THE CITIZEN IS WILLING, BUT SOCIETY WON'T DELIVER

THE PROBLEM OF INSTITUTIONAL ROADBLOCKS

Norman Myers and Jennifer Kent

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"As this book well demonstrates, many of the ways in which we manage our societies need radical revision. Too often we are locked into wrong ways of thinking, particularly in the field of economics. The focus should be on wellbeing rather than mere productivity. This book lays out the pathways of change."

Sir Crispin Tickell, Director of the Policy Foresight Programme at the James Martin Institute for Science and Civilization, University of Oxford.

"Myers and Kent have again put their fingers on an essential problem of our time—and on its solution. If we really want to *solve* the interconnected problems of climate disruption, biodiversity loss, poverty, and sustainability (rather than arguing about them), this book is a must read and this approach is a must do."

Professor Robert Costanza, Gund Institute for Ecological Economics, University of Vermont

"This great book is about one of the most dangerous aspects of our time. We know how to deal with most of the problems—there are pragmatic solutions—but all too few in society are taking any action. Instead, there is paralysis."

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"With insight and style alike, Myers and Kent have produced an imaginative analysis of the many roadblocks that prevent us from achieving a sustainable world. Dissecting the massive problems that confront us, the authors have produced a powerful book that will contribute to our knowledge of how to tackle problems and turn them into solutions."

Peter H. Raven, President, Missouri Botanical Garden, St. Louis

Dedicated to governments who will start to govern and
to leaders who won’t get so far ahead of the band
that they can’t hear the music.

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BOXES

FOREWORD

This has certainly been one of the toughest of our books. When we came to write about Institutions and their Roadblocks, we found we had to wrestle with economics, politics, environment, law, government, governance, civil society, and a lengthy list of other sectors—plus (and this was the hardest bit to figure out even though it was the most important) their many interconnections. In the world outside the window, a proliferant fact of life lies with linkages, yet it's often viewed as rather an alien concept. We like to divide up our world into "manageable" chunks, even though that is to compartmentalize what truly can't be compartmentalized at all. Then there's been the challenge of making institutions sound like an interesting phenomenon. They are hardly an issue to send the pulse racing, nor does one hear much about them over a dinner party, even though they are the very stuff of everyday life for all of us. They set the rules of the game for the bulk of our interactions with each other.

The International Institute for Sustainable Development based in Geneva and Winnipeg, has offered support to us in many forms over many years, for which we are very grateful. Special thanks to Mark Halle and Javed Ahmad in Geneva and Stuart Slayen in Winnipeg, who have agreed to disseminate the findings in short order. Your triumvirate efforts are much appreciated.

We are also grateful to an army of friends, colleagues and other collaborators for their help and support as concerns an unusually complex and—better accept it—prickly topic. We have frequently called upon their expertise on all manner of issues, benefitting from their skills scientific, economic and political. The following have been specially helpful: Aidan Dodson, Sam Evans, Alastair Gray, Cameron Hepburn, Lucas Joppa, James Keay-Bright, Lord John Krebs, Jeff McNeely, Bill Manley, Richard Norgaard, Stuart Pimm, Steve Rayner, Chris Scarre, Kate Spence, Sir Crispin Tickell, Bruce Trigger and Toby Williamson.

Most helpful of all has been Wren Wirth of the Winslow Foundation in Washington DC. For a fourth time she has supplied munificent funding for a research/writing project, and without her support there would have been no book, period. Without your help, Wren, there would have been no mega-scale projects such as "Perverse Subsidies", "Food and Hunger in Sub-Saharan Africa", or "New Consumers." What better way to express it than to say that we owe a large part of our careers over the past decade to you!

