

Greenleap:

Innovating to an ecologically sustainable economy - before 2030

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Updates of this paper

This paper is updated from time to time. Skim this copy to see if the ideas interest you. If they do, you might like to read the latest version for the detail. To download the most recent version go to:

<http://www.green-innovations.asn.au/Greenleap-before-2030.htm>

1. Introduction

It is increasingly widely recognised that the economic-development model that is now dominant is creating serious environmental problems and that very significant changes to the model are needed if the problems are to be prevented (Raskin et al., 2002.). There is also awareness that corrective action is urgently required.

But, while awareness is growing, the number of places where environmentally-desirable development models are being applied systematically is still very small. So something more needs to be done than we are doing already.

This paper provides an introduction to a set of strategies that could be used to drive the implementation of a desirable development model so that a truly ecologically-sustainable economy can be created on a fast timeline. The purpose of the paper is not to provide a comprehensive wish list of desirable actions. Instead it sets out to summarise a new paradigm for approaching the whole issue of creating an ecologically-sustainable economy in a timely manner. The intention is for the paper to be as brief as possible while still presenting the proposed new paradigm in an understandable form.

Being a summary, this paper cannot fully describe or prove every proposition that it advances. However, as far as possible, this depth is provided through links to material on the web and to printed references. The additional material on the Green Innovations website provides the arguments in support of the propositions presented in this paper.

But beyond the intellectual purpose of articulating a new strategy paradigm, the paper has been written to spark action.

The basic structure of the paper is as follows:

- Sections 2 - 5 set out a way of thinking that helps to make sense of the main strategies in sections 9 - 11.
- Section 6 outlines what an ecologically-sustainable economy would need to look like in broad terms. Of course, until we create such an economy we won't know exactly what a working model will look like *in detail*, but even at this stage we can be very confident that it will have the attributes described. And this description is needed to provide the specifications for innovation and design required to create the real thing.
- Given that the structure of an ecologically-sustainable economy is so different from the present economy, then next two sections, 7 and 8, present the case that the effort is worthwhile and that there is a real prospect that it will be possible to make the transformation on the scale and within the timeframe proposed later in the paper.
- Section 9, 10 and 11 describe some key strategies that could be used to get the big leap to an ecologically-sustainable economy happening. These sections do *not* provide a comprehensive list of what needs to be done. The specifics are there for illustrative purposes.
- Section 12 invites people to become involved in setting the paradigm shift or specific strategies in motion.

Please note that, unless the context indicates otherwise, when the term 'sustainability' is used it is being used as shorthand for 'ecological sustainability'. Many of the ideas in the paper however could be adapted and applied to the pursuit of social and economic sustainability as well.

2. Sorting out the goals - environmental, triple bottom line, sustainability & genuine progress

Environmental

People need to have a sustained environment for their own benefit - for example - to maintain life support systems, provide economic resources and for a host of psychological reasons. And many people, in many societies, feel that we also need to protect the environment for the sake of the other 10-20 million species of life on the planet.

To fulfill the goal of protecting the environment it is necessary to ensure that species persist - at least as long as they would have done in the absence of the effects of technologically powerful humans¹, and we need ecosystems services to persist in an adequate state as long as they are important to other species and to humans. This means that there are a host of environmental irreversibilities that need to be avoided, in many cases, effectively forever.

This is why environmental protection has to be so effective that it can ensure that the desired environmental values are actually sustained. Merely slowing the rate of deterioration or loss is not good enough.

This is one of the most fundamental principles upon which the strategies in this paper are built. The task before us is not to work forever 'towards' sustainability, but to get 'to' sustainability, soon (Meadows et al., 1992). If sustainability is not achieved, then the things that we want to sustain will, at some point, cease to exist. So there is no point in being interested in sustainability unless we set out to achieve it².

Triple bottom line goals

It is of course obvious that society has goals other than environmental ones. So if environmental goals are to be achieved they must be pursued in a triple bottom line context. That is, society needs to pursue its environmental, social and economic goals simultaneously.

Sustainability and genuine progress

Society is interested in not only maintaining environmental, social and economic values (ie. sustaining things or attributes that it values) but is also interested in improving on past conditions (ie. achieving genuine progress). So sustainability and genuine progress need to be pursued simultaneously too.

We must consider, at all times, what we want to change for the better and what we want to maintain because it is valued.

¹ The *average* life a species is estimated to be about 2 million years.

² In the case of sustainability the 'journey' is only ultimately relevant if destination is attained.

To achieve *sustainability* across the triple bottom line spectrum we have to ask, in relation to each of the three domains (environmental, social and economic): *what do we want to sustain* (maintain) that we value from the present or the past? And *why* do we want to do this?

To promote *genuine progress* across the triple bottom line spectrum we have to ask, in relation to each of the three domains (environmental, social and economic): *what do we want to achieve for the first time* (ie. change for the better)? And *why* do we want to do this?

By doing both we achieve a society that is not static but that also does not undermine itself or other living things. (See the web reference on the definition of sustainability.)

3. No major trade-offs and win-win

One of the critically important implications of trying to achieve sustainability in a situation where society wants to pursue a whole range of goals simultaneously is that it is necessary to use a decision-making process based on "no-major-trade-offs". Logically if society is committed to sustaining something (ie. keeping it going), it cannot then trade-off the continued existence of that thing or attribute as a consequence of trying to meet other goals. And, if a triple bottom line approach is adopted then it is desirable if actions taken in the pursuit of one goal can also contribute to the achievement of other goals, that is, if "win-win" outcomes can be achieved.

Traditionally, following a rather simplistic application of optimisation theory, it has been assumed that the pursuit of multiple goals means that no one goal can be maximised. In other words that there must be major trade-offs. However, in complex systems such as economies, societies and ecosystems we are so far from a theoretical perfect optimum that there is actually huge potential to find solutions that can deliver "no-major-trade-offs" and "win-win outcomes" for multiple goals. To deliver such outcomes however requires a major commitment to fostering innovation based on whole-system design and to greatly increased capability in handling complex issues. In the past, complex issues have been avoided because they were seen as too hard to deal with. But we have done so well in dealing with simple issues that the greatest opportunities for improvement now lie in the domain of complex issues.

(See the 'triple bottom line' matrix in the diagrams section of the Appendix.)

4. Stretch goals

There is now widespread recognition that we are a long way from achieving the goal of ecological sustainability and that major changes need to be made in the economy and, even, in the way we live. But how do we handle this gap between where we are now and where we want to be?

Over the last few decades a methodology has developed in the business world for handling what are called stretch goals. A clear distinction is made between short-term performance goals that managers are held strictly accountable for and longer-term difficult goals that are used to drive the innovation process, that is, the stretch goals. When President Kennedy set the goal for the US to land astronauts on the moon within 10 years this was a stretch goal. When the goal was set it was not clear how it would be achieved, so the means had to be developed after the goal was set. (See Kennedy's "man on the moon within a decade" speech in the web references; and Collins & Porras, 1994/1998 for a discussion of 'Big hairy audacious goals' [BHAGs]).

Committing ourselves to create a closed-cycle/zero waste economy would, for example, involve the establishment of a similar stretch goal. And the stretch goal methodology can be applied to the whole task of creating an ecologically-sustainable economy.

(See the web reference on *Stretch goals - the methodology.*)

5. The Dual Track

The stretch goal methodology is designed to ensure that people reach beyond the usual short-term preoccupations to deal with the big picture. The risk with this approach is that action programs based purely on this approach will get out of touch with pressing near-term considerations. A way of avoiding this problem is to deliberately adopt a "dual track" approach so that the short term necessities and the long-term necessities are worked on simultaneously and potential conflicts between goals are minimised. (Blanchard & Waghorn, 1997)

6. Scoping and dimensioning the task of creating an ecologically-sustainable economy

If we are to create an ecologically-sustainable economy we need to scope and dimension the task so that we are truly addressing what needs to be done. There are five key dimensions that need to be scoped: (i) the nature of the new economy, that is, its preferred state; (ii) the necessary scale of change, (iii) the necessary speed of change; (iv) how the innovation process can be modified so that it is relevant to the local setting; and (v) how the process of engaging with the task will be spread through society, locally and globally.

Preventative precautionary cybernetic rules

The scale of the human economy and its power is now so great that we are causing massive environmental changes and these changes will propagate into the future - setting off further changes that are hard to predict and which in some cases will be unknowable until they occur. We therefore can no longer afford to use a "let's see what damage we do and then rein it in" approach. We have to use an anticipatory

precautionary approach based on cybernetic rules which lead the economy away from areas of high risk and towards areas where human endeavours can be carried out with a low level of inherent risk.

The Natural Step organisation has pioneered the use of precautionary cybernetic rules (Robèrt, 2002; Natrass & Altomare, 1999). Some of their most well known rules are that human society must not systematically:

- increase the concentration of substances in nature that are sourced from the earth's crust or from the economy
- decrease the diversity or productivity of nature through the extraction of resources or the transformation of ecosystems.

In coming years, it is very likely that additional precautionary cybernetic rules will be developed and popularised to guide the creation of an ecologically-sustainable economy³.

Scoping and the five 'Ss'

State

People are often unsure what an ecologically-sustainable economy will look like. While the details will emerge as such an economy is created, we can be very confident that it will have the following broad characteristics.

Massive dematerialisation - beyond Factor 10

All economic outputs (whether goods or services) can be thought of as generating a flow of services from a physical delivery platform. The key idea behind dematerialisation is to maintain or increase the service flow while radically cutting the physical resource requirements of the physical delivery platform. It is argued by organisations such as the Wuppertal Institute and the Dutch Sustainable Technology Development program that resource intensity per unit of economic output needs to be cut by a Factor 10 or more (ie. by 90% or more) if environmental impacts are to be substantially cut to achieve ecological sustainability, while taking account of necessary improvements in the living standards of the poor, the likely continuation of economic growth and the growth of world population that cannot be avoided⁴.

Encouragingly, their research suggests that with radical innovation in service delivery it will be possible to achieve a massive Factor 10+ stretch goal.

³ For example:

- a growing economy (with growth measured in terms of increasing real purchasing power) must not encroach on nature (or land required for the restoration of nature) in order to close the recycling loop - so the expansion of recycling must be accomplished within the human economy
- the human population must not systematically increase
- dematerialisation (in terms of both material resources and the use of lands and waters) must systematically keep pace with any increases in population, economic growth, and the elimination of poverty.

