

# mind over matter: greening the new economy

Charles Leadbeater



“green alliance...”

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## Digital Futures

The *Digital Futures* project is a year-long inquiry into the environmental and social opportunities of e-commerce and the new economy. Co-ordinated by Forum for the Future, the project is a unique partnership between three government departments, eight think-tanks and 14 companies. Further information can be found at [www.digitalfutures.org.uk](http://www.digitalfutures.org.uk)

## Green Alliance

Green Alliance is one of the UK's foremost environmental groups. An independent charity, its mission is to promote sustainable development by ensuring that the environment is at the heart of decision-making. It works with senior people in government, parliament, business and the environmental movement to encourage new ideas, dialogue and constructive solutions. Green Alliance is a member of the Digital Futures consortium.

## new politics series

Green Alliance's New Politics pamphlets provide a platform for eminent thinkers to examine interactions between current political debate and environmental thinking. The views expressed are those of the authors.

Other pamphlets in the New Politics series are:

- *Sustaining Europe: A common cause for the European Union in the new century*, Ian Christie, December 1999
- *In Our Backyard: The social promise of environmentalism*, Ken Warpole, September 2000

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# introduction

Shawn Fanning, the twenty-something renegade founder of Napster, is an unlikely environmental hero. Napster, the on-line music community, is based around a technology which is simple yet powerful. It allows a computer user, armed with a modem and Napster software, to download music via the internet as a computer file.

At first sight it might appear that this technology has little to do with protecting the environment from climate change or pollution. Yet, on closer examination, the environmental

“All great entrepreneurs open up possible futures that would have remained closed without their insight, imagination and drive.”

potential of Napster could be very large indeed. If the entire music industry were to embrace Napster-style technology, we could phase out the production of compact

discs, tapes and all the materials, packaging and transport associated with these physical products. Shawn Fanning turns out to be not just a techno-entrepreneur but an environmental entrepreneur as well.

Entrepreneurship of the kind Fanning is engaged in will be critical if we are to achieve

environmental sustainability. All great entrepreneurs open up possible futures that would have remained closed without their insight, imagination and drive. One of the central claims of this pamphlet is that protecting our environment will depend as much, if not more, on entrepreneurship and innovation to find solutions to environmental challenges as it does on regulation and laws to force changes in consumer and corporate behaviour.

Of course, Napster is not an environmental free lunch. To download a file using Napster, you first need a computer, which has to be manufactured and disposed of and which consumes electricity. The Napster story also highlights some of the difficulties this kind of innovation will face if its environmental potential is to be realised. It will take a long time to wean consumers away from their compact disc collections. Consumers, as well as producers, will have to adapt and innovate. Mired in court proceedings, Napster's legal status is uncertain too, as it threatens normal conventions of copyright. The mainstream media companies will not take up Napster until they find a way to make sure that they can charge people to listen to music and watch films.

Even so, the environmental benefits from the world's music industry making this switch would be very large indeed. Similar gains could be made for films, television, video and even books if major publishers shifted to digital, computer-file formats. The economics, technology and environmental impact of the world's entertainment and media industry could be transformed within a decade, not by new regulations nor by big corporate research and development, but by the revolutionary ideas of some young turks working at the margins of the law. Fanning has made it possible to imagine the world's media industry developing along entirely new lines.

In the next few years more and more industries will face this kind of challenge as new technologies, carried to the market by entrepreneurs, make it possible to revolutionise the production and organisation of industries from top to bottom. Not only will we witness entirely new kinds of product emerging, like Napster, but traditional industries and the products they make, like cars and televisions, could be made more efficient, more intelligent and as a result more environmentally friendly.

I should not really be writing this pamphlet. I am not an environmentalist, my knowledge of environmental issues is at best patchy, and, as my wife likes to point out, my love affair with consumerism leaves a lot to be desired from a green point of view. Yet despite all this, I find myself writing about the environment because it

seems to me that environmentalism should become increasingly central to something I am directly involved with: the rise of the knowledge-driven new economy.

This pamphlet is about creating an intellectual and political bridge between the new economy and the environment. The argument will lead to some controversial conclusions, particularly about the role that markets, competition and entrepreneurship could play in creating a more sustainable economy.

My interest in this new agenda developed from my work over the past four years. I helped to conceive and draft the Government's White Paper on the Knowledge Economy which was published in December 1998.<sup>1</sup> My book on the new economy, *Living on Thin Air*, was published in July 1999.<sup>2</sup> Both were criticised, with justification, by environmentalists for neglecting green issues. That criticism alerted me not just to the omission, but also to the potential for bringing together environmentalism and the thinking behind the new economy.

In *Living on Thin Air* I argued that we were in the midst of a far-reaching shift toward an economy based on ideas, creativity, imagination and research and development. This shift requires us to rethink the role and purpose of policy and institutions that were created for the old industrial economy. We need to understand and value intangible assets which are not recorded on

"This pamphlet is about creating an intellectual and political bridge between the new economy and the environment."

corporate balance sheets; we need to encourage entrepreneurship and innovation; and we need to rethink how companies are managed and owned.

The environmental movement's economic agenda is strikingly similar. Many environmentalists now argue that making our economy environmentally sustainable will require innovation in what we make and how we make it, what we consume, and how we value intangible environmental assets.

These two forces when taken together are creating the basis for a post-industrial, environmentally sustainable economy, in which people value intangibles such as services, software and know-how for both environmental and commercial reasons. Some organisations and people already embody this shift. These include: progressive mainstream businesses such as BP, which is aiming to become the world's leading new generation energy provider by investing in solar and renewables; new businesses like Dyson, the vacuum cleaner maker, where innovation, design and environmental improvements to products go hand in hand; green economists working on how markets and innovation can be harnessed to environmental goals; scientists seeking to find ways to channel innovation in areas such as genetics towards health and food production; local authorities at city and regional levels, such as California, which are trying to drive innovation through public policy.

"The two most powerful forces shaping the character of the 21<sup>st</sup> century post-industrial economy are the new, innovation-driven economy and environmentalism."

The diverse constituencies that inhabit this common ground will never amount to a political alliance, but they need a shared language and a common understanding of the main opportunities and obstacles they face. Amory Lovins' book *Natural Capitalism*<sup>3</sup> is perhaps the most articulate statement of the potential for innovation to benefit the environment. More recently, Michael Jacobs'

Fabian pamphlet *Environmental Modernisation*<sup>4</sup> is an impressive attempt to locate these ideas within a UK political context. And the Department of Trade and Industry's forthcoming sustainable development

strategy will attempt to integrate the Government's thinking about innovation, competitiveness and the environment.

The *Digital Futures* project, of which this publication is a part, brings together think-tanks, business and government in an explicit attempt to forge a new consensus. Many of the arguments outlined in this pamphlet will be developed in greater depth and detail in further publications from the project.

The two most powerful forces shaping the character of the 21<sup>st</sup> century post-industrial economy are the new, innovation-driven economy and environmentalism. They should be brought together.

In this pamphlet, I put forward a set of recommendations which focus on environmental innovation and entrepreneurship. Until now,

environmental policies have been largely understood, at least by the public at large, as regulations or taxes to dissuade companies and consumers from engaging in environmentally harmful activities. In the future, we need to focus all the tools of policy - taxes, regulations, inward investment, competition policy, research and development - to drive environmental innovation. The goal is not simply to regulate a reduction in the environmental harms caused by the old industrial economy. The goal should be to help

create the more environmentally sustainable industries of the future. Our hopes of creating an economy that is both dynamic and environmentally sustainable rest on the same source: the motive power of innovation and knowledge creation to develop commercially viable solutions to environmental problems.