Norman Myers and Jennifer Kent
October 2008

1. INTRODUCTION: WHAT'S THE PROBLEM, WHERE'S THE SOLUTION?

"If, in our everyday lives, we know what is the right thing to do, why don't we do more of it?"
Socrates 469–399 BC

When I (NM) wake up in the morning, the first thing I do is switch on my bedside light. I don't stop to think that I am starting my day by burning electricity that is heavily subsidized and thus artificially cheap, and hence is often used wastefully by consumers such as myself. Nor do I pause to consider that the electricity has almost certainly been generated by fossil fuels, also heavily subsidized. All this means that, however unwittingly, my first act of the day is to contribute to climate change, especially global warming, that will be a central focus of my work throughout the day while I rail against those many fellow citizens who should be finding ways to head into a future free of "cheap" electricity and fossil fuels. What I shall urge with my word-processing right hand I shall have partially undone already with my wasteful left hand.

In turn, I should reflect that a central focus of a different sort lies with the fact that climate change is going to dominate everybody's lives for centuries. It is going to transform our environments, our economies, our lifestyles, our outlooks, our aspirations for all our futures. In the view of many leading climatologists, it will—unless we take immediate steps to tame it—alter the face of our planet almost beyond recognition. Many experts tell us that climate change will set back our economies by as much as 50 years, possibly much longer. Some of the best climatologists tell us that if we ever decide we don't like global warming and want to get back to a familiar stable climate, that will take at least 1,000 years (Hansen et al., 2006; Schneider, 2004).

Relative to these downside futures, our present efforts to fix climate change are puny indeed. So why don't we get on and truly fix the problem? Answer: when it comes to confronting challenges of a nature and scale that are altogether new to us, we lack the institutions—government systems, economic mechanisms, scientific bodies, legal frameworks, media networks, citizen activism, etc.—of sufficient scope to deal with the problems. In short, we are caught with our institutional pants down. We have simply not developed the ways and means to handle problems such as today's. Rather the opposite, in fact: as this book demonstrates, we run up against what we might term "institutional roadblocks" (IRs), which means that those institutions we do possess are bedevilled by all manner of deficiencies, as epitomized by the munificent subsidies that promote artificially cheap electricity and fossil fuels, and thus foster consumers' wastefulness.

The electricity saga

Back to the saga of my getting out of bed and climbing into my day. If I were to ponder my first act and decide I want to do something about wasting electricity, I might suppose I could try to get up without the electric light. But it wouldn't take me long to figure that's a non-starter because I need to see my way around the bedroom, gather up my clothes off the floor, find a matching pair of socks, and fix all the other essentials before I even make it across the bedroom and into the bathroom. And anyway, I've already fitted a long-lasting and energy-sparing light bulb, and I've signed up for green electricity. The biggest anomaly by far is that electricity is still far cheaper than it ought to be. Insofar as it stems from fossil fuels, the price should reflect all costs, especially costs of pollution and notably the billions of pounds that Britain spends on the ill health effects of dirty skies over our cities. And, the big "and", we still do not have sufficiently good estimates of the long-term costs of climate change, even though they will surely be many times greater than all the conventional forms of pollution put together.

Bottom line: When electricity appears to be cheap, consumers switch on lights without thinking, and they rarely do much thinking about switching off lights that are wasting electricity. In my own case, it is altogether likely that I shall wander off downstairs and forgetfully leave the bedside light burning. Oh well, responds my half awake head, that's life—except that it's not that way at all, it's the road to ruin by courtesy of climate change. Much the best way for me to play my part in resisting climate change is to pay an electricity price that covers all costs, which I shall do when the electricity company starts to charge as much as it should. There is no better educator than the wallet. But—here we go again, another "but" to distract me from responsible behavior—the electricity company will not make its electricity more expensive unless all competitor companies are obliged to do the same. The way to do that is to persuade the government to cancel electricity subsidies until the price matches costs.

In short, more expensive electricity would be good for both the climate and my conscience. It would eventually help to save millions of lives from hurricanes, tidal waves, storm surges and other freak weather phenomena. Further down the road it would help to save tens of millions of lives from famine and starvation as a result of climate change-induced droughts and floods. It would ultimately help to save hundreds of millions of lives from all these disasters taken together, plus many more we can barely anticipate as yet. Also significant is that dearer electricity would save trillions of dollars from damages due to assorted economic impacts of climate change.