⁴ There is now some hope that the world population might cease growing in about 50 years time, however by that time total numbers are expected to have grown by a least a further 3 billion people.

The Dutch Sustainable Technology Development program has developed the best methodology so far for calculating the necessary scale of dematerialisation. They do not arbitrarily select a Factor 4 or Factor 10 goal. Instead, for each major issue, they calculate the factor improvement needed if ecological sustainability is actually to be achieved. The requirements for many issues, as measured during the 1990s, range from Factor 20 to Factor 50. Achievement of these factor improvements, while certainly not easy to achieve, is not as difficult as it may seem at first because: the improvements are reductions on what the demand might have been in the future if action had not been taken - so they can be achieved through a combination of population stabilisation (at possibly a lower level than at present), reductions in the amount of material needed to support each person and through fostering economic development that does not require each person to consume more material per head. (See: Weaver et al., 2000)

Closed-loop/closed-cycle/zero waste

Dematerialisation in part depends on the creation of a closed-loop economy⁵. But closed-loop production of materials is essential if pressure is to be taken off nature (arising from the extraction, processing and return of materials to the biosphere) whilst allowing for continuing economic growth. Also we cannot use nature as the major means of closing the recycling loop. For example, even natural biodegradable materials like excreta from humans or livestock can cause serious problems if the quantities to be processed through nature become too large.

Non-toxic products & production

Design-for-the environment and green chemistry programs open up the possibility that our economy can innovate its way very close to zero toxicity for people and nature. The strategy of 'designing out' toxicity is the best way to control the cost of toxics reduction across the whole economy.

Renewable resource-based

If our economy depends, on a continuing basis, on resources extracted from the earth's crust, this will cause systematic increases in concentrations of materials in the biosphere - and that will sooner or later cause serious environmental problems. Even programs designed to return wastes to the crust will not enable continuing unconstrained extraction of resources from the crust, because of the resource depletion and environmental costs of the sequestration programs. In the final analysis the economy will need to depend almost wholly on renewable resources cycled through the economy and on energy from the sun.

⁵ An economy can only be closed-loop in relation to materials. While major improvements in energy efficiency are possible, and cascade reuse of energy is possible to some degree, energy quality inevitably degrades fairly quickly to uselessness, so you can't have an economy that has a closed energy loop.

Biodiversity sustaining

Biodiversity needs to be sustained not only in order to maintain the essential flow of ecosystem services but also because there is a moral imperative to ensure that other species of life have a chance to survive, flourish and continue their evolutionary development *in the wild. Biodiversity conservation, whilst assisted by 'cleaner production' style programs, needs to be consciously taken into account in the development of the economy and the creation and use of products and services. (See the topic-related web references below: *Biodiversity*.)

Sustainable population

Economic growth cannot be fully decoupled from environmental impact if the world population keeps growing - as each person has a basic set of physical needs that cannot be designed away. Also, lifestyle options become more constrained if the population keeps rising while society tries to achieve ecological sustainability.

Restructured to eliminate major threats:

There are a number of major environmental issues (for example those listed below) that are so large in their impact that they cannot be allowed to continue - but the necessary solutions will have huge, virtually macroeconomic implications for business and industry. One of these issues, greenhouse, will be used in this paper as an example to illustrate the implications of trying to create an ecologically-sustainable economy. The arguments advanced in the sections below that deal with the issues of scale and speed are taken from a paper titled "*How far and how fast? The critical issue of speed and scale-illustrated by the case of global warming*". (See the website on *How far and how fast* in the appendix below.)

All major environmental issues need to be examined in a similar way to see what implications they have for the preferred state of the environment and the economy and for the necessary scale and speed of change required to achieve an ecological sustainability.

Some issues that are known to have huge implications for the scale and speed of change are:

- biodiversity loss
- decline of cheap/high net energy oil
- scarcity of useable water
- decline of soil
- and of course, greenhouse impact.

(See the diagram in the Appendix: 'The ecologically-sustainable economy'. This diagram summarises the basic structure of an ecologically-sustainable economy.)

Scale

Any program to create an ecologically-sustainable economy needs to be framed to take account of the desired scale of change. The Greenhouse issue can be used to illustrate this very clearly (See the web paper "How far and how fast?"). Detailed

data based on the composition of air extracted from ice cores drilled in the ice cap in Antarctica shows that CO₂ levels in the atmosphere have not been above 300 parts per million for at least 400,000 years. And data based on isotope ratios in marine micro fossils suggests strongly that CO₂ levels have not in fact been above, or much above, 300 parts per million for about 23 million years.

Most species have evolved so much in 23 million years that any capacity that they may have now to deal with ecosystems modified by the impacts of elevated atmospheric CO₂ levels (above 300 parts per million) must be either coincidental or the result of a lucky absence of other selection pressures that might have accidentally lessened the coping capacity that was present 23 million years ago. So a prudent application of the precautionary principle would suggest that we should try to keep atmospheric CO₂ levels at or below 300 parts per million.

The CSIRO reported in 1994 (Enting, 1994) that 8 out of a sample of 10 climate models estimated that if CO₂ in the atmosphere was to be stabilised at 350 parts per million⁶ then emissions arising from human activity⁷ would have to be reduced to zero and significant amounts of CO₂ removed from the atmosphere. The CSIRO report did not investigate a 300 parts per million scenario but such a scenario would chiefly differ in terms of how much CO₂ would need to be removed from the atmosphere. In other words a 300 parts per million scenario would also require CO₂ emissions from human activity to fall to zero.

Assuming that there are some practical limits to the capacity for economically viable and environmentally sound sequestration of CO₂ (in both the short and long term) and that whatever capacity we have for sequestration needs to be reserved at least for the foreseeable future for the removal of excess CO₂ already in the atmosphere, then it looks as if we need to transform the economy so that it can completely eliminate its dependence on fossil fuels. So the greenhouse case suggests that we need to make changes to the economy on a huge scale if sustainability is to be achieved.

(See the diagrams in the Appendix: “CO₂ levels in the atmosphere over the last 400,000 years” and “A scenario for stabilising atmospheric CO₂ at 350 ppmv”.)

Speed

Based on the arguments described in "How far and how fast?" it seems that in 1997 we had *no more* than 225 Gigatonnes of carbon that can be put safely into the atmosphere⁸. It was estimated that the 225 Gigatonnes of carbon would be used up in 20 years (about 2017) if usage trends at the time continued.

So it seems that based on the greenhouse case alone the economy should, desirably, be massively restructured in about 14 years or less!

⁶ 50 parts per million above the precautionary maximum and about 70 parts per million above the current levels.

⁷ This of course doesn't include CO₂ generated by the metabolism of the human body.

⁸ In fact this is probably a significant *over*-estimate. For example, even with current levels of CO₂ in the atmosphere the glaciers that feed water to north-eastern India and Bangladesh and to Western China and the global coral reef systems will be lost.

(See the diagram in the Appendix: “A scenario for reducing fossil fuel consumption to zero after consuming a further 225 Gigatonnes of carbon”.)

Setting

The transformation required to create an ecologically-sustainable economy needs to occur globally and it needs to occur quickly - so learning from others will be vital. However, it would not work to simply develop a single model of an ecologically-sustainable economy and then slavishly copy this model everywhere. Firstly the environmental, social and economic conditions vary significantly from place to place - what works in one place may not work elsewhere. Also a 'copy-one-model' approach ignores the fact that there is creativity and originality to be tapped in every area.

So we need many models and lots of local adaptation and even transformation of these models to suit the local setting and take advantage of local creativity (Mintzberg, Ahlstrand & Lampel, 1998)

Spread

The required scale and speed of change suggested by the greenhouse case means that rapid restructuring is required in all economies, especially the developed ones, and that all rapidly developing economies need to develop in a way that does not add to the greenhouse and other environmental problems. So societies need to engage with the task virtually simultaneously across the globe. To do this, engagement in the restructuring process needs to spread rapidly to cover all countries and at the same time, the depth of engagement needs to be strengthened within each country.

Change of the magnitude required, occurring so widely and so quickly poses major challenges for decision-makers and leaders. Effective and fast action requires enthusiastic leadership from the top of hierarchies but most leaders high in hierarchies are not currently trying to drive this change. In this situation all organisations that can see the need for a major restructuring need to adopt a stance of "undiminished responsibility" for the change and not only do what they can within their own normal spheres of action (eg. the provision of products or services) but they also need to act catalytically to prompt others to take action. "Managing upwards" (Bellman, 1992) and lateral or 'outside-in' management will be required on a very large scale (see the diagram in the Appendix: “Change model - convection and lateral”). (See also the topic-related web references below: *Sustainability-promoting organisation*.)

7. Can an ecologically-sustainable economy be successful?

Faced with the need for such large scale and rapid restructuring it would be very discouraging, for many people, if the end result was going to be an economy that could not provide full employment, good incomes and prospects for future improvements in wellbeing.

There are, however, good grounds for thinking that it is possible to systematically decouple the creation of additional economic services from the use of natural resources and the creation of environmental impacts - once the population is stabilised and people's fundamental physical needs have been met. Once basic material needs are met all other needs are psychological/experiential/informational, and additional and improved services to meet these needs can be developed without the need to expand the physical kit of resources needed to support human life - provided there is a sufficient investment in innovation.

See two diagrams in the Appendix:

- *Change in service flow output from the old and new economies*
- *Model of an economy that can decouple growth in service flow from a drop in environmental impacts.*

Analyses of models of ecologically-sustainable economies created through innovation (rather than wind back) suggest that these economies can be successful in terms of full employment, good incomes and prospects for future improvements in wellbeing. (See the topic-related web references below: *Can an ecologically-sustainable economy be successful?* - in particular the paper on the “new economic model”.)