This pamphlet is a modest attempt to outline how that could be achieved.

# the promise of the new economy

The holy grail may have appeared on the horizon: the emergence of an economy based primarily on a combination of services and technology, which will be highly productive without undermining the environment that sustains and protects us. In this economy, it may be possible to do what we have failed to achieve in the past century and more: to combine economic growth with sustainable development. It is not just that we are witnessing the emergence of new technologies, like hydrogen fuel cells and solar power, that have tremendous potential to reduce environmental harm. The promise of the new economy goes further than that. It is that the very nature of the mainstream economy of retailing, banking and manufacturing is changing. Knowledge, ideas and innovation are becoming the new critical sources of wealth creation. Companies, regions and even individuals must increasingly base their comparative advantage on their ability to generate, apply and exploit distinctive forms of know-how.

The 'new economy' can be defined in narrow or broad terms. At its narrowest, the idea of the new economy is associated with the rise of information and communications technology, particularly the internet and e-commerce. A broader understanding of the new economy is that

it is not defined by a particular technology but by a capability: innovation.

The new economy is innovation-driven. New sources of competitive advantage, derived from innovation, are being applied to all sectors, from agriculture to banking, and to all parts of a business. This pamphlet will adopt this much broader definition of the new economy.

This new economy comes in many guises: the post-industrial society, the information society, the knowledge economy, or simply the new economy. It has emerged at the turn of this century only through a combination of developments, some quite recent, others long in gestation. A trend toward increased efficiency and dematerialisation, a focus on innovation, and new ways of thinking about economics, all features of the new economy, are developments that provide the potential, at least, for environmental improvement.

"A trend toward increased efficiency and dematerialisation, a focus on innovation, and new ways of thinking about economics, are all developments that provide the potential, at least, for environmental improvement."

## Doing more with less

The first such development is the growth of the service sector. As manufacturing productivity has increased and incomes have risen, so we spend more on services, and more people are employed in service companies. By and large, services make far less use of material resources than manufacturing. The more gardening, caring, teaching, cooking and serving we do, rather than mining, hewing, forging and making, the less environmentally destructive our economy should become.

A second factor is that manufactured products are far less materials intensive. We are doing more with less. We can push more data down a strand of copper wire. Cars are made with thinner and thinner steel and more software and electronics. The average coke can is 80 per cent lighter than a similar can 20 years ago because scientists and technologists have found ways to reduce the amount of metal needed to contain the liquid. The modern can, in effect, is a thin film of metal kept in shape by the liquid inside it.

Even more important, some products are dematerialising. EMI will soon stop making compact discs, because in future music will be delivered in the form of computer files, through MP3 and other formats. Film and television, which rely on tapes, will soon go the same way. Immaterial products obey different laws of consumption. A physical product is a rival good: if I am playing a compact disc in my compact disc player you cannot do so. If we both want to listen

to the same music then another compact disc has to be manufactured. However, any number of us can share MP3 files of the same music. These immaterial products, like software, can multiply without using up any more resources. When we consume these new products we do not literally devour them, we replicate them. The products of the industrial economy were like chocolate cakes - if you ate the last piece of cake, I could not do so. The products of the new economy are like chocolate cake recipes - if you use a recipe I can use the same recipe and so can many thousands of other people without any of us being worse off.

## Innovation

Information technology is having an equally profound effect on the way businesses are organised. Increasingly, supply chains are co-ordinated through information technology networks. Industrial processes that were once highly wasteful can now be monitored and controlled with much greater precision, using robots and computer technology. More manufacturing companies recognise that waste is both costly and environmentally harmful. Business has learned how to reduce labour and capital costs; there are now signs that the leading companies are reducing their intake of materials.

All of this is the product of an economy which is far more innovation driven. The goal in the old, industrial economy was optimisation: to find the one most efficient way to make a product, given existing technology. The new economy is driven by innovation and adaptation: to find new ways to

create value and to make products more efficiently. This emphasis on innovation creates opportunities for whole systems of production, and the design of products, to be rethought from the ground up rather than being changed incrementally.

Innovation really takes off when a series of complementary products come together: cheap personal computers, new software, modems and

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printers powered the rise of the internet in the mid-1990s. We can imagine similar linked innovations

taking place, for example, in the way we use cars: more efficient, lighter engines; drive-by-wire systems that will replace mechanics and gears; lighter materials; alternative fuels - and all combined with more intelligent roads that help to optimise the flow of traffic. At the moment it is as if we occupy two worlds at once, especially in our congested cities: the physical world of clogged roads, which is inefficient, slow moving, unresponsive and rigid; and the immaterial world of computers and communications, in which we can work with people on the other side of the world at the touch of a button. The ease of use and responsiveness of the new, immaterial economy will make us increasingly frustrated with our experience of the cumbersome old economy of physical machines and roads.

## New economic insights

The explosion of scientific knowledge that is one driving force behind the new economy may in turn give a new value to the environment. As we will discuss later, natural resources, and particularly biodiversity, are coming to be seen as crucial assets in the new economy. But links between the new economy and the environment go deeper than this. Within the next decade a new intellectual synthesis could emerge which applies the same principles to understand both the modern networked economy and complex ecosystems. The more the economy becomes knowledge and innovation driven, the more relevant evolutionary theory will become to our understanding of how firms innovate, and even why stock markets rise and fall.

Jane Jacobs, the American economist best known for her work on cities<sup>9</sup>, recommends that we learn from ecology how we should improve our economic systems, particularly their ability to self-organise, correct and self-refuel. She suggests we learn from how spiders can spin fragile but complex webs, at variable temperatures, or the principles by which plants capture sunlight and turn it into energy.

This emerging intellectual synthesis is moving from theory into practice. Already there are evolutionary models of financial markets such as Nasdaq. These models dispense with the assumption that investors are rational and fully informed and instead assume that investment strategies co-evolve and investors move in herds.

Economic growth and evolution are driven by complex interactions between many factors. Innovations, whether in business or ecology, are rarely the products of individual, unilateral action. Organisms evolve in their niche within the environment; a company co-evolves and declines with its customers, suppliers and partners. An evolutionary account of innovation and economic growth stresses the features of the economic system as a whole - the extent of experimentation and diversity, tolerance of failure, opportunities for co-evolution - rather than explaining innovation as an individualistic, profit-driven activity.

Another insight common to biological and economic thinking is drawn from complexity

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theory. As the economy has become more networked and global, and less organised by hierarchical organisations, so it has become like

one of the complex adaptive systems in nature, such as a tropical forest. These complex systems are ordered without being designed.

The attraction of these biological models is that they explain not just the force driving the new economy, but some of its disorderly downsides as

well. The new economy is prone to bubbles and slumps, because all too easily, dynamic self-organisation can descend into either gridlock or chaos.

### Promise or problem?

Greater efficiency, dematerialisation, economics as biology - these are the grounds for the promise that the new economy might be more environmentally friendly than the old. Yet just as we are constantly aware of the potential for new technology to change the world around us, we are also aware of a pervasive sense of environmental threat. Indeed, elements of that threat stem from new technologies such as GM foods. Although the new economy may have the potential to combine economic growth with sustainability, it is only that: a potential. By contrast, environmental problems of enormous scale, complexity and import are very much with us: climate change; deforestation; acid rain; species loss; fisheries collapse; pesticide poisoning; water depletion. If the environmental potential of the new economy is to be made good, it must make a contribution to solving these pressing and immediate problems that need action on a global scale. It cannot just remain a promise of improvement in the future. To establish how this might be achieved, we must turn to look at the common ground between the new economy and environmental thinking, and examine how we might move toward a more sustainable new economy.