So why haven't governments done the "sensible" thing long ago by tackling climate change head on? Well, governments aren't like that. Consumers like cheap electricity right now even if it will prove horrendously costly in the long run. Result, governments are reluctant to get rid of electricity subsidies. After all, electricity companies may well have offered financial donations to political leaders at election

times, i.e., "inducements" to keep their hands off those munificent subsidies. Plus lots of other factors that militate against a rational electricity sector (Flannery, 2006; Pearce, 2006).

Reader, why not take a moment to figure out what else is at work to distort the workings of the energy sector as you experience it during your daily round. If you do gain insight into something of what's what, and follow the chain of "culprits" from start to finish, you will have done more to stave off climate change than thousands of your fellow citizens who, in this sense at least, stay stuck in waking up mode throughout the day (and throughout their lives?). I know because I've been expert at it.

In summary of my day thus far, I find myself pondering that the bedside light is not a problem in itself. It is a symptom of a problem, the true problem being the overly cheap electricity. In turn, that is due to something so obtuse as subsidies. I glare at the subsidies as the source of the problem, and I make a mental note to track down, sniffer dog style, the root cause of my bedside light issue. How could I have been so dumb as to confuse a symptom of a problem with its source?

The water connection

Following the saga of the bedside light, I stagger off to my bathroom. As I brush my teeth, I take care to switch off the tap so as to save precious water. Not that water is usually scarce in Britain. But it turns out that my lifestyle serves to make water scarce in lands way beyond the horizon of Britain—and, more importantly, beyond the horizon of what I sport between my ears. The global water situation is that many countries suffer severe shortages. More than a billion people use no more water each day for all purposes—washing, sanitation, cooking, the lot—than a rich-world person uses each time he or she flushes the toilet. Worse, the "thirsty total" is expected to keep on soaring. Water-short people can quickly become violent people. Already there have been confrontations over water between Israel and Palestine, Egypt and Ethiopia, India and Pakistan, and India and Bangladesh. Water wars ahead, anyone (Postel, 2005; Gleick, 2004)? Don't bet against it. Some 5000 years ago, the Sumerian cities of Ur, Kish and Uruk went to war over waters of the Tigris and Euphrates rivers.

What, you might wonder, does all this have to do with "rainy" Britain? Turning off the tap while I brush my teeth won't help the parched croplands of Asia or Africa. But there are all kinds of water feedbacks that link our consumerist lifestyles with far-off farmers in developing countries. Consider your early-morning caffeine fix in the form of a cup of coffee. While savouring the smell, figure that if the coffee beans have been grown in Ethiopia, that will quite possibly have been at the cost of over-pumping underground water stocks to irrigate coffee plantations. Every cup of coffee requires roughly 140 liters (560 cups) of water. Plus, a teaspoonful of sugar in the coffee takes

another 50 cups of water to grow the sugarcane in some distant tropical country (Hoekstra and Chapagain, 2007; see also Pearce, 2006; Sims, 2006; Ward, 2006; World Water Council, 2004). Parts of several countries growing coffee or sugar have already been suffering droughts, and the rich world's water connection can turn a tough situation into a full-blown crisis.

So my morning cup of coffee will have used more than 600 cupfuls of water in those distant tropical countries before the coffee reaches my lips. In other words, I am engaged—inadvertently but effectively—in importing "virtual" water from distant lands. And if my breakfast includes tomatoes from Morocco, mangoes from Kenya, avocados from Israel, or the many other items that stem from other water-short countries, I am contributing to a sizeable problem, however unaware I might be. So too if my breakfast includes pineapple or banana or other tropical fruits, many of which could well have come from countries that are over-using their water stocks.

In short, water is becoming scarce in many lands because of consumerist demand in distant countries, and it is not easy to keep an eye on the proliferant linkages that often make water scarcer still. You may even be helping rivers to run dry, as has happened with China's Yellow River and with dozens of other rivers that will shortly become dry (Postel, 2005; Cain and Gleick, 2005; Ward, 2006). I am sure I often play my part in these dire dislocations of water supplies in far-off thirsty regions.