This conclusion is important as the changes in the economy to achieve ecological sustainability need to be accomplished within a time period in which it is unlikely that most societies, and most people within those societies, will have decided to abandon the pursuit of economic development or economic growth.⁹

Although long-term productivity is expected to be high and to keep growing in an ecologically-sustainable economy, the biggest unresolved issue is whether there will be any discernable dampening of income growth during the period of rapid structural change. Contributing factors to a decline would be (a) the retirement of long-lived capital equipment and infrastructure before the end of its usual economic life, and (b) the adoption of new production techniques where lack of experience and lack of complementary systems and rapid sequences of obsolescence driven by very fast innovation causes an initial or temporary productivity drop (Bluestone & Harrison, 2000). On the other hand some new techniques and technologies can bring big productivity gains despite their novelty eg. lean production techniques (Womak & Jones, 1996). So the careful crafting of economic strategies may significantly improve the outcome by producing a favourable balance between productivity boosting and productivity depressing influences.

So, this issue of net productivity in the transition needs further strategic and analytical attention.

⁹ It is by no means a foregone conclusion that a majority of any large population will adopt a radical voluntary-simplicity lifestyle, even in the long term.

8. How fast can an economy change?

The Industrial Revolution is said, somewhat arbitrarily, to have started in about 1750 in Britain and it took till about 1810 before a fairly comprehensive industrial system had developed that could be transferred to another country¹⁰. So the earliest industrial system was at the very least 60 years in the making. Other countries were then able to adopt the system in a much shorter time, ie. 20-30 years, once sufficient investment resources were available to them (Hobsbawm, 1962).

In more recent years, many of the Tiger Economies have made the transition from an agricultural to an industrial economy within only a few decades. The record is held apparently by South Korea, which made the transition in two decades. Another interesting transition is the restructuring the US made to a war economy after the attack on Pearl Harbor. This was apparently accomplished in about a year. Although this is remarkably rapid, it involved the reorientation of an industrial economy rather than the creation of an industrial economy from scratch.

The massive but very rapid transitions of industrialising and reindustrialising economies, such as Belgium, Germany, Japan, Taiwan, South Korea, Malaysia etc. give hope that a transition to a sustainable economy could be achieved very rapidly if the will is there. But the weakness of these examples is that the technologies and production methods were largely known before their transitions began.

The transition to an ecologically-sustainable economy, however, will need to involve a large amount of innovation in technologies and production and consumption systems¹¹ - which would normally be expected to slow the transition process down. So, if a rapid transition is to be achieved then innovations will need to be made in the innovation process itself so that everything can be speeded up. Innovation will need to occur too in the social processes of transition so that social stresses do not build up to unacceptable levels, with the risk that the transition will derail itself. The economic rationalist/globalisation revolution of the last few decades demonstrates how lack of attention to the social stresses can lead to the reform process being severely challenged.

9. How fast should the change to an ecologically-sustainable economy be?

There is no perfect speed. Given the damage done already to the environment and the built in momentum in the economy, a good time to have made the transition would have been sometime in the past! But we don't have that option.

¹⁰ The first major transplantation was to Belgium.

¹¹ The technology exists currently to achieve an ecologically-sustainable economy - but it is probable that not all the current technologies have high enough total factor productivity to enable the economy to fully sustain current real-income levels. This is why further technological development is desirable.

Is there a point in time when it will be all too late? Probably not. Environmental losses are likely to just get worse the longer we leave things. So giving up just ensures an even worse outcome.

The best speed would be the fastest speed we can manage (without sowing new seeds of disaster, caused by ignoring the longer term effects of the change process we adopt). Even though the best speed is “as fast as we can do it” it is hard not to try to second guess what that speed might be, and our guesses then affect how long things actually take.

If we think it will take 50 years or more to achieve an ecologically-sustainable economy then we see the job as belonging to the next generation and we are likely to slow down our own effort. If we think the job has to be done in 10 years or less we might assume the task is impossible and then give up.

To avoid these reactions, it is proposed that the goal should be to achieve an ecologically-sustainable economy *before 2030*. Posing the goal this way makes it our generation’s job, gives us the sense that we have some time to tackle what is clearly an enormous task and encourages us to complete the task in less than 30 years if we can work out how to do this. And the ‘before 2030’ formula also avoids drift - every year taken brings the deadline at least a year closer.

To carry out a new industrial revolution for sustainability, that is, to create an ecologically-sustainable economies globally before 2030 we have to find the time to complete three key processes:

- the creation of fairly complete working models of ecologically-sustainable economies, including developing any essential technology
- the spread of models to all countries
- the implementation of models with all the adaptations and improvements (sometimes quite extensive) that are necessary to respond to the local situation or that take advantage of local creativity.

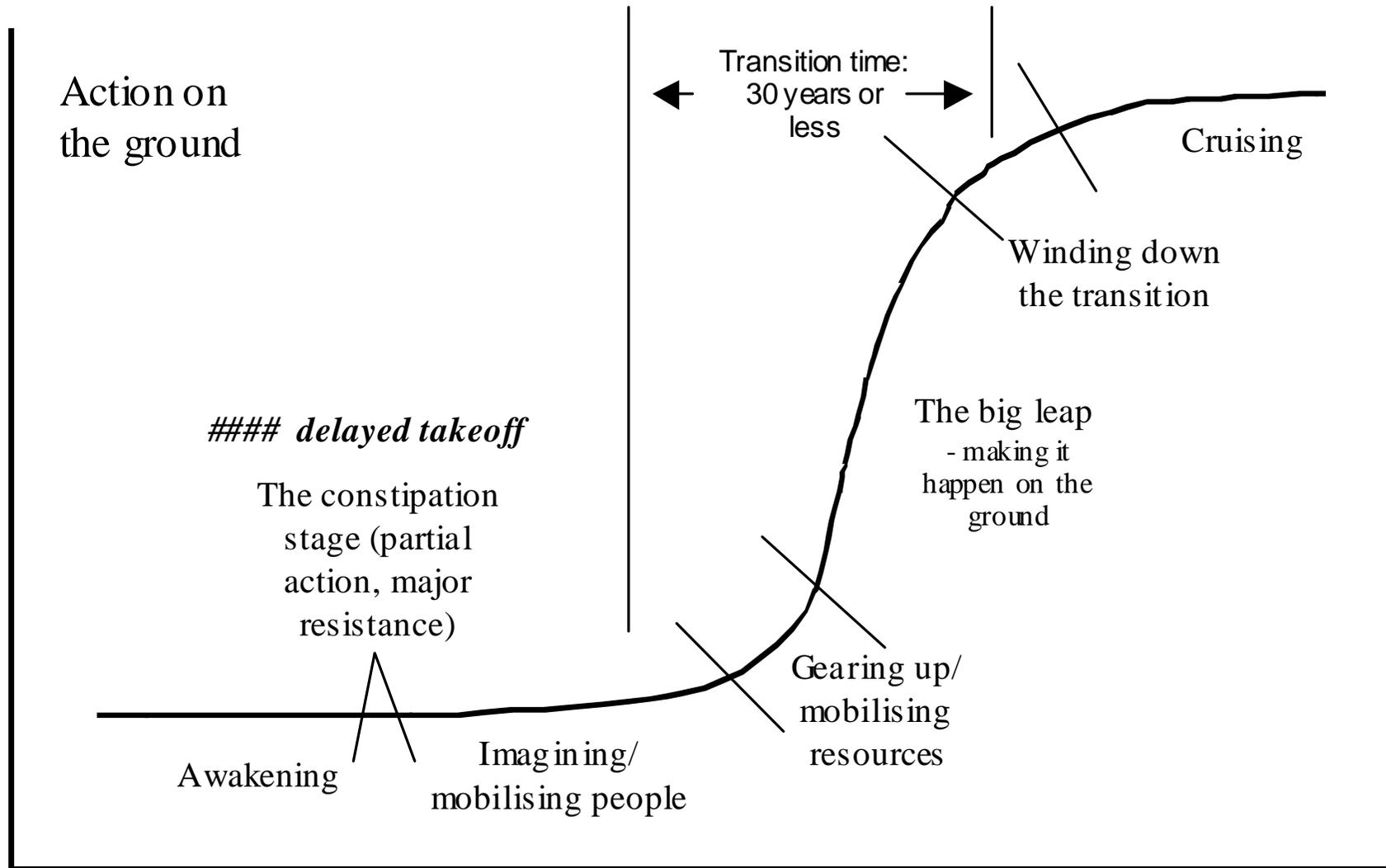
Needless to say doing all this before 2030 is a very tall order!

Clearly we cannot simply try to replicate the processes of the first industrial revolution if we are to achieve an ecologically-sustainable economy within this timeframe - because just the first step (creation of a reproducible model of an industrial economy) took 60 years and the spread to all countries has taken hundreds of years.

10. The Greenleap: Looking more closely at the sigmoid curve and the big leap

A useful way to look at the required economic transformation is to picture it as a sigmoid (s-shaped) transition from an unsustainable economic configuration to a sustainable one¹².

¹² The sigmoid curve is sometimes also known as a 'logistic' curve.



The diagram plots out a series of stages (horizontal axis) and gives a notional quantification to the amount of actual on-ground restructuring in each stage (vertical axis). The diagram is particularly useful because it makes it easier to develop an intuitive integration of the scale and speed issues and the strategic issues of transition.

The earliest stage is dominated by 'awakening'. This stage has now been underway since at least the 1960s (and can be traced to even earlier times). Following this is a stage dominated by the task of imagining solutions (at least at a general level) and mobilising people to take action. Then the process of change gathers momentum as resources for implementation are mobilised. The next stage is dominated by the very fast evolution of solutions and by their rapid implementation. Once the transition to an ecologically-sustainable economy has been accomplished the transition process can ease off and the task is then to maintain a sustainable configuration as society, the economy and the environment continue to evolve under the pressure of other drivers.

Sigmoid transition curves can be used to describe all sorts of 'phase changes' (where there is eventually a fast transition between fairly stable states) - for example - in physics - to describe the transition of a liquid to a gas, or in history - to describe the initial transition from agricultural economy to an industrial economy. Exactly what the sigmoid curve will signify will depend on the specifics of each case.

11. Some key attributes of the sigmoid curve and the big leap

The constipation stage

While there is no doubt that environmental awareness and corrective action on environmental issues has been growing significantly for over 30 years in many parts of the world, it is also true that action, in almost every country in the world¹³, falls short of the dramatic shift in the economic development that is required.