# the new common ground

A common ground has been created by the twin developments of the knowledge-driven economy and the maturity of the environmental movement into a mainstream political force. The developments described above show that it is now possible, in a way that it was not 20, or even ten, years ago, to argue that a technologically-rich, innovation-driven, service society is our best hope of environmental sustainability.

Both the new economy and sustainable development are creations of the last third of the last century. Thirty years ago most people had not seen, let alone used, a computer. Neither had they heard of global warming. The new economy has emerged alongside our growing recognition of the environmental challenge we face. The values espoused by some in the new economy - global co-operation, creativity, distrust of government - are quite attuned to those of the environment movement. Independent, well-educated knowledge workers, who want to work in a clean environment, are likely to support green ideas. California, the home of the new economy, is also home to one of the world's most assertive environment movements (although Silicon Valley

*"A technologically-rich, innovation-driven, service society is our best hope of environmental sustainability."*

itself is a growing environmental nightmare of overcrowding and congestion). Both the green movement and the new economy of the internet have grown up in a world where national politics and boundaries matter less.

The shift in business thinking on the environment, illustrated by BP's recent decision to rebrand itself as 'bp - beyond petroleum' is a further sign of emerging common ground. As Jonathon Porritt puts it, companies are increasingly conscious of "a swathe of new legislative pressures... the loss of reputation that comes from being branded an environmental pariah... and the very real opportunities of doing good business by doing it in a leaner, greener way."<sup>6</sup> As new generations of business leaders emerge, more attuned to environmental values in their own lives, this shift in business thinking is bound to go further.

Of course, the mere fact that this path to a green future might be a possibility does not mean it will become reality. Far from it. At the moment much of the innovation in the new economy seems devoted to creating faster computers or higher band-width communications. Yet the really

big challenges we face, for example to reduce fossil fuel emissions and waste, will only be met through efforts to find new forms of energy, new kinds of transport systems and new environmental design. This kind

“The mere fact that this path to a green future might be a possibility does not mean it will become reality.”

of innovation - whole system innovation, rather than simple product or process innovation - is fraught and complex.

Scientific and technological innovations are often only realised within a much larger context of social, organisational and political change. The inventors of the telephone thought it would be used by people to listen in to live theatrical performance on the West End stage. It was only when consumers themselves started to innovate by using the telephone to talk to one another that it really came into its own. Even if we direct more scientific research toward sustainability, the products of that research will only make a difference when they are combined with social and political innovations, yet the pace of technological innovation runs so far ahead of organisational change.

Take car use as an example. New, more sustainable forms of car transport will require scientific and technological innovation, such as new fuel sources for cars. But the true potential will not be realised without social innovation to create new patterns of car use, and even ways for consumers to share and own cars through leasing

schemes. It will require regulatory innovations such as road pricing, which may well only be possible if we have political innovations to give cities more powers to control their own transport taxation. We need to imagine not just new technologies, but whole new social systems for transport.

As I argued in *Living on Thin Air*, the 19<sup>th</sup> century was revolutionary because the Victorians matched their scientific and technological innovations with radical institutional innovations: the extension of democracy, the creation of local government, the birth of modern savings and insurance schemes, the development of a professional civil service, the rise of trade unions and the emergence of the research-based university. We are timid and cautious where the Victorians were confident and innovative. We live within the shell of institutions the 19<sup>th</sup> century handed down to us. Our highly uneven capacity for innovation is the fundamental source of our unease. We are scientific and technological revolutionaries, but political and institutional conservatives. To realise the environmental potential of the new economy we have to harness its innovative power by creating social institutions designed to deliver a sustainable way of life. The building societies and insurance schemes created by the Victorians had a lasting legacy, shaping the lives of millions of people over many decades. The institutions we should create should have a similar longevity and impact. That will

“We need to imagine not just new technologies, but whole new social systems for transport.”

require new approaches to how we measure value and investment, to production and consumption, and to ownership.

Although the green movement and the new economy share some features and antecedents, we should not be naïve about the potential for deep conflicts over values, particularly the commercial imperatives of the global economy. Either extreme of thinking is unlikely to succeed. On the one hand, we must realise that heavy control and regulation of the economy in the name of the environment is a dead end: it would kill off the innovative impetus that is our best hope of tackling our environmental problems. Neither must we fall prey to the over-optimism that infects so many starry-eyed advocates of the new economy, who believe that technology and free markets will solve all our problems.

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The potential of this coming together of environmentalism and the new economy is huge. It could put the relationship between the economy and the environment on a new footing and allow us to find new solutions to intractable problems. This is the new common ground that environmentalists, scientists, policy-makers and executives should explore. The convergence of the new economy and environmentalism will not remove hard choices or wish them away. It may make them easier to resolve, especially if technological and scientific innovation is accompanied by innovation in the way we produce and consume, in how we own and value products and assets.

The question to which we now turn is how we should go about making good its potential. We will do this by looking in turn at new approaches to capital, to consumption, production and ownership, which make the most of the synergies between the two strands of thought.

## new approaches to capital

In industrial and agrarian economies, the material assets of land, machinery, raw materials, and brute labour power were of paramount importance. The new economy depends instead on intangible assets - knowledge, imagination, creativity, trust - and takes intangible forms - brands, services, software. We are becoming more aware, too, of the social capital which underpins knowledge: the way we invest in education and learning.

Traditional financial accounting, the foundations of which are more than 500 years old, is designed to track and record transactions involving physical property. It is poor at measuring the value of assets that cannot be easily packaged, bought and sold, such as brands, and research and development. Most corporate balance sheets record the value of assets like land and buildings, which are not critical factors of production for many companies, while the most valuable wealth-creating assets go unrecorded.

Innovations in accounting aim to measure these so-called stealth assets. The Balanced Scorecard in the US relates financial performance to customer and employee satisfaction. The Skandia Navigator, developed by the Swedish insurance company Skandia, is one among many intellectual balance sheets designed to measure a company's intellectual assets. More companies are paying

attention to social audits of how they are viewed by their stakeholders.

In a striking parallel, environmentalists are calling for more systematic accounting of 'natural capital', a similarly intangible asset. The environment provides vital services to industry - such as clean air, water, raw materials, waste disposal - which

are generally under-valued and under-priced. As

*"The most valuable wealth-creating assets go unrecorded."*

Paul Ekins points out, because environmental functions - an atmosphere that yields climate stability, biodiversity, degradation of wastes and so on - are under-priced, they are over-used, and as a result the underlying stocks and capital are being run down.<sup>7</sup> The challenge is to assess the value of these assets, and to work toward accounting for the full environmental costs of economic activity. The value of these unpaid services should be factored into corporate costs as well as national accounts.<sup>8</sup>

Already, a good deal of progress has been made on developing environmental accounts at a corporate and a national level. A good example of the corporate approach is the carpet manufacturer Interface, which is working with Forum for the Future to calculate the company's sustainability cost: the notional sum it would have to set aside to make good the environmental damage its activities

cause. That calculation allows the accounts to be amended with a figure for 'environmentally sustainable profits'. Just as companies set aside the money they need to modernise machinery as it wears out, they should also set aside money to restore the environmental capital they use up. Just as profits are amended to take account of taxes and interest, they should be amended to take account of environmental costs. Shareholders have an interest in better environmental accounting, particularly uncertain liabilities which might affect the value of their stocks.