The feedback loops of everyday living

Even if I could keep an eye open for the multiple linkages that are a front-rank factor of modern-world life, I could not take direct action about many of them. Every time I boil the kettle for a cup of coffee and heat enough water for two cups rather than one, I am using unnecessary electricity and thus contributing to the day when one fifth of Bangladesh and tens of millions of its people suffer permanent sea-level rise. There is no institutional mechanism to enable me to meet up with any of those Bangladeshis and discuss whatever arrangement might help to resolve the problem. The same applies to the hundreds of other linkages that I shall engage in throughout the day.

To be a trifle technical: can it be that the guts of the problem lies with lack of "feedback loops" that would keep us in better touch with our lifestyles' impacts around the world? Well, that is why we need institutions: a single international agreement can facilitate the needs of millions of individual citizens at a stroke. We have thousands of such agreements, and many of them work surprisingly well (the postal system for one; aviation regulation for another). But as more people with more demands want to negotiate more settlements with more fellow globalists, we stand in dire need of many more institutional supports. Right now we aren't even keeping up with the game, let alone getting ahead of it.

Lifestyle linkages are a basic fact of life for people in all parts of the planet. For the most part these linkages are as covert as they are disruptive, and proliferating as international trade grows in many forms and directions. True, there is often nothing wrong with globalization per se; in fact it can serve as a powerful source of economic growth for poor countries (Goldin, 2007; Stiglitz, 2006). But as we have seen, the prices of globalized goods rarely cover all costs of production, indeed they often reflect only a small portion. It is not that the principle practitioners of globalization are wantonly anti-social people; quite the contrary, they can justifiably claim to be (so far as they know) upright citizens to rank with the best. Nonetheless they, or rather we, are wrecking the planet with unholy vigor through our addiction to "reasonably" cheap products of many a sort.

All in all, then, my consumerist hands at dozens of points throughout the day are busily undoing much of whatever good I achieve by writing books such as this one. I shall have undertaken these destructive activities in all innocence, urged on by distortive pricing systems, absurd subsidies, marketplace madness, governments that won't govern, and a host of other institutions gone awry. I shall be largely unaware of my impacts if only because there are so many of them. Even by the end of breakfast I shall have taken one free ride after another on the backs of my fellow citizens, and I shall take many more during the course of the day.

Institutional snafus: a sampler

Finally, note a sampler of institutional snafus, these being snafus because they illustrate how institutions of many a sort can sometimes generate adverse consequences. They let us down, they cost us dearly, they work unfairly, and they undermine our best efforts to live together agreeably and equably.

- In the year 1900 when travel was mostly by horse and carriage, Londoners travelled at an average speed of 15 kilometers an hour. During the last century the city spent the equivalent of one trillion dollars on roads, bridges, tunnels and the like. Result, Londoners still travel at an average speed of 15 kilometers an hour.
- No major country is more dependent on scarce water than Egypt with its River Nile, yet the government charges consumers less than one fifth of the cost of supplying water, thus generating an incentive for consumers to use water wastefully (de Chatel, 2005).
- Fossil fuels are the main source of climate change and other forms of grandscale pollution, yet they are among the most heavily subsidized of all economic sectors—whereas they should be severely taxed (Myers and Kent, 2001).