In part, the failure to act on a new paradigm is due to insufficient public awareness and limits on investment funds, partly it is due to the inevitable inertia in very large complex systems (societies and economies) and substantially it is due to the active resistance of organisations (both private and public sector) and sections of the community that see the change as a threat to their immediate self-interest.

So while there is strong action in the direction of change, there is also strong resistance that is substantially blocking the necessary fast and rapidly accelerating change that is needed: hence the characterisation of this stage on the transformation curve as being that of constipation. This stage will continue indefinitely until a critical shift in the balance of influences occurs. The key to moving beyond this stage is to work out how to progressively change the pattern of risks and rewards to favour effective action. (See Strebel, 1992; Yoffie & Kwak, 2001.)

¹³ Sweden, the Netherlands and Denmark are amongst the very few near-exceptions)

The hyper-fast transition (big leap) depends on first thinking through what's involved

Even after building a sufficient critical mass of support for change, the big leap stage or hyper-fast transition, which must occur if the transition to an ecologically-sustainable economy is to be timely, may not start and certainly won't be sustained if societies do not think through, in advance, how the change is to be accomplished.

We are used to thinking about first steps and then waiting till things have unfolded a bit before devising the next steps. Of course we cannot know everything that will happen in the future and we must always revise plans in the light of what becomes apparent at a later time. But there will be some aspects of an unfolding sustainable economy and the transition imperatives that can be worked out, at least to some degree, in advance.

We need to think about what an ecologically-sustainable economy looks like so we can devise the most attractive transition strategy possible. We also cannot work out who has most to gain from an ecologically-sustainable economy if we don't try to imagine such an economy. Improving the attractiveness of the transition and identifying the likely winners will increase the chances that the big leap actually starts.

But the big leap will lose momentum if we don't have any idea how to roll out each successive change and how to avoid creating major blockages as we go.

We must remember that a full transition before 2030 is not a very long time. There is a lot that can be anticipated in such a short time period.

Innovating to improve the innovation process

One of the key recommendations of the Dutch Sustainable Technology Development program was that it will be necessary to make innovations in the innovation process itself in order to speed up the transition to an ecologically-sustainable economy (Weaver et al., 2000).

The CISCO Systems model

During the first industrial revolution, innovations (especially new products and services) were often developed by companies with a limited product range. The makers of the older generation of products would battle it out with the innovators. Sometimes it could be many years or even decades before the innovations began to dominate the market.

This competition-based model of innovation is too slow for our current needs. Fortunately there is another model, which is well illustrated by the business strategy of the internet giant, CISCO Systems (Waters, 2002). When CISCO Systems was founded, the company was a maker of 'routers', computers that packaged data for transmission via the internet. But instead of the company seeing itself as selling routers it saw itself as being the provider of the latest solutions for transmitting data

via the internet. So now CISCO Systems scours the world for the latest and greatest technology and the company quickly drops obsolete products. The result is that the company's business model allows it to race up the 'curve' of technology development as fast as possible, indeed the business model demands that it does this. So the company can introduce innovations very rapidly - in a matter of a few years rather than decades.

Only about 3 investment cycles

Dealing consciously with the issue of the desired speed of change or more specifically the desired length of the transition period is critical. For example, the upswing of the business cycle is the best time to roll out major innovation programs that require investment but in a transition period of 30 years it is likely that there will only be about 3 business cycles¹⁴.

Given that there are so few periods that favour major investment, these opportunities need to be anticipated. All the hard work needs to be done before each upswing so that investments can proceed at the beginning of the business cycle and the whole period of the upswing can be taken advantage of.

(See the diagram "The business cycle and preparing for investment" the Appendix.)

Only a few political cycles

Although the shifts of political parties into and out of government are less regular than business cycles, there are nevertheless likely to be a few changes within a 30 year transition period to an ecologically-sustainable economy. Strategies need to be developed to make the most of these changes.

12. Making the big leap happen

The general significance of the mechanisms below

There are a vast array of useful things that could be done to make the big leap happen. The purpose of describing, in this paper, a small sample of possible ideas is to show how valuable it is to think through the practicalities of making a timely big leap on an adequate scale.

Transforming the economy before 2030, on the scale recommended in this paper, probably seems like an impossible task. But what has become apparent from the work that has led to this paper is that it is only through contemplating the apparently 'impossible', with a firm intention of trying to make it possible, that ideas like the ones below can be invented or applied in this new context. The conclusion to be drawn from this is that if a great many people have a good solid go at inventing/innovating their way to new mechanisms for transforming the economy before 2030, we would

¹⁴ Short run business cycle usually last for 7-14 years

almost certainly uncover a great many new and powerful ways to take action. And in the end, much to our surprise, all these ideas might, when implemented, make the creation of a truly ecologically-sustainable economy possible - before 2030.

"The only way of finding the limits of the possible is by going beyond them into the impossible."

--Arthur C. Clarke

Some useful mechanisms

Transformative financing

At present those with the motivation and ideas to achieve an ecologically-sustainable economy and those with the cheque books to make things happen are generally different people. And given that governments tend to only provide facilitative leadership (and public funding) once a foundation-consensus has been reached in key sectors of society, then it seems we need to propagate a new type of organisation to invest in projects that will make a strategic and decisive contribution to the creation of an ecologically-sustainable economy. This in effect would involve the creation of a third wave of the ethical investment industry

The third wave would be represented by a new type of ethical investment function: the *transformative financing*. Transformative financing would not only avoid destructive investments through negative screening (first wave ethical investment) and preferentially invest in helpful projects using a positive selection process (second wave ethical investment) but it would be guided by very sophisticated research and solution generation capabilities to find investments that would have very high strategic leverage - enabling them to be transformative, that is, to actually create an ecologically-sustainable economy. And given that many important transformative projects will generate their return through public benefit rather than via private income, a transformative fund would need to combine commercial investing with philanthropic granting. (See the topic-related web references below: *Transformative financing*.)

The Race to Sustainability

The Race to Sustainability is a cooperative competition between communities to see which one can get to a state of ecological¹⁵ sustainability first. The Race has been designed to help deal with a number of important issues. If we are to create an ecologically-sustainable economy we need to mobilise whole communities - to get the necessary scale, diversity and momentum of change. Also whole-system design, which is essential for lowest cost dramatic change, has its greatest scope when applied to whole communities, and especially large communities. And the Race also has the crucial attribute that it focuses people's mind on actually achieving ecological

¹⁵ The race could be expanded to see which community can first get to a state of environmental, social and economic sustainability and to a decent life for all.

sustainability, fast. It is no longer makes sense to say that it's the journey rather than the destination that counts. And the speed with which we get there also matters. (For a full description of the concept of the Race see the topic-related web references below: *Race to Sustainability*.)

Sustainability-promoting organisations

We do not have an ecologically-sustainable economy at the moment so any organisation trying to be a part of such an economy must not only innovate within its own area of operations (eg. new or revised products and services, etc.) but it must also take action to catalyse changes in the general economic and social settings. (See the topic-related web references below: Sustainability-promoting organisation.)

(See the diagram in the Appendix: 'Change model - convection and lateral'. This diagram illustrates how ideas can be introduced into an organisation and spread through it.

Useful references are: Hawken et al., 1999; Ellyard, 2001; Hamel, 2000; Collins, 2001; Collins & Porras, 1994/1998; Grove, 1998.)

Resource stewardship cluster

Companies that are close to the consumer in the supply chain, and are therefore sensitive to customers environmental demands, are too far away from the production of the basic input materials to know what materials options are environmentally superior. So there is a need for a cluster of firms to develop green materials and to move as fast as possible up the innovation curve. To avoid being tied to materials that might become obsolete, firms in the resource stewardship cluster that are involved in marketing should not be locked in indefinitely to any one type of material and they may benefit from following a CISCO Systems-style innovation model.

The resource stewardship cluster is the segment of the economy that can best drive the creation and maintenance of the closed-loop economy.

Lean production and the closed-loop economy

Production process experts have developed a sophisticated and economically highly rewarding method for organising manufacturing - called lean production. This method opens up the prospect that a closed-loop economy might be highly economic for non-environmental reasons. Lean production carefully optimises the amount of financial capital and operating costs required by the *whole* manufacturing process.

Womak & Jones (2003) who are leaders in lean thinking speculate that closed loop production might be a better way to cut total manufacturing costs across whole supply chains. In this way a major economy/environment win-win outcome might be achieved with the closed-loop production becoming an economic proposition as a byproduct of lean production. But also the very large economic gains obtainable

through lean production might help offset the short-term costs of adopting new environmentally motivated technologies.

Lifestyle stewardship cluster

Firms in the lifestyle stewardship cluster can develop close alliances with people and could promote lifestyles and consumption patterns favouring the achievement of sustainability.

Firms that are close to consumers/members of the community are in the best position to pursue dematerialisation driven by increases in the service flow from products and by the redesign of the physical platform that delivers the services so that material demand is dramatically reduced. Like the lead firms in the resource stewardship cluster, the lead firms in the lifestyle stewardship cluster need to avoid being locked into to any one product solution as they need to have the maximum freedom and motivation to move rapidly up the innovation curve - so they might also benefit from adopting a CISCO Systems-style business model.

Boosting 'complexity competence': modelling capacity and creativity methods

One of the biggest blockages to taking effective action to achieve an ecologically-sustainable economy is that so many of the related issues are very complex. Many societies have a cultural aversion to dealing with complex issues and the skills and tools needed for handling complexity are not widely available.

So, to the extent that it is necessary to deal with particular issues, we need to reduce this complexity-averseness and we need to build up complexity-handling competence. Albert Einstein expressed it well when he said: "Everything should be made as simple as possible, ***but not one bit simpler.***"

Goldratt (1994) has a useful method for mapping and working with complex situations. His methods have been developed based on experience in the manufacturing and services industries. But these methods can be usefully applied to the task of creating an ecologically-sustainable economy.

Beyond that, the capacity to model complex systems and to test multiple scenarios is a critically important capability. A specific application of this approach is the notion of profligate design. (See the topic-related web references below: *Imagining (modelling) the future.*)

While being able to handle complexity is important for solving environmental problems, it also has an economic benefit. Market economies, with large numbers of actors that work independently, have been incredibly effective in using incremental change (often quite rapid) to generate wealth. However, traditional market economies have not been as good at creating wealth where coordinated action is needed to cope with or take advantage of complex situations. So if a society's complexity-handling capabilities can be improved then it has the opportunity to tap the huge reservoir of

opportunities awaiting those who can handle complexity. (See: <http://www.green-innovations.asn.au/econ-mdl.htm#dynamics>)

Some other useful references are: de Bono, 1992; Fisher & Ury, 1981;); Nadler & Hibino, 1998).