There are similar initiatives at a national level, such as the Namea methodology (National

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accounts matrix including the environment) for national environmental accounts developed in the Netherlands in the 1980s. Many

countries, including the UK, now have national environmental accounts. Environmental economists at the World Bank, too, have developed new tools for measuring national wealth in terms of natural, human and manufactured capital.<sup>9</sup>

One could never hope, or want, to put monetary value on all aspects of the natural environment. But as these examples show, methodologies for valuing environmental capital are well developed, and efforts continue apace. The challenge now is to integrate valuations of environmental capital, and other forms of

intangible assets, into both corporate and national accounts. As the borders of financial reporting break down, it will become far more common for companies and nations to provide a more textured, complex set of accounts combining financial and non-financial measures of performance. Processes such as the Global Reporting Initiative are at the forefront of this trend.

### New sources of environmental capital

There is another sense in which the environment might be considered among the assets of the new economy.

Biodiversity in itself is an untapped stock of resources, not just for traditional industries such as food and medicines, but most potently for the genetics industries of the new economy. Nature, reduced to the level of genetic code, is a vast new branch of the information economy.

Craig Ventner, the controversial US geneticist and founder of Celera Genomics, who leads the private sector effort to unravel the human genome, explains this connection by saying that "Our

fundamental business model is like Bloomberg's [the financial information provider]. We're selling information about the vast universe of molecular medicine."<sup>10</sup> He claims boldly that Celera will one day help analyse the genomes of millions of people, and

"Nature, reduced to the level of genetic code, is a vast new branch of the information economy."

then design drugs tailored to their genetic make up.

The advances that have opened up the value of nature's genetic vaults are largely due to the convergence of information technology and biology. Genomics is a child of the information technology revolution. Ventner's work at Celera, for example, is made possible by digital DNA sequencing machines that have become available only in the past couple of years. Ventner says that "a year ago [1999] this work would have taken one to two thousand scientists. With this technology we are literally coming out of the dark ages of biology. As a civilisation we know far less than one per cent of what will be known about biology, human physiology and medicine."

Many will find Venter's appetite for yoking together genetics, new technology and commerce alarming. Yet similar arguments, expressed in more sophisticated and empathetic terms, have been made by eminent biologists like Edward O. Wilson. In *The Diversity of Life*<sup>1</sup> Wilson argues that each evolutionary adaptation is a form of innovation and learning as an organism adjusts to its environment. When a species is extinct we lose access to that knowledge bank and collective memory. Wilson quotes poetry to describe the loss: "Any number of rare species are disappearing just beyond the edge of our attention. They enter oblivion like the dead of Gray's *Elegy*, leaving at

most a name, a fading echo in a far corner of the world, their genius unused."

Wilson argues that the case for biodiversity as a form of ecological capital is quite different from the case for environmental capital as a set of material resources. It is not simply a resource input into a manufacturing process but the source of new products and innovation: a giant knowledge bank. The rosy periwinkle of Madagascar, for example, produces two alkaloids that can cure most victims of two of the deadliest cancers: Hodgkin's disease and acute lymphocytic

"Given the right economic and political framework, the more we utilise biodiversity, the more likely we are to cherish and protect it."

leukaemia. The income from the manufacture of these two substances exceeds 180 million dollars a year. Aspirin, the most widely used

pharmaceutical in the world, is derived from salicylic acid discovered in meadowsweet. In the US, a quarter of all prescriptions dispensed by pharmacies are substances originally extracted from plants, another 13 per cent come from micro-organisms and three per cent from animals. There is immeasurable untapped potential in thousands of other organisms.

Biodiversity will be protected only if we have an incentive to do so, and the best incentive is to show how useful biodiversity is. Given the right economic and political framework, the more we utilise biodiversity, the more likely we are to cherish and protect it. So far, however, attempts at valuing and protecting biodiversity have been marginalised and of limited success. Wilson makes

a powerful argument that our approach to animal husbandry, farming and medicines research, has been haphazard. Were we to make it more systematic and intelligent, we might realise the vast hidden riches in biodiversity in a sustainable fashion.

The way to save the planet's biodiversity is to open it up to sustainable, innovative human use. One possible way forward is the agreement that the Costa Rican government has reached with the drug company Merck, which pays an access fee of one million US dollars a year to be able to gather genetic material from Costa Rican national parks.

Many would say that this vision of benign exploitation is extremely optimistic, given our poor record to date. The richest nations preside over the smallest and least interesting biological environments, while the very poorest nations, with the fastest growing populations and relatively little

“Many would say that this vision of benign exploitation is extremely optimistic, given our poor record to date.”

to spend on science, are stewards of the richest ecosystems. The likelihood of the value created flowing back to

indigenous farmers, rather than to global corporations, is disputed. Vandana Shiva, founder of the Research Foundation for Science, Technology and Ecology, in New Delhi, for example, writes that “this resource base of the poor is under threat as their plants and seeds are patented and claimed as inventions by Western scientists and corporations, that deny the collective innovation of centuries of Third World peasants,

healers and crafts people who are the true protectors and utilisers of biodiversity.”<sup>12</sup> Far from promoting diversity, without systematic reform, international commercial investment could actually reduce it. Indian farmers used to cultivate 30,000 varieties of rice. By 2005 three quarters of Indian rice fields may contain no more than ten varieties. As well as the loss to biodiversity, there is a real risk that the livelihoods of small farmers will be eclipsed by the multinational life sciences companies that will straddle genetics, medicines and food production.

“Far from promoting diversity, without systematic reform, international commercial investment could actually reduce it.”

A further risk lies in potential applications of biotechnology. Uncertainties abound over the potential environmental consequences of the release of biotechnology products like genetically modified crops into the environment. Optimism over the potential for innovation must be tempered with foresight and precaution, to take account of the possibility of irreversible environmental damage.

Biodiversity will only be saved with knowledge exchange, technology transfer and investment on a world scale. This is an immense challenge, and we must be constantly aware of the dangers, both to people and to the environment, of poorly controlled biotechnology exploitation. As new knowledge-based industries, built on modern genetics and biology, as well as food production and tourism, emerge in biodiversity-rich countries,

they must provide local populations with an equitable share of benefits, to avoid exploitation of fragile ecosystems.

Of course, biodiversity conservation, sustainable use and equitable benefit sharing were chief amongst the goals of the 1992 United Nations Convention on Biodiversity. But the convention has been marginalised, and its success is patchy at best. Until the governments of richer countries invest properly in supporting less developed countries in

“Biodiversity should be regarded as a shared capital stock which companies can claim access to only if they reinvest in local ecosystems and culture.”

reaching these goals, it will be impossible to achieve the sort of change necessary. One way forward is more national agreements of the kind pioneered in Costa Rica, to bring together multinational capital and indigenous interests.

Biodiversity should be regarded as a shared capital stock which companies can claim access to only if they reinvest in local ecosystems and culture. If this is achieved, far from being the enemy of the natural environment, genetics, commerce, eco-tourism and innovative food production could possibly be among its saviours.

## new kinds of consumption

The convergence of the new economy and environmentalism could lead to far-reaching changes in what we consume and how we consume it.

There are four main ingredients to the new consumer culture that could emerge: an emphasis on services rather than physical goods, the dematerialisation of some consumer products, the virtualisation of others and, lastly, the impact of the new economy on consumer values and ethics.