- Our prime economic measuring device, Gross National Product, tells us that any economic activity will expand the economy and hence contribute to human wellbeing. What about the person who has been dreadfully burglarized, has been involved in an appalling car crash, is fighting a costly divorce, and has been diagnosed with long-term cancer? All these entail lots of economic activity and supposedly they thus add to the sum of human happiness (Hawken, 1997).
- In 2006 Britain exported 1080 tonnes of butter to France—France in turn exported 5406 tonnes to Britain (lorries passing in the night?). Similarly, Britain exported 669 tonnes of gingerbread and other biscuits to various trade partners and imported 586 tonnes (why not simply swap recipes?) (Simms and Johnson, 2007).
- Over 9 million people die of hunger every year, 6 million of them children. One of the U.N. Millennium Development Goals pledged to halve the proportion of people suffering hunger between 1990 and 2015. Reducing the 20% total in the developing world to 10% is not so much of a success as it sounds since the 823 million of 1990 would fall to "only" 600 million. Far from decreasing, the latest figures show an increase to at least 925 million (Food and Agriculture Organization, 2006; see also Diouf, 2006; United Nations, 2008; UN News Centre, 2008; FAO/World Food Programme, 2008). According to the Food and Agriculture Organization, a funding increase of just $24 billion per year could do the job and eventually reap $120 billion in enhanced human wellbeing (Food and Agriculture Organization, 2006).
- A European Union cow receives subsidies of $2 per day, almost as much as it would get if it were one of the three billion poorest people in developing countries. Yet European taxpayers, through their governments, ostensibly protest they cannot afford more support for developing countries' agriculture (Stiglitz, 2006).
- The U.S. government subsidizes energy costs so that farmers can deplete aquifers to grow alfalfa to feed cows that make milk that is stored in warehouses as surplus cheese that does not feed the hungry (Hawken, 1997).
- A typical American taxpayer forks out around $2500 per year to fund harmful subsidies, then pays another $1500 to repair environmental damage and in higher food prices (Myers and Kent, 2001).
- One branch of the British government argues that aviation fuel, currently free of tax, should be taxed at the same level as petrol and diesel, viz. a little over 50%. This would mean that air travel would suddenly become a lot more costly. Meanwhile another branch of the British government is projecting a steep increase in present-day cheap air travel, and is thus planning for an outburst of new runways, even new airports (Monbiot, 2006).

Some of these glitches stem from ignorance, others from ignore-ance; some from government inertia, others from sheer idleness; some from incompetence, others from indifference; some from mega-errors, some from meta-failings. There are dozens of such institutional roadblocks, and they are proliferating like crazy.

These 10 examples highlight the point that much of the world's workings are out of joint. To further demonstrate the point recall that the world features more than a billion people without sufficient supplies of that most basic element of human existence, water. Poverty (<$1.25 a day in 2005) afflicts 1.4 billion people in the developing world. Some 925 million people live with hunger as part and parcel of their daily lives. The world is losing topsoil that in principle could grow enough grain to meet the needs of 27 million people. Over 800 million people, mainly women, are illiterate, and 115 million children receive no schooling. We are dislocating the world's climate systems to a degree that could set back our societies by at least two generations. The world is poised to lose perhaps half of its 10 million species during this century, with severely downside implications for the planet and hence for the world extending several millions of years ahead. A world out of joint indeed (Myers and Knoll, 2001; Myers and Kent, 2005).

We know all this, plus a whole series of other extreme debacles. Broadly speaking, moreover, we possess the science and technology to convert these profound problems into superb opportunities. Nor will it cost the earth to save the earth, indeed it will often save us money. So why don't we get on with it when we know so clearly where we are now and where we want to get to? How to get from here to there? Answer (to be surrounded with neon flashing lights, then we might recognise the path ahead): we often lack the institutional mechanisms to put us on the straight and narrow until we emerge onto open landscapes of sustainable lifestyles for everyone and forever.

To repeat the key question: Why don't we, as they say, just do it? Well, it is not generally because people are stupid or ignorant or mean. A good many people are semi-aware of institutional shortcomings, but they lack the means to express their views and press government leaders among other lever pullers to translate them into action. Most people recognize that global warming (better call it global heating) is beating at the door, and we shan't like it one bit. We can fit efficient light bulbs and solar panels, but their climate benefits will be overwhelmed if we keep on driving over-size cars fuelled with artificially cheap gasoline. When we fill 'er up at the gas station, we know that the economists tell us the full cost of burning one gallon of gasoline is not the $3 at the pump, but at least $10 if the price is to cover all the external costs such as traffic congestion, road accidents, and grandscale pollution whether at local, national or global levels (especially CO_2 emissions) (Brown, 2006; see also Hawken et al., 1999). But we can't offer the gas station attendant another $7; it doesn't work that way. Nor can we

send a check to the U.S. Treasury. All we can do is agitate with our politicians to devise institutions to take care of the problem.

