tightening these constraints through time. Monitoring and evaluation would need to be conducted to determine when the constraints were sufficiently tight.

In order to administer such an approach, preliminary indications are that government departmental structures would need to reflect the nested reality of economy nested within society and society nested within ecology. Nested within these 'departments', one can imagine issues based units and associated governance structures with regional, river basin and local layers of governance. These would be entities with spatially defined responsibilities for managing the landscape and landscape processes from an ecological, social and economic point of view. Such a "nested" governance structure would cohere naturally with the nested character of ecological, social and economic systems.

It is becoming increasingly apparent that a new approach to governance for sustainability will be needed in the government sector. There are promising signs that the nested approach to governance may be able to reduce the complexity of managing a complex ecological, social and economic reality.

A Systems Approach to Governance – where to from here?

Some promising signs of a new approach to governance for sustainability are emerging through the Federal government's National Action Plan for Water Quality and National Heritage II funding that involves devolution of responsibility into the community at a regional level. Moving towards sustainability will require a paradigm shift not just within government and other policy circles but also within the community as a whole.

The experience of significant positive social improvement in the sustainability initiatives of Portland Oregon and the 'Imagine Chicago' project show the importance of driving these initiatives from the community level. Key to these changes has been the process of community envisioning of a sustainable future. It is through this process of community envisioning that the paradigm shift in our understanding of sustainability can occur.

It will be much easier for government to facilitate the necessary changes if the demand for such change arises from within the community. Part of this facilitation process must include creating the necessary space within the community for this envisioning process to occur. All of the signs are that communities are aware of these issues and receptive to moving towards a less materially intensive society.

Hamilton (2003) argues that the growth imperative of the economy means people are continually persuaded to consume more and more. Advertising persuades us we are inadequate unless we consume this product or that brand. We have become defined by what we consume leading to increasingly meaningless, stressful lives and depression⁶. Three studies (Mackay, 1999; VSO, 2000; Harwood Group, 1995) have all come to essentially the same conclusion – people want a simpler, less materialistic lifestyle with a greater sense of meaning and purpose. They don't want the 'stress and spend' lifestyle although they find themselves doing it anyway due to peer pressure and the effects of advertising.

If a national (and ultimately international) community envisioning processes can be facilitated, it is possible that the necessary community pressure for a new approach to sustainability can be brought about.

Conclusions

The key argument presented in this paper is that the current sustainability paradigm is inadequate to deal with the complex realities of sustainability. A paradigm shift in how sustainability is conceived will be needed if we are to move towards a genuine

form of sustainability. Ultimately, the central organising principle of our society will have to shift from economic growth (a relatively new idea from the 1950s) to living within ecological limits. Associated with this shift, and given the incompatibility of the market with this, there will need to be a much stronger role for government. An emerging new form of nested governance provides hope that it will be technically possible to bring about the necessary changes.

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