### Services

The new economy will accelerate the rise of the service economy and shift us away from manufacturing, at least in developed countries. Computer and information technologies will continue to raise productivity in old industries

“By the year 2050 perhaps as little as five per cent of the population will be able to manage and operate in the traditional industrial sphere.”

2050 perhaps as little as five per cent of the population will be able to manage and operate in the traditional industrial sphere as we know it, according to Jeremy Rifkin, the American futurologist and commentator.<sup>13</sup>

and, as a result of this productivity improvement, jobs in manufacturing will decline and jobs in services will grow. By the year

Increasingly, people will value manufactured goods - like mobile telephones - for the services they bring: voice-mail, short-messaging, internet access. The falling costs of technology will allow more people to start service businesses using computers and communications: design, marketing, public relations and so on. Moreover, as the world becomes full of more efficient gadgets consumers will increasingly value

“Consumers will increasingly value experiences.”

experiences which make a lasting impression upon them, which give them a high, make them feel special and leave them with a warm glow. The new service economy is about delivering experiences to people, which in the words of American futurologist James Ogilvy means: “trading in what makes the heart beat faster.”<sup>14</sup> Similarly, B. Joseph Pine and James Gilmore tell companies that “in the emerging ‘experience economy’ companies must realise that they make memories not goods.” Car-makers, they argue, should focus on enhancing the all round ‘driving experience’, furniture-makers the ‘sitting experience’, clothing manufacturers the ‘clothing-experience’. Physical goods matter, but only to the extent that they provide people with the experience they want.<sup>15</sup>

In a world where technology delivers efficiency, personal service, creativity and skill may command a new premium.

A service-based economy could be more environmentally sustainable. Ireland's environmental accounts published in 1999 found, for example, that forestry and fishing accounted for 29 per cent of greenhouse gases while employing only 12 per cent of the labour force and generating only 8.5 per cent of national wealth. Ireland's service sector, however, generates 19 per cent of greenhouse gases while employing half the workforce and accounting for a similar share of gross domestic product.

But the rise of a mass service economy is not without its own environmental challenges. A shift to a service economy in one country may hide the fact that manufacturing has moved elsewhere - probably to developing countries - rather than disappearing. The search for new consumer experiences - the latest foods, the most exotic destinations - may not be environmentally friendly. Take the hotel complexes which ring the Indian Ocean Island of Mauritius. These vast hotels welcome hundreds of guests at a time, mainly flown in from Europe and South Africa. These hotels manufacture experiences for their guests. They are experience factories. The experience is not that of being on the island of Mauritius but of lying on a palm tree-lined, silver beach, bathed in blazing sunsets. Not only do these experience factories consume large quantities of towels, linen, detergents and cleaning materials, not to mention air-conditioning, but they also depend on global travel.

"The service economy could be less environmentally harmful than a manufacturing economy, but only if innovation is directed toward reducing environmental impacts to a minimum."

According to Rifkin, world tourism, the leading experience industry of the new economy, accounts for about 11 per cent of world gross domestic product and is projected to rise above 20 per cent by the year 2008, when the industry world-wide will be worth more than 7.5 trillion dollars.<sup>16</sup> Travel and tourism is a very large physical industry: it accounts for 7.5 per cent of world capital investment. Twenty years ago about 287 million people took international trips. In 1996 more than 595 million people travelled abroad.

The World Trade Organisation forecasts that by the year 2020 more than 1.6 billion of the expected world population of 7.8 billion will take a foreign trip. The experience economy of tourism leads to marine pollution, the destruction of fragile habitats, hotels that soak up scarce water and the consumption of massive quantities of aviation fuel.

Thus the service sector itself will need innovation to realise its environmental potential. Innovation in aerospace, such as hydrogen-powered engines, would be needed to allow more environmentally sustainable long distance travel. Hotel groups such as the Inter-Continental, the Scandic and the Taj Group in India have pioneered waste saving programmes in their hotels, to recycle materials and water. The service economy could be less environmentally harmful than a manufacturing economy, but only if innovation is directed toward reducing environmental impacts to a minimum. That means, for example, shifting the tax burden

away from labour and services towards materials, energy and consumption.

## Dematerialisation

We are producing more and more with less and less energy and material per unit of output. Physical products are becoming lighter, using fewer materials, and incorporating more software and electronics. Toyota, for example, estimates that electronics and software will account for 30 per cent of the value of its average car by the year 2005. The laptop computer I am using to write this pamphlet weighs about the same as the older model it replaced. Both contain similar amounts of plastic, gold, silicon and other metals. Yet this newer laptop is perhaps five times more powerful than the old one. This difference in power is entirely due to the way that the same physical ingredients have been minutely rearranged according to a new recipe. The improvements in power and performance are the result of human intelligence rather than additional materials.

The combination of computing power and communications has created the potential for e-commerce to reorganise physical retailing. Banks used to measure their market share by the total length of the counters in their branches up and down the country. These days most banks are investing in electronic services, delivered over the internet and digital television. These electronic services are much lower cost and far less energy intensive. And, of course, electronic banking does not require a customer to make a physical journey in a car to a bank.

However, estimates of the impact of e-commerce and dematerialisation generally vary considerably. On the positive side, a study commissioned by the RAC Foundation and the Motorists Forum estimated that road traffic would be cut by eight per cent by the year 2010 as a result of e-retailing. A reduction in car journeys to shops would be offset partially by a slight rise in vans making home deliveries. The ratio of energy used per book sold in a traditional bricks-and-mortar shop compared with Amazon.com is 16:1. Amazon's energy costs per 100 dollars of sales are three cents, compared with 44 cents in a traditional book shop. A recent report by the US Centre for Energy and Climate Solutions, estimated that e-commerce could reduce overall US CO<sub>2</sub> emissions by 1.5 per cent per annum between 2000 and 2007.<sup>17</sup>

However, other studies contradict this. A study commissioned for the Dutch association of transport operators, for example, predicted that e-commerce would lead to a 17 per cent increase in road journeys. The risk is that, as computers and other electronic devices become cheaper and as communicating with them becomes easier, so we will use more of them, more of the time. The internet will create a 24-hour economy in which the lights and computers are always switched on. In my family home in London, we have four kids, five computers, three mobile telephones, four landlines, two televisions, a microwave, electric kettle, washing machine, dishwasher and dryer and two ovens as well as numerous compact disc players, Walkmans and radios. Compare that with my grandparents' home in Pudsey, Leeds: they had

neither a television nor a car, their kettle went on the gas hob and they used their single telephone as if it were a luxury. As technology has got cheaper we use it more, and so consume more energy and raw materials, and dispose more quickly of products which have shorter lifespans. Any attempt to grasp sustainability must take these important changes in consumption habits into account.

## Virtualisation

Dematerialisation means doing more with less by making more efficient use of resources. Virtualisation is the spread of entirely intangible products: entertainment, information and software that can be delivered in the form of a computer file. As we discussed earlier, virtual music formats like MP3 involve none of the physical manufacture, storage and travel costs of the compact disc.

These virtual products create a completely different culture of consumption. A computer file can be endlessly replicated at little cost and with few extra resources. The environmental potential for the world's entire music, film, television and possibly publishing industries to move onto computer formats and away from physical formats is huge. Without the entrepreneurship of a handful of renegade software entrepreneurs who created companies such as Napster and Freenet, the potential of these new formats would not have come to public attention. There is no sign that left to their own devices the world's big record and video companies would have shifted from physical formats - compact discs, videos - to digital formats

that transfer content in the form of a computer file. Within the space of a few years the economics and the environmental impact of the entire world music industry could be transformed by a handful of twenty-something entrepreneurs.