Long-range planning for achieving the transition before 2030.

Creating a truly ecologically sustainable economy before 2030 is going to require an immense, sustained effort by a very large number of people. While there is an enormous need for innovation (and so it will not be possible to predict *exactly* what the path to an ecologically-sustainable economy will look like) people will nevertheless need to have a good idea of what some of the broad characteristics of an ecologically-sustainable economy and the transition path to it will look like.

So it is going to be essential to think hard about what the whole transition might entail and how it might be accomplished and these insights will need to be made transparent. Also the key tasks to be done, to move society effectively down the transition path, will need to be identified in a timely fashion.

To facilitate this anticipatory thinking and action it will be useful for bodies like governments, community groups, larger businesses, political parties and unions to develop plans or comprehensive strategies for the achievement of an ecologically-sustainable economy - and as far as possible these plans/strategies should be accessible to all so that people can join in the effort and can contribute critiques and improvements.

The shift to an ecologically-sustainable economy is necessarily going to be so large and in some senses so challenging that it will not be technically possible or even culturally or politically feasible to articulate all the changes that need to be made right now. And yet we need to move quickly to a position where both the planning processes and plans¹⁶ truly reflect what needs to be done. One way to get to this position quickly is to revise any major plans for the transition on a very frequent basis - for example, annually.

To enable the big leap to occur most easily it will be useful to have people thinking about the entire transition period right from the start - for example clusters of work could be established around time periods that cover the complete transition eg. (a) the first couple of years, (b) the first 10 years, (c) the middle ten years, (d) the last ten years. It will be useful also to have an (e)-team that can look at how to accelerate innovation, planning and implementation programs so that the time to a fully functioning ecologically-sustainable economy is shortened as much as possible, that is, we don't want to take 30 years to get to an ecologically-sustainable economy if it can be made possible to get to it in much less.

¹⁶ In situations where changes are being made from one paradigm of thought and action to another, plans cannot take the form of detailed, inflexible blueprints that pin every action down ahead of time. Instead the plans will need to include significant amounts of material that is advisory rather than prescriptive and they will need to be rolling plans that have long time horizons for the consideration of issues but short time cycles for updating and elaboration.

By having these teams covering the whole transitional period there is a better chance that potential blockages along the way will be identified early and strategies will be put in place to deal with them in a timely way. This long range anticipatory work will be necessary if the transition curve is to follow a classical sigmoid curve - rather than a 'rising roller coaster' type curve characterised by surges of progress interspersed with periods of stagnation or reversal. The start-stop-start-stop of the 'roller coaster' curve implies that the transition to an ecologically-sustainable economy will be a lot longer than if society can follow the sustained leap of the classical sigmoid curve.

Given that it might be some time before key players and ultimately whole societies 'buy into' the creation of an ecologically-sustainable economy it might be useful to promote two modes of planning or strategising, that is, pre-commitment and post commitment strategising. Essentially, pre-commitment planning and strategising is where the 'creation of an ecologically-sustainable economy before 2030' is treated as one of several possible scenarios for the future.

For ideas on effective strategising and on the transition to an ecologically-sustainable economy see the hard copy references: Mintzberg, Ahlstrand & Lampel, 1998; Government of the Netherlands, 2001; Government of Western Australia, 2002; Gawer & Cusumano, 2002; and, in the web resources list, the Green Innovations strategy for creating an ecologically-sustainable economy in Australia.

13. What can an interested person or organisation do?

There are a great many organisations around Australia and internationally that are working on the creation of an ecologically-sustainable economy. For example, in Australia we have: the Australian Conservation Foundation, the state/territory conservation councils¹⁷, the Natural Step, the Sustainable Living Foundation, the Natural Edge Project and the Australia New Zealand Society for Ecological Economics and more mainstream organisations like the CSIRO and the Academies of sciences and technologies; and internationally: the Wuppertal Institute, Rocky Mountain Institute, World Resources Institute, International Society for Ecological Economics and the Global Scenarios Group, International Human Dimensions Programme on Industrial Transformation (IHDP-IT), Greening of Industry Network - to name just a few. You might like to link up with any one of these organisations. Contact details for all of them can be found on the web.

Green Innovations is, currently, the only organisation in Australia that we know of that is working explicitly on *the development and implementation a comprehensive strategy for creating an ecologically-sustainable economy before 2030*¹⁸. If you are interested in contributing to the achievement of this objective please contact Green Innovations:

greenleap-project@green-innovations.asn.au

¹⁷ For contact details see: <http://www.nccnsw.org.au/ncc/context/natecs.html>

¹⁸ But what we really want is to lose that distinction as soon as possible as other groups take on this objective too!

<http://www.green-innovations.asn.au/>

You might also like to subscribe to the Greenleap email list that Green Innovations runs. To subscribe send a blank message to:

greenleap-subscribe@yahoogroups.com

For more information about the greenleap email list see:

<http://www.green-innovations.asn.au/greenleap.htm>

Green Innovations will also be running a program of public lectures and training courses on this project.

You can also help this project by passing on copies of this paper to anyone who might be interested - or you can let them know where to find the paper on the web:

<http://www.green-innovations.asn.au/Greenleap-30y-or-less.htm>

In particular, see if you can introduce the ideas in this paper into organisations you are associated with so that they can start to move down the path to becoming a sustainability-promoting organisation.

You might also try to engage your organisation with the idea of 'creating an ecologically-sustainable economy before 2030' by having this notion included amongst the scenarios that your organisation uses to inform and enliven its strategising.

If you would like to see up-to-date information on what is happening to promote the ideas in this paper go to:

<http://www.green-innovations.asn.au/Greenleap-action.htm>

14. Conclusion

It has been clear for many years that society must undertake the transition to an ecologically-sustainable economy. It has not been clear however what the scale of change and the speed of the transition should be. But until the scale and speed issues are settled it is not possible to decide the best strategies to accomplish the necessary transformation.

This paper has outlined a new paradigm for approaching these issues and has explored some of the solutions that have emerged so far, driven by this line of thinking.

It is hoped that the paper will also provide a stimulus for further action.

Appendices

Diagrams

The 5 layer TBL matrix

Model of an economy that can decouple growth in service flow from a drop in environmental impacts.

CO₂ levels in the atmosphere over the last 400,000 years

A scenario for stabilising atmospheric CO₂ at 350 ppmv

A scenario for reducing fossil fuel consumption to zero after consuming a further 225 Gigatonnes of carbon

Change in service flow output from the old and new economies

The ecologically-sustainable economy.