In short, and as this book will demonstrate, the world is starved of institutions to promote the common good. We have lots of them but alas not nearly enough. Equally to the point, our world is bedevilled with numerous institutions that hold us back from the promised land; worse, they urge us lemming-like toward the edge of the cliff, where we are all too adept at plunging over with abandon and in multitudes. The culprit institutions don't intend it that way, but they can be extremely efficient at their destructive role. For want of better labels, they are designated in this book as Institutional Roadblocks.

Finally, let us consider the issue in terms of a famous experiment. If we take a frog and drop it in a saucepan of hot water, it will respond instantly by jumping out. If we then drop it in a saucepan of cold water, it will swim round and round revelling in the familiar environment. If we turn up the heat a bit, the frog may well rejoice at the warmer and more agreeable environment. Turn up the heat a bit more, and the frog delights still more, albeit feeling a tad drowsy in the unusually warm temperature. Keep on turning up the heat and the frog will eventually fall into a coma—and boil to death. The world outside the window is our saucepan and it is heating up. Can we respond better than a frog? Remember that it is hardly the frog's fault that it is not better adapted to marked environmental change; rather, the responsibility lies with the institutional source of the change.

2. INSTITUTIONS: HOW THEY WORK AND HOW THEY DON'T

"Institutions are the rules of the game in society."

Nobel Economist Douglas North

Let's figure out just what we mean by institutions. The term sounds vague and jargon-y. Something to do with government perhaps—which makes it sound all the more technical, distant and abstruse. To pin down the idea of institutions is like getting your foot on a dozen jellyfishes. Yet we should feel thoroughly acquainted with institutions. After all, we deal with them dozens of times a day. Without them we would never get out of the door after breakfast. Indeed we would never get around to breakfast in the first place without the institutions known as markets that bring us milk, cereals, eggs, toast and coffee, also water and electricity. Nor would we get far along the road toward our daily business without the road networks themselves, plus the car, bus and train systems that transport us. Some of these institutional devices enable us to function more efficiently (more quickly, more cheaply, etc.), while others help us to avoid conflicts. Moreover institutions are with us all day long, and thank goodness too, otherwise we would spend all our time climbing out of the multi-messes we would find ourselves in with every tick of the clock.

This all means that the term institution embraces a host of entities and activities: governments, international agencies, businesses, banks, stock exchanges, laws, police, doctors, schools, religious bodies, marriage, family, the military, radio/television, books, mail, food and drink, supermarkets, jobs, sport, recreation, social clubs, arts, trade unions, professional groups, science bodies, and cultural traditions, to cite just a sampler—each of them manifested in many a sort and stripe. Then there are less obvious entities that nevertheless make their contribution to our daily rounds: corner shops and street-side stalls, billboards, garbage bins, recycling centers, newspaper racks, weather forecasts, traffic lights, parking meters, and fire trucks. In a generic sense, then, an institution can be an organization, a widely accepted policy, a tradition or customary outlook, or even a prominent building. (For more elaborate accounts of institutions, see Frey and Stutzer, 2002; Fukuyama, 2004; Heckelman and Coates, 2003; Lall et al., 2005; Scott, 2001). We need not be unduly specific in spelling out a definition; one of the most esteemed institutions of all, the British constitution, remains completely unwritten.

We function better as both individuals and societies by courtesy of myriad institutions. They are what make the world go round instead of careening off its tracks. And in a world that is ever-more crowded, we need ever-more institutions to help us share our one planet and our individual patches of it. The world is now so congested that we are close enough to each other to shake hands in many more ways than humans have

ever enjoyed before—and close enough to tread on each other's toes if we don't have patterns of behavior to guide us.

Big bore as it may sometimes sound, then, the term "institutions" is vital to how we go about our daily lives, and hence we should keep an eye open for them at many a point throughout our day. Thus we humans face a duality in our identity and everyday living. On the one hand we are individuals, free to go our separate ways and to heck with what anyone else might want. But "anyone else" would certainly want to exercise the same freedom, whereupon there is lots of scope for treading on toes. True, a purist might protest that he senses an infringement of his personal freedom when he is obliged to drive on the same side of the road as everyone else: what a crimp on individual liberty!, stemming from the institution of road rules. But if he and everyone else were to drive on whichever side of the road suits their whim, there would not only be carnage but nobody, including the protester, would get very far along the road at all. As John Stuart Mill, David Hume and lots of other philosophers have pointed out, true freedom is not the same as unlicensed liberty.