However, there are a number of qualifications. First, these gains will take a long time to be realised, not least because consumer preferences will take a long time to change. Second, virtualisation is unlikely simply to displace the real economy of goods and objects but to enhance and complement it. The rise of home videos encouraged film viewing and helped to increase the number of people visiting cinemas. The same may be true of virtual and face-to-face communication. The internet allows more people around the globe to communicate electronically. As a result more may want to meet face to face. Global communications will encourage global trade and travel. Third, publishers will have to establish ways for consumers to pay for the files that they download, whether they are books,

films or music. Computer programmes such as MP3, Napster and Scour, which allow consumers to download and share files containing music and video, have alarmed the established industry because they allow consumers to get access to material without paying for it. The potential for these virtual services will only be realised with regulatory and other innovations to make sure that

*“As technology has got cheaper we use it more, and so consume more energy and raw materials, and dispose more quickly of products which have shorter lifespans.”*

content creators, publishers and distributors can earn a return from them. Fourth, a full assessment of the environmental costs of these products needs to take into account the entire system used to produce and distribute them. To play an MP3 file, a consumer also has to have a computer and other equipment which has to be manufactured and disposed of. Consumers may choose in future to download books from the internet, but if they then simply print them off at home onto high quality paper, the environmental gain over traditional books may be limited, or even negative.

Nevertheless, in policy terms, it seems clear that the environmental potential of virtualisation is very large. Not only should governments encourage the growth of virtual music, film, television and books through regulatory policies but they should also avoid tax policies, for example internet taxes, which hold back the development of these families of products.

### Consumer values

The new economy will be rich with information, including information about where and how products have been made. Modern production systems will generate this information as a matter of course. Consumers should have ready access to it. This could provide the basis for electronic eco-labelling of products. It should be easier for consumers to choose products on the

basis of whether they are made through environmentally friendly processes.

The internet is creating many new ways for consumers to buy products in groups, including buyers' auctions, sellers' auctions and reverse auctions. E-commerce allows consumers to aggregate their buying power in consumer clubs. Environmental consumers could form such clubs or mutuals to give their combined buying power the weight it lacks in the traditional high street.

But the new economy will also extend the reach of consumerism. The global communications revolution amounts to a globalisation of desire. Consumers all round the globe now have access to digital television and the internet and with that they can be reached by consumer marketing. The internet could also encourage consumers to shop around to find the lowest price, not the greenest product.

Of course that does not have to be the story. Improved information systems in production should give manufacturers and retailers far better information about the pollution created and resources used in making a product. Improved environmental auditing and accounting should allow that information to be collected and analysed far more systematically, and passed on to consumers in a manageable form.

“The environmental potential of virtualisation is very large. Governments should encourage the growth of virtual music, film, television and books through regulatory policies.”

## new kinds of production

As well as reshaping what we consume and how we consume it, the new economy will reorganise the way we produce goods and services.

### Local or global?

The falling cost of technology could make it economic for more people to work in smaller units, possibly at home. This could mean fewer journeys, less commuting and less use of inefficient office space. As technology costs fall, and with them production costs, so the internet could allow local small markets to flourish.

But the new economy is also propelling a process of globalisation and consolidation, which is creating global brands of immense scale. Greater

“As technology costs fall, and with them production costs, so the internet could allow local, small markets to flourish.”

specialisation and greater scale are parallel responses to the rise of a more globalised economy. Information technology is allowing the creation of far more dispersed, complex and opaque production networks. In the old industrial economy, organised within national borders, it might have been possible to identify the factory that made the goods and emitted the pollution. These days most manufactured products - shirts for example - are made by complex, elongated networks. Identifying who, in these

networks, bears responsibility for pollution is difficult when the basic material might be woven in one east Asian country, dyed in another, finished in another and packaged in Hong Kong, before being shipped to retailers in Europe.

### Intelligent production

New technology should allow companies to make far more efficient use of physical capital. Better measurement of how production processes operate - everything from steel furnaces and chemical plants, to painting and cleaning cars - should enable companies to eliminate waste and use capacity more efficiently. As a result the yield from a fixed piece of capital should go up, replacement costs should go down and waste should be minimised.

Manufacturing companies have long recognised that increasing the productivity of existing equipment reduces the need to invest in costly new plants. Texas Instruments, the semi-conductor maker, estimated in the 1980s that small improvements to quality in its existing chip plants had increased yields to such an extent that it was the equivalent of building an additional production plant.

The same argument applies to our transport system. Within the next decade motorways and major roads in the UK ought to be fitted with a

system of sensors to collect information about traffic flows. This information will be analysed and disseminated via a range of new systems, such as gantries above roads and in-car navigation and communication systems. This improvement in information should mean that we will need fewer new roads, although it will not reduce the number of cars on the road.

Public transport could also be a major beneficiary of better information systems. One of the main disincentives for using public transport is the time it takes to transfer between trains, taxis, buses and other modes of transport. On some estimates up to 50 per cent of journey time can be taken up with changing modes of transport. Better information and planning, including integrating taxis and mini-cabs into public information systems, should make it easier to plan a journey from beginning to end and thus make public transport more attractive.

Simply having the information is only the first step; what policy-makers and managers do with it is what counts. Real gains may well come only when this flow of information is used to underpin new approaches to road and journey pricing, which in turn will require both political and social innovation.

### Innovation in production

As we have stressed, the real heart of the new economy is not a particular technology, nor an industry, but the process of innovation. Advanced

economies invest systematically to produce innovation. It is a powerful force behind the knowledge-driven economy and it will be the critical ingredient in our ability to solve our most pressing environmental problems.

The case for this approach is put powerfully by Amory Lovins.<sup>18</sup> He argues that production processes can be made more efficient and less environmentally harmful by redesigning them from scratch. This ‘whole-systems-redesign’ approach is a prime example of how we can generate win-win innovations that simultaneously improve competitiveness and the environment.

The traditional view is that regulations to promote improvements in environmental performance are at odds with competitiveness. Firms make choices about their optimal, lowest-cost

production strategies and environmental regulations simply add costs to them. But in the knowledge-driven

economy, environmental regulation could have a new role within a wider process of innovation. Open markets and tough environmental standards, when combined intelligently, may be the best way to spur innovation.

“Environmental regulation could have a new role within a wider process of innovation. Open markets and tough environmental standards, when combined intelligently, may be the best way to spur innovation.”

What is the realistic scope for such innovations? Take pollution as an example. Pollution is a form of waste: the unnecessary or inefficient use of materials. Waste is the result of poor process control and design. The best way to reduce pollution is not to treat it as it emerges from the process, but to redesign the process itself. That process of redesign means making production more knowledge-intensive. It means both embedding knowledge in the process at the outset, through improved design, and building in better information-gathering to production processes so that they can be monitored and controlled more accurately.

The Massachusetts jewellery company Robbins was facing closure for violating waste discharge regulations.<sup>19</sup> The company developed a new waste management system, which purified wastewater and re-used it. The water was 40 times cleaner than in the city's pipes and helped to improve quality as well as reducing discharges to zero. Robbins saved more than 115,000 dollars per year in water, chemicals, disposal costs and laboratory fees. The company reduced water usage from 500,000 gallons per week to 500 gallons per

“The best way to reduce pollution is not to treat it as it emerges from the process, but to redesign the process itself. That process of redesign means making production more knowledge-intensive.”

week. The capital cost of installing the new water purification and recycling system was 200,000 dollars. A wastewater treatment plant that would have enabled Robbins to comply with environmental regulations would have cost 500,000 dollars. Similarly, Du Pont has installed better information technology systems that allow it to reduce downtime caused by interruptions to production, thereby reducing waste generation.