The business cycle and preparing for investment

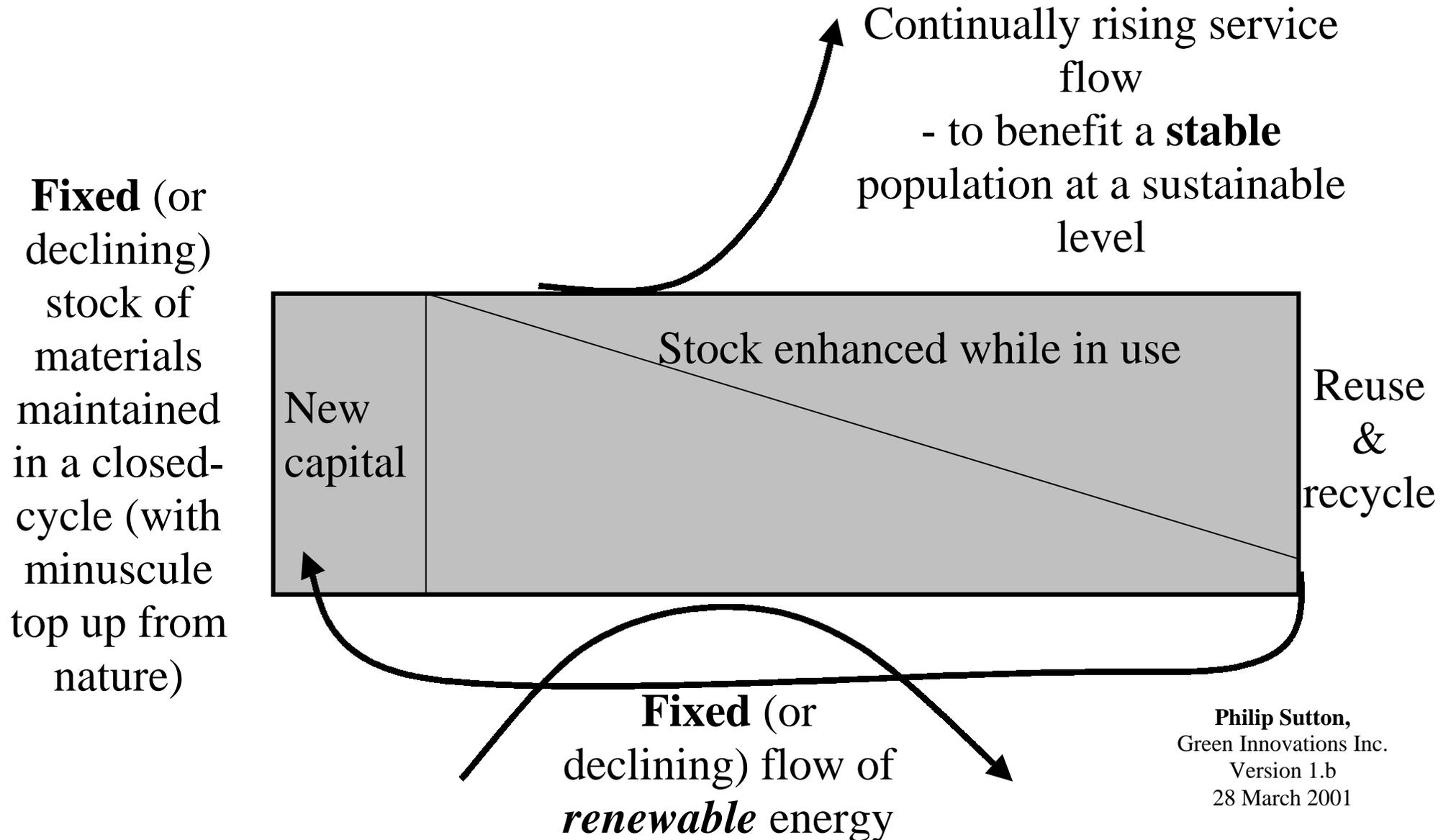
Change model - convection and lateral

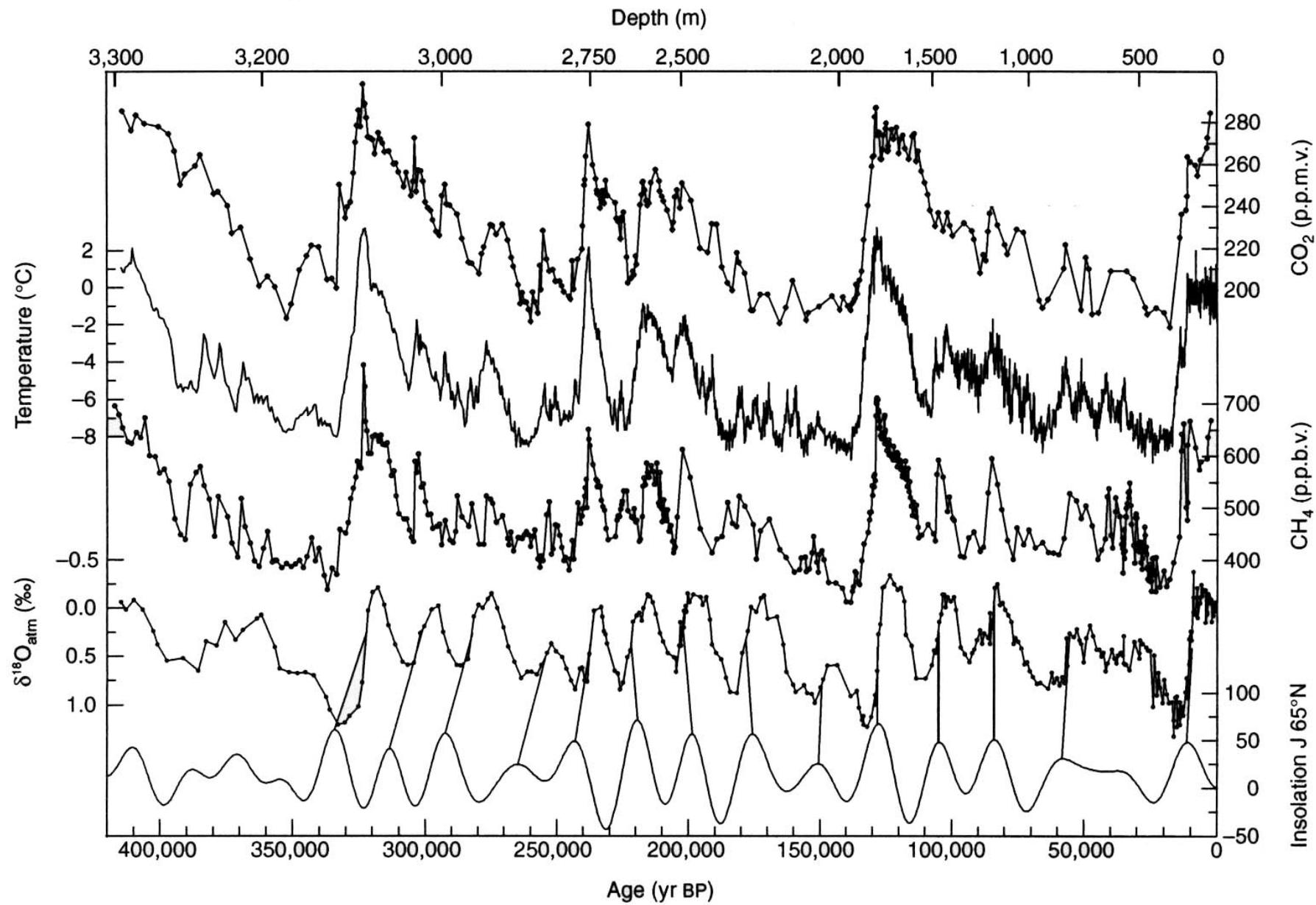
The Greenleap (sigmoid curve)
(Diagram located in section 9.)

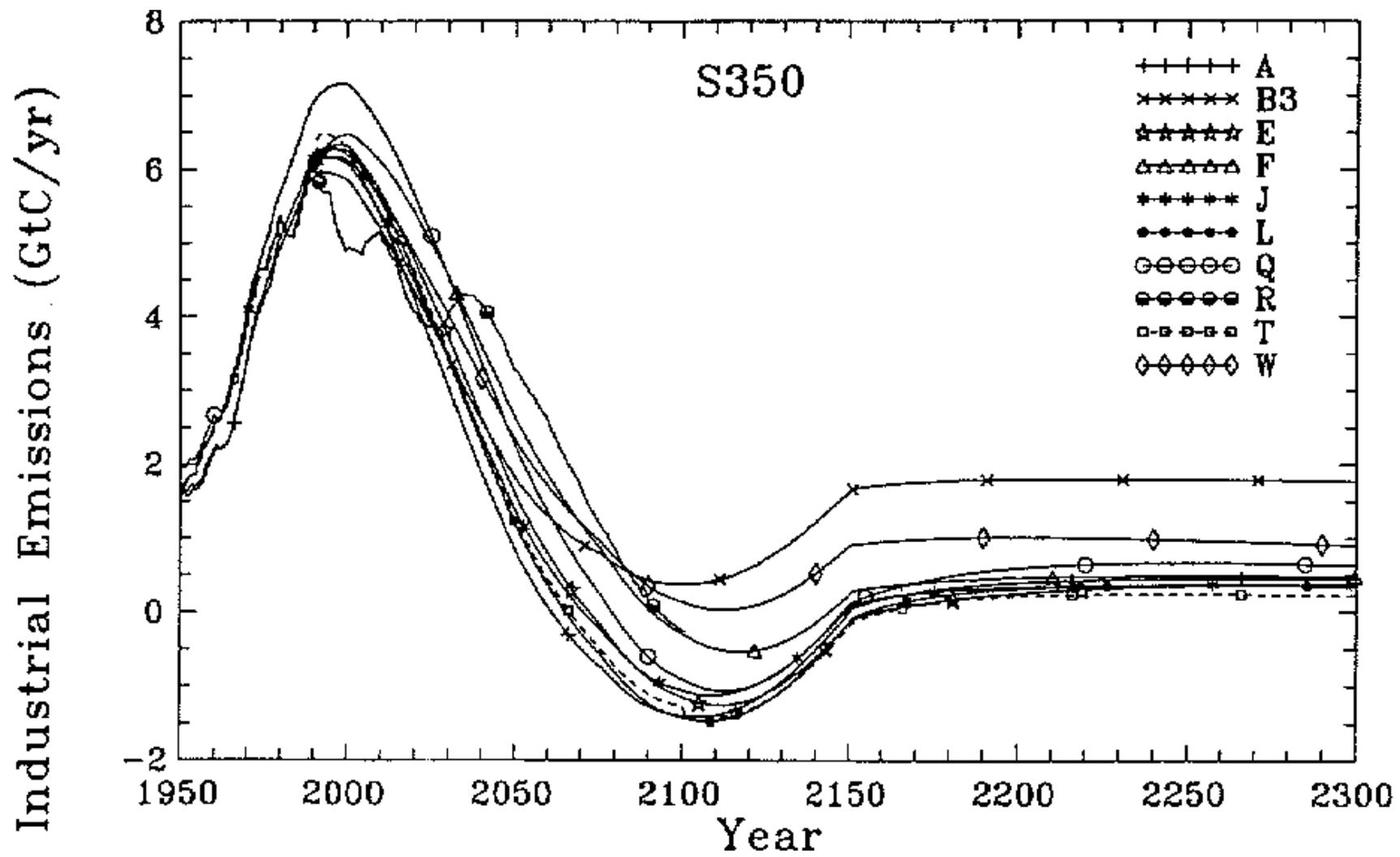
Triple bottom line scope (aims, actions, performance) (5 layer)