These factors are all the more pertinent today when there are many more people in the world with many more aspirations and many more technologies to pursue their lifestyles—and hence with all the more scope to conflict with each other. Equally to the point, they offer much more scope for people to collaborate with each other, to an extent never practiced or even envisioned before. However, an institution, being devised by fallible humans, can fail to live up to what is expected of it. In fact it frequently fails outright, and in spectacular fashion, as governments make abysmal mis-judgements, businesses collapse, and scientists, economists and other supposed experts deliver anything but the goods. This much is known, with plenty of evidence from all countries and all stages in history. Not so well known is why an institution falls down on the job. This chapter makes a start on addressing the key question of "Why?" The rest of the book seeks to clarify the institutional processes involved, to examine their weaknesses and to propose amendments; and the book does all this by looking at sectors such as governments, governance, business, economics and science—and even that arch-dysfunctional institution, war.

Institutions at work

For the most part, institutions do a good job. Without them we would swiftly descend into ultimate anarchy. They supply many more roads than roadblocks. Moreover many of them function with exceptional efficiency. A friend of ours lives in a grass hut in Kenya and possesses a mobile phone so we occasionally call her for a chat. Within just a dozen rings she is on the line, whereupon we talk for quarter of an hour at a cost of less than $5. Globalization with a wallop! This instant hook-up would not be

feasible without the inputs of institutions all along the way, viz. engineering, satellite networks, international agreements and the lengthy like. Another example: Each day sees the mail system delivering hundreds of millions of letters worldwide, and only a tiny proportion gets lost. Every morning brings a remarkable variety of newspapers with details of doings all around the world, everything bang up to date—and all for a trifling cost. Then there is that further marvel of modern communication, e-mail; plus an associated technology, Google, with its instant access to wonderlands of information on billions of topics. Plus, again, that ubiquitous phenomenon the credit card, with billions of uses per day worldwide, all of them depending on the good faith of almost all the retailers who do not pass on card numbers to rogues and vagabonds.

Alas, these success stories are little noted for the most part—until one turns into a breakdown. A crash at a busy international airport such as Heathrow in London would make instant headline news, yet we never read that at the same airport yesterday, 1300 planes took off or landed safely.

Institutional shortcomings

Despite abundant successes, we should still ask why institutions screw up so often and in such spectacular fashion. Answer: because they are devised by humans, and since humans are fallible, institutions are subject to major shortcomings (Delbecq, 2001; Gray, 2004; Nutt, 2002). Foremost is their tendency to remain static in their make-up and their functions even though they operate in a forever changing world. True, they have regularly developed a sensitive capacity to cope with local changes that emerge only slowly. Often enough, though, they deserve their reputation for stodginess, built-in delays and tramlines thinking. This lack of rapid-fire ability to reflect changes that are increasingly rapid and global, has been cited by those many commentators (e.g., Bond, 2000; Gunderson et al., 1995; Robillard, 2004) who speak of institutional "constipation" or "sclerosis." Note a front-rank British analyst, James Robertson (2004): "Institutions are primarily programmed for their own survival. Hence they can act as barriers to change, obstructing the conversion of new ideas into norms of behavior for most people."

The world over it is the case that people's outlooks are entrenched in myriad ways, inducing institutional inertia in virtually every sphere of activity (especially government activity, which is often anything but "active" even though it can account for 35-45% of a nation's expenditures). This inertia is an exceptionally powerful force, and changes demand an even more powerful counter-force (Bond, 2000; Robillard, 2004). Recall that at the Rio Earth Summit in 1992 and the World Summit on Sustainable Development (WSSD) in 2002, political leaders engaged in rousing rhetoric in support of their goals, but the developed nations (being leaders in the global community) have not

come up with a single worthwhile across-the-board initiative to counter excessive consumption ("excessive" in environmental and hence economic senses); to stem deforestation