BP, which emits roughly double the amount of carbon dioxide as Portugal, has introduced an internal emissions trading scheme, to reduce its CO<sub>2</sub> emissions by ten per cent, in response to the Kyoto protocol. Prompted by international agreement to reduce emissions, the company has developed a scheme which makes environmental gains, whilst improving competitiveness and establishing the company as a market leader in emissions trading.

As the BP example shows there is clearly a role for both market competition and demanding standards to drive environmental innovation. This approach works with the grain of the knowledge-driven economy, not against it.

## new forms of ownership

The full potential of this innovation-driven approach to making companies both more competitive and sustainable may only be realised with far reaching changes to the way we view ownership of assets and products.

The new economy is built on weightless foundations. The products we use we increasingly

“The new economy is built on weightless foundations. The products we use we increasingly value for the intelligence and service they embody.”

value for the intelligence and service they embody. As a result, both consumers and companies may shift quite

profoundly their attitude towards physical products. In the old industrial economy, ownership of physical products and assets was essential. Owning a car or a stereo was a badge of honour for young people. In the new economy, outright ownership of physical products may come to matter less as consumers and companies value assets more in terms of the services and experiences they produce.

Knowledge-intensive products, like software and recipes, never cease to be the property of the owner when they are transferred to a user. A recipe does not stop being Delia Smith's when it is used by a cook at home. The cook at home, in a sense, becomes part owner or borrower of the

recipe for just as long as they need it. Computer users increasingly download software from the internet as and when they need it rather than owning it outright. The pure knowledge products of the knowledge economy are not consumed and owned in the way that physical products were: they are licensed, leased and shared.

Companies and consumers will increasingly seek to minimise the costs of owning assets that they do not need all of the time. People will increasingly regard products as commodities. They will want access to products as and when they need them. Take cars as an example. One small car is very much like another small car. Cars are simply a means to an end: the completion of a journey. In future consumers may be more interested in how to complete a journey in the most efficient way, rather than in buying a car which may sit outside their home most of the year unused.

Rather than owning a car people might become increasingly interested in a journey service. They would lease or borrow a car only when they need it, complementing this service with taxis, buses and trains.

“The pure knowledge products of the knowledge economy are not consumed and owned in the way that physical products were: they are licensed, leased and shared.”

The environmental potential of this shift from owning towards leasing, borrowing and sharing has been highlighted both by Amory Lovins and by Jeremy Rifkin.<sup>20</sup> Rifkin reports that in less than 18 years non-commercial auto leasing has risen from obscurity to encompass one in three cars and trucks on US roads. One-third of new vehicles remain the property of the car-makers or dealers who lease them to the customers. Half the luxury cars on US roads are leased. In Germany about 20 per cent of cars are leased, but mainly by companies. In the UK Mercedes Benz runs a pool leasing scheme in which customers can lease whatever car they want, when they want it, within an agreed price range. Were a family to need a people carrier for their annual holiday, they could get one, return it after they had used it and then get a saloon for the rest of the year. Pool leasing schemes of this kind transform the car from the owned property of the customer into a service provided by the dealer. According to Helmut Werner, the chairman of Mercedes Benz, “We do not want to just sell another car but rather offer a complete package of transportation services.” Rifkin points out that city car clubs are sprouting across Europe, although car sharing schemes have had mixed success.

Many companies now lease assets that they used to own outright. Increasingly companies do not want to own assets that are not core to their business or which they have no particular expertise

in managing. Stan Davis and Christopher Meyer argue in their book on the new economy *Blur*: “We need to walk away from the idea that owning or even controlling capital is a necessary resource for fulfilling market need.”<sup>21</sup> Davis and Meyer argue that in a fast-paced economy ownership of fixed assets and equipment will often hinder a company’s ability to move from one business to another. Instead companies will use assets just-in-time, as and when they need them. Davis and Meyer’s maxim for fixed assets like land, offices, computers and machinery is: ‘Use it, don’t own it.’ About a third of business machines, equipment and vehicles are leased in the US. Knowledge-based companies need to own and retain their real assets: their people and the culture which binds them together. The offices, furniture, cars and machinery can be bought in from elsewhere.

This shift from outright ownership to leasing could result in significant environmental gain.

“In a fast-paced economy ownership of fixed assets and equipment will often hinder a company’s ability to move from one business to another.”

Leasing means that producers retain ownership and ultimate responsibility for the product. That gives the manufacturers an incentive to make the product as robust and

durable as possible, extending its life. The manufacturer would be responsible for disposing of the product. That would give them an incentive to design in materials which can be easily recycled, thereby minimising waste.

Take as an example the gain-sharing agreements between major car manufacturers in

the US and chemicals suppliers. Chrysler has a shared savings agreement with PPG Industries, which is responsible for all chemicals related to the cleaning, treating and coating of Chrysler car bodies. Chrysler does not buy the paint from PPG. It pays a fixed service fee for delivering the finished coated car. In effect Chrysler has found a leasing/licensing solution to car painting. Chrysler and PPG share the gains that come from better usage of materials. This approach has give PPG a different incentive. In the past it made money by selling Chrysler more paint which would generate

more waste. Under the new arrangement PPG will gain by selling Chrysler fewer chemicals, not more. The agreement is made possible because more sophisticated process control technologies allow both sides to monitor it in detail.

This example, and many others, illustrate that when better information about yields from capital equipment is combined with the shift towards leasing and outsourced ownership, it can lead to dramatic environmental improvements.

# the way forward

A new synthesis is emerging from the convergence of the new economy and the spread of the environment movement. Thirty years ago both were on the margins of the economy, politics

“The combined rise of the new economy and growing environmental awareness will not solve our environmental problems overnight. It is far from a magic bullet. However it has created an opportunity.”

influence over how our societies develop. This influence will extend from the local detail of how we shop and travel, to global issues such as the potential for biodiversity to provide the basis for knowledge-based industries.

The combined rise of the new economy and growing environmental awareness will not solve our environmental problems overnight. It is far from a magic bullet. However, it has created an opportunity. More of the economy, at least in the developed Western economies, is dematerialising. We are doing more with less: consuming more products in which the value rests in software, communications, entertainment, and service. This shift should, in the long run, create opportunities

and society. These days the new economy and the environment, combined, will exert a huge

for us to combine economic growth with sustainable development. Innovation is the ultimate source of competitive advantage in this knowledge-driven economy, and also the ultimate solution to our most pressing environmental problems, which will only be resolved through a cycle of technical, scientific, social, organisational and political innovation.

Very little of the potential of this new synthesis lies purely in science and technology. It seems more environmentally sustainable to listen to music using an MP3 file than on a compact disc, watching streamed video on your computer than at a cinema, shopping from home over the internet, than driving to a vast mall. But making these products and services more environmentally friendly, in

the long run, requires not just technical but social change. It might be more

environmentally friendly to read a book on a specially designed computer. But if every reader of *Bridget Jones's Diary* had downloaded the book from the internet and printed it off on a home printer,

“Innovation is the ultimate source of competitive advantage in this knowledge-driven economy, and also the ultimate solution to our most pressing environmental problems.”

then that would probably have been less environmentally efficient than buying books made in environmentally efficient factories, using recycled paper. Simple, direct comparisons between electronic and material products provide a misleading account of environmental costs and benefits.