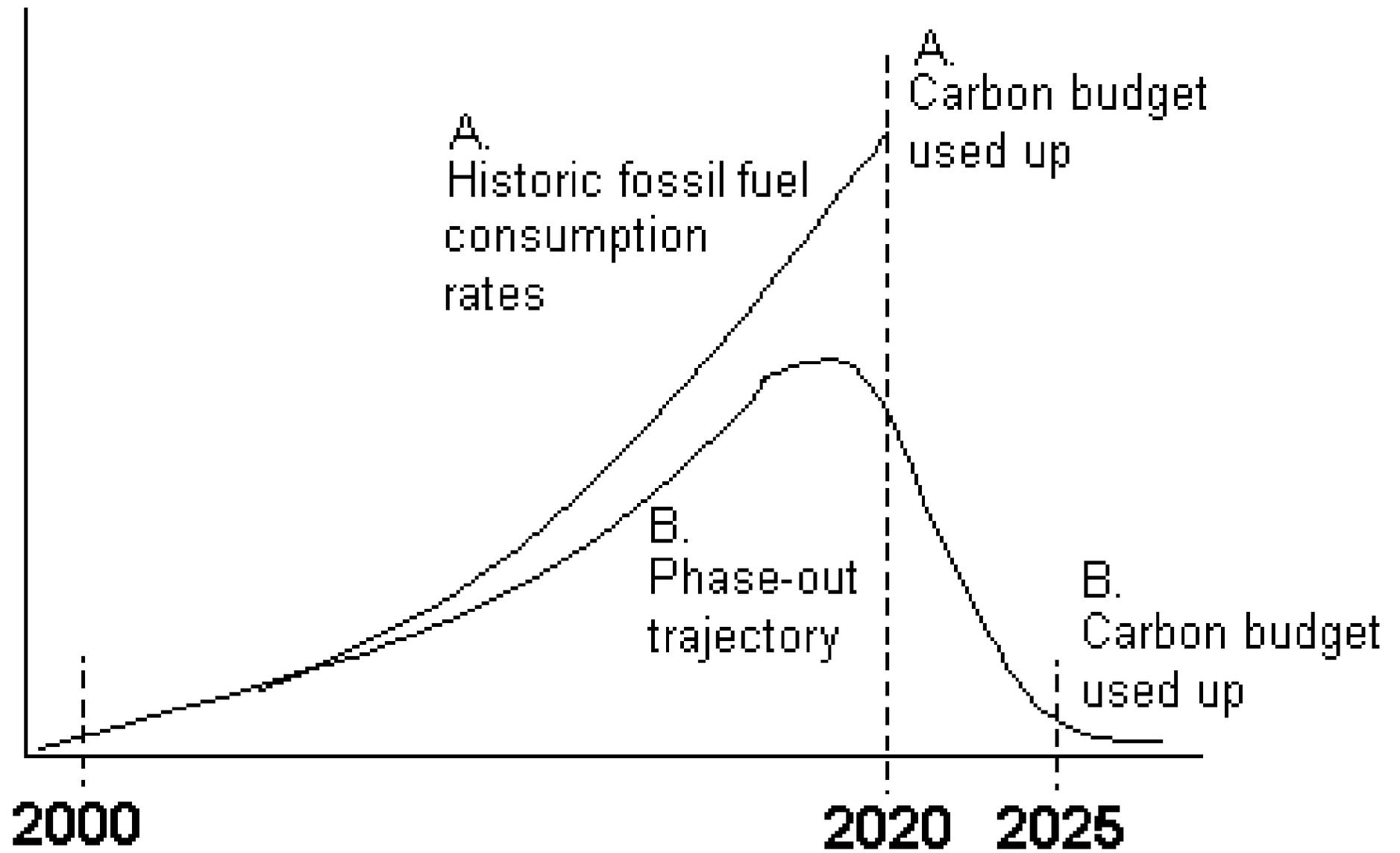
	Environment	Society	Economy
Sustainability (maintaining)	What would it take for the aspects of the environment/society/economy that we value to be sustainable? (locally / globally)?		
Genuine progress (improving)	What would it take for everyone to have a worthwhile life (locally / globally)? How can we improve on the status quo?		
No major trade-offs (essential)	What would it take for <i>specific</i> initiatives in pursuit of sustainability/improvement to not undermine TBL sustainability and the achievement of a decent life in <i>general</i> ?		
Win-win (desirable)	What would it take for <i>specific</i> initiatives in pursuit of sustainability/improvement to contribute simultaneously to sustainability and the achievement of a decent life in <i>general</i> ?		
Complete portfolio	How can the portfolio of all projects/activities add up to a desirable outcome (locally / globally)? (So the <i>combination</i> of projects has a strong 'tick' on all env/social/econ issues but doesn't have a major negative in any one category)		

The conditions under which a truly sustainable economy could have continuing economic growth

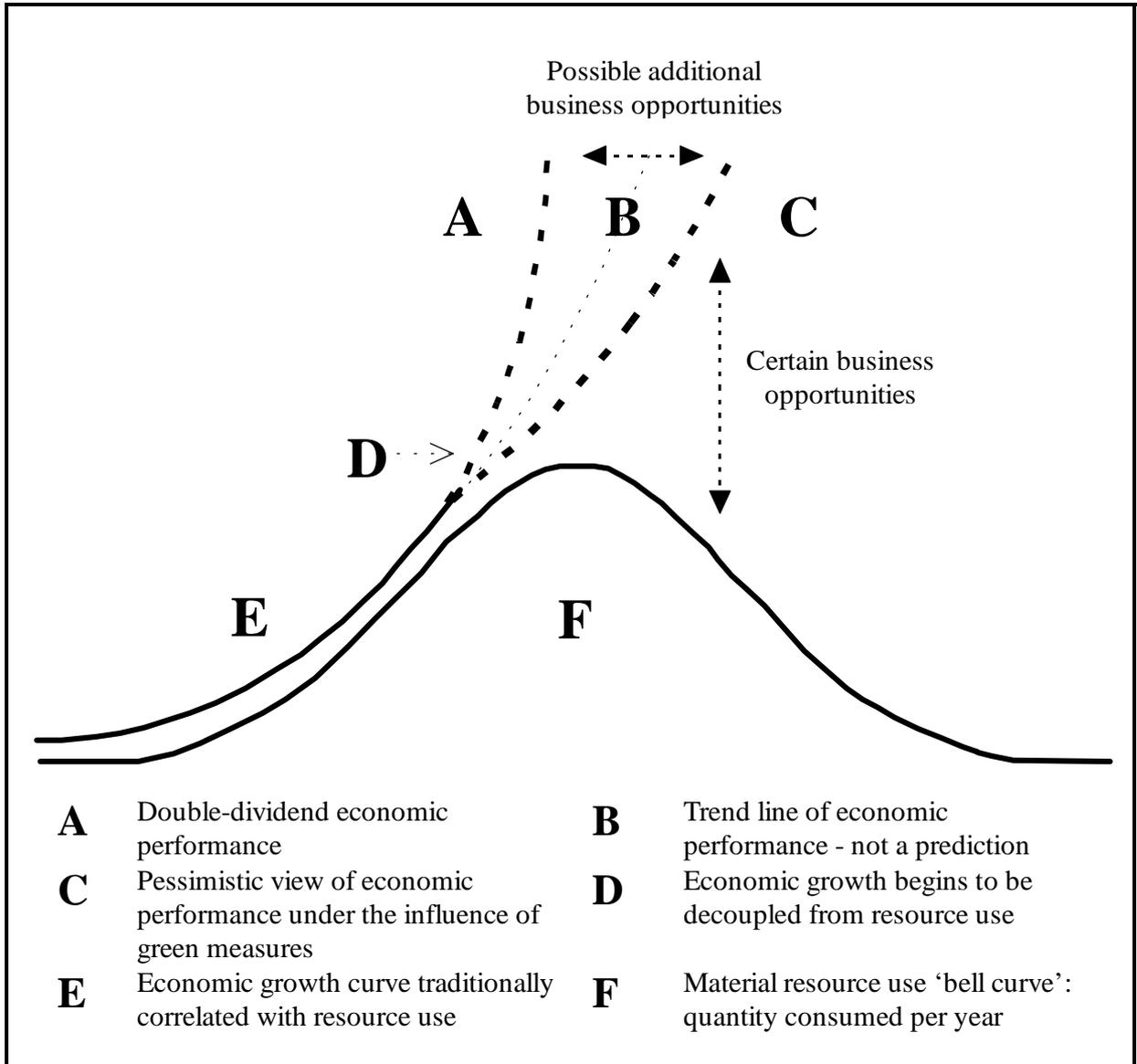


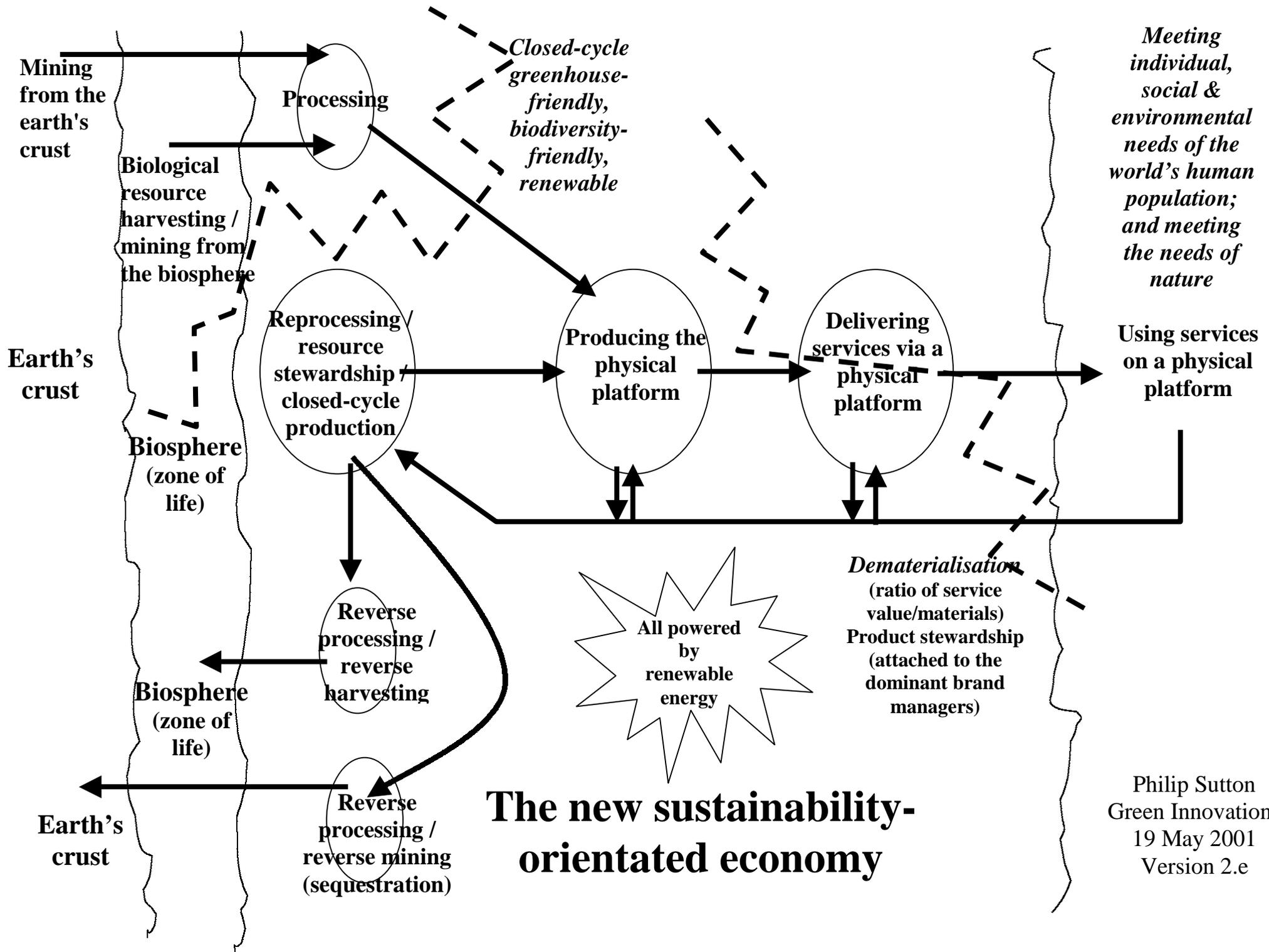






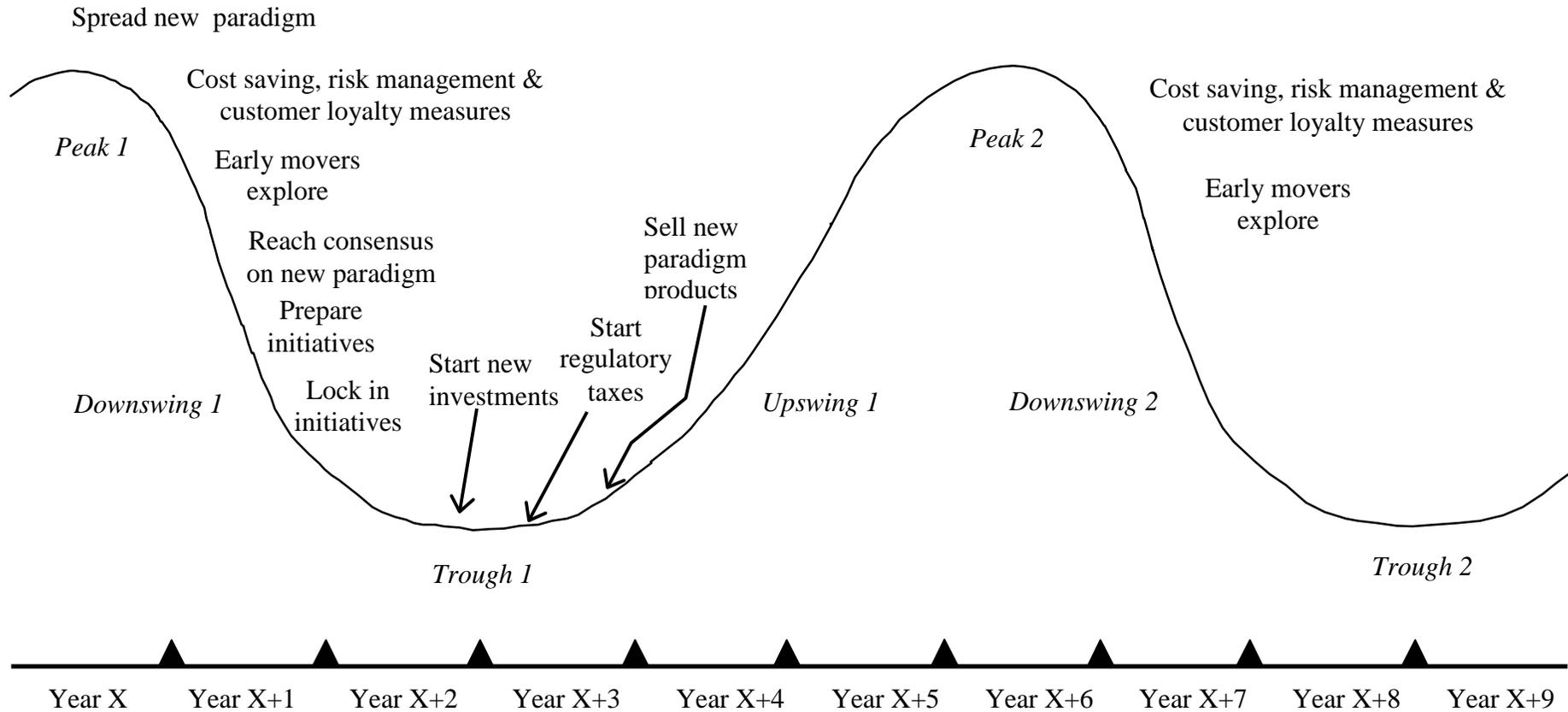
SCOPE OF BUSINESS OPPORTUNITIES ARISING FROM THE RESPONSE TO ENVIRONMENTAL ISSUES



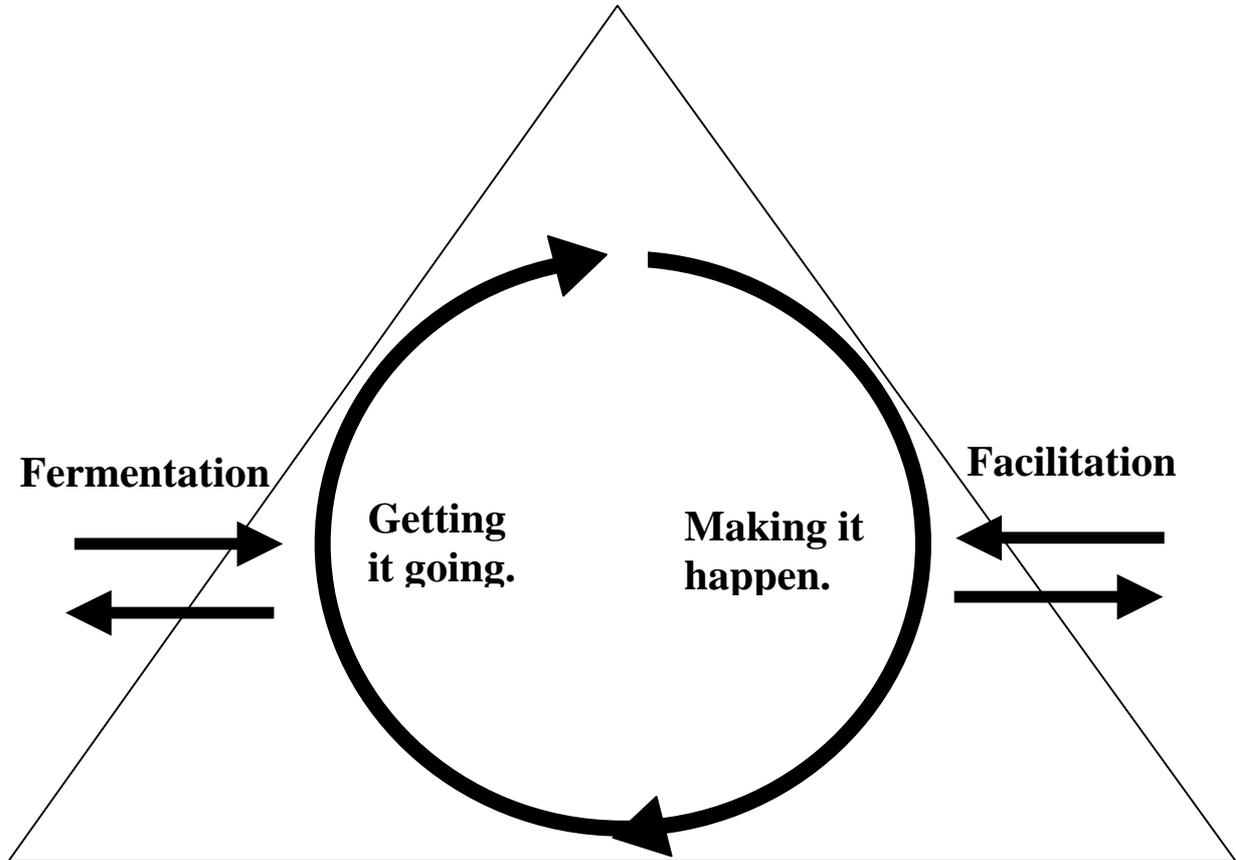


Philip Sutton
 Green Innovations
 19 May 2001
 Version 2.e

Managing for sustainability-promotion through the business cycle



Bottom-up / Top-down / Outside-in / Inside-out Action



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Web resources

What does sustainability mean?

- <http://www.green-innovations.asn.au/sustainability-getting-orientated.htm>
- <http://www.green-innovations.asn.au/sustainability-unachievable-or-practical.htm>

'Man on the moon by the end of the decade': Kennedy's speech to Congress in 1961

- <http://www.luminet.net/~tgort/moon.htm>

Stretch goals - the methodology

- <http://www.green-innovations.asn.au/stretch-goals/Stretch-goals-resources.htm>

Biodiversity

- <http://www.greenhouse.gov.au/yourhome/technical/fs35.htm> (building and the management of indirect biodiversity impacts)
- http://www.envict.org.au/pdf/LCA_Do_For_Biodiversity.pdf (life-cycle assessment and biodiversity)
- <http://www.green-innovations.asn.au/green-purchasing.zip> (biodiversity and green purchasing)
- <http://www.green-innovations.asn.au/LCA-paper-notes-the-Australian-environment-1b.zip> (implications of the Australian environment for life-cycle assessment)

How far and how fast?

- <http://www.green-innovations.asn.au/how-far-how-fast-greenhouse-case.htm>

Can an ecologically-sustainable economy be successful?

- <http://www.green-innovations.asn.au/tmcp.htm> (transformed market conforming planning)
- <http://www.green-innovations.asn.au/econ-mdl.htm> (new economic model)
- <http://www.green-innovations.asn.au/growth2.htm> (economic growth)

Transformative financing

- <http://www.green-innovations.asn.au/transformative-funds.htm>
- <http://www.green-innovations.asn.au/btf.htm> (about a proposal to set in train a strategy to create transformative financing institutions - starting with a transformative financing brokerage focused on biodiversity conservation)

Race to Sustainability

- <http://www.green-innovations.asn.au/Race-to-Sustainability.doc>

Sustainability-promoting organisation

- <http://www.green-innovations.asn.au/tapsmrkt.htm> (tapping the sustainability market)
- <http://www.green-innovations.asn.au/spf.htm> (sustainability-promoting firm)
- <http://www.green-innovations.asn.au/spf2.htm> (more on the sustainability-promoting firm)
- <http://www.green-innovations.asn.au/iso14001.htm> (sustainability-orientated application of ISO 14001 Environmental Management Systems)

Imagining (modelling) the future

- <http://www.green-innovations.asn.au/imagine.htm>

A strategy for creating an ecologically-sustainable economy in Australia

- <http://www.green-innovations.asn.au/strategy-ecologically-sustainable-economy.zip>