The new economy will develop along more environmentally sustainable lines only if scientific and technical, social, organisational and political innovations work in combination. Governments, national, local and international will play a critical role in stimulating this innovation by setting standards, investing in research and creating new networks and linkages within the economy. Governments can help to create capabilities, through investment in science, research and development; they can stimulate linkages between science and business to exploit these new technologies, and they can promote innovation in consumer markets, by setting

demanding standards and encouraging competition. However, the lion's share of the innovation itself will have to come from business and consumers working together.

The new economy could provide us with new impetus on the path to sustainable development. But the potential for the new economy to develop along sustainable lines will only be realised by careful policy which works with the grain of both the economy and the environment, and which promotes the synergies we have identified. Policies which have hitherto been experimental or hesitant - valuing intangible assets, providing incentives for innovation, developing regulatory systems which encourage the responsible use of biodiversity resources - will need to become mainstream and bold. The following principles, recommending specific ways forward, begin to map out how we could seize this opportunity while it is open to us.

*"The potential for the new economy to develop along sustainable lines will only be realised by careful policy which works with the grain of both the economy and the environment."*

## ten principles for greening the new economy

### Valuing the intangible

The Government, working with accounting bodies, should develop and reach consensus on new measures of economic activity, to bring together assessments of the value of intangibles, such as knowledge and assessments of environmental impacts. These new measures should work at the level of national and corporate accounts, to provide a more rounded assessment of the total costs of an individual product. Environmentally, they will have to measure not just emissions but materials usage, disposal costs and related environmental impacts. They should be linked into traditional financial and economic accounts. The aim should be for an EU-wide standard environmental accounting system for intangible assets, for both nations and corporations.

### Protecting biodiversity

In the run-up to the tenth anniversary of the UN Convention on Biological Diversity, in 2002, the UK government should encourage a thorough assessment of its implementation and effectiveness. Informed by these findings, leading international institutions should launch a new programme to spread best practice in protecting biodiversity. The aim of this programme must be to co-operate with developing countries to better protect the quality of fragile ecosystems by developing them as centres for tourism, and sources of information on genetics, rather than as sources of raw materials. The vision of biodiversity protected by more intelligent global husbandry will only be realised if there is a global transfer of knowledge and funding, to combine the know-how of indigenous farmers with the scientific know-how of life sciences companies. That will require new institutions and channels through which that knowledge and investment could flow; and new joint ventures between global companies, governments and farmers, to share both knowledge and benefits.

### Sustainable services

The UK government, working with the EU, should develop a manifesto for a sustainable service sector. As more of the developed Western economies become service-based and more affluent consumers demand services from around the world, there is an opportunity for the service sector to grow on the basis of high standards. The main focus should be the world tourism industry.

### Encouraging the virtual

The UK Government should carry out, in conjunction with other governments, a thorough assessment of the benefits of shifting from physical to virtual products, such as MP3 and other computer formats. This should be a major influence upon tax and regulatory policies. For example, it may be that there could be huge environmental gains from a rapid uptake of MP3-style formats, which could justify differential taxation and approaches to regulation.

### New green consumerism

The green movement should be at the forefront of attempts to create a green consumer culture on the internet. It should create green consumer clubs to aggregate buying power, and provide more environmental information to consumers on-line. As more information becomes available, consumer decisions, and resulting changes in prices, could create a new impetus for green consumerism.

### Encouraging corporate responsibility

The UK Government should explore the possibility of preferential treatment to promote leasing schemes with an environmental aim, designed to encourage manufacturers and retailers to take more responsibility for the total environmental impact of their products. Laws to make producers responsible for disposing of a product are aimed at a similar outcome. Once again, the environmental gains from these new approaches to ownership of household products, like fridges and computers, might be so great that they would warrant tax concessions to promote them.

### Promoting innovation

Governments should review product and process regulations so that they are designed to promote, in the context of competition, innovations which are both good for competitiveness and good for the environment. One of the government's roles should be to design regulations for manufacturing and services processes as well as for products, which promote experimentation and innovation. This means shifting the onus away from using 'best available technology' as the basis for regulation. Instead regulations need to mandate outcomes and general processes, rather than particular technologies. The Government's role should be to set ambitious targets that can only be achieved through radical innovations in the way we work, and use materials and energy.

### Encouraging knowledge-sharing

The government should work with industry to sponsor more sharing of information, practice and knowledge, particularly among clusters of companies and along supply chains, to spread environmental best practices.

### Innovation and clusters

Most innovation takes place among clusters or networks of companies, often linked to a university which provides a knowledge base and large companies which provide a route for innovations to reach the market. Silicon Valley in California and Silicon Alley in New York are both outstanding examples of these clusters, where new ideas are shared quickly between firms that are often competing and collaborating. To develop environmental innovation we need a concerted 'green valley' initiative, to create two or three centres of excellence in environmental technologies. They should be linked to business incubators and accelerators to seed and grow businesses that could market environmental technologies. The green valley initiative would only work if it engaged the collaborative effort, know-how and resources of universities, scientists, entrepreneurs and big companies.

### Environmental entrepreneurship

The Department of Trade and Industry, with the Department of the Environment, Transport and the Regions, should jointly investigate how to promote a new breed of environmental entrepreneur. Environmental entrepreneurs would not be confined to developing businesses around new environmental technologies. Most would be like James Dyson, the household appliance innovator, who regards the environment as a vital ingredient in mainstream product and process design. The Department for Education and Employment should encourage universities and business schools to incorporate environmental issues within mainstream business education and MBA courses.

Amory Lovins, Jeremy Rifkin and Edward O. Wilson write from very different perspectives and disciplines, but they all alert us to the opening of a new way forward for the economy and the environment. It is a way forward in which innovation can feed competitiveness and environmental sustainability, efficiency and biodiversity. We will only find our way through with new ways of thinking, provided, for example, by the synthesis of economics and biology, as well as new ways to combine competition and regulation to realise the innovations they promote. The way forward will require us to innovate new solutions, which combine new technology, tough standards, competition and knowledge-sharing.

“We will only find our way through with new ways of thinking, provided as well as new ways to combine competition and regulation to realise the innovations they promote.”

It would be a mistake naïvely to believe that we have entered a new promised land in which the interests of business and profit can be magically reconciled with the interests of tropical forests and poor peasant farmers. However, it would also be a mistake to turn our backs on the opportunity opening up before us: a chance to explore new territory that did not exist 30 years ago, and of whose existence even ten years ago people were only dimly aware, a territory in which the interests of the innovation-driven, knowledge economy and the environment may converge. There is no such thing as a free lunch, even in the new economy. With the right framework of regulation and market competition to drive innovation, though, we could cut the environmental cost of lunch substantially.

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## Mind Over Matter by Charles Leadbeater

In the new economy, matter matters less. Ideas, creativity and innovation are replacing physical assets as the key to competitive success.

Real environmental gains could flow from this shift. A high-tech, knowledge-based economy could go hand in hand with dematerialisation and resource efficiency. The shift from bricks to clicks could reduce traffic congestion. And the internet offers new ways to empower ethical consumers.

But there are dangers, too. Will increased efficiency lead to ever more consumption, as prices fall? Will globalisation help companies evade environmental standards? And will the leading lights of the new economy embrace the environmental ethic?

In *Mind over Matter*, Charles Leadbeater offers a compelling vision of the environmental opportunities of the new economy, and outlines the political and cultural innovation needed to ensure that the new economy is cleaner, greener and more competitive than the old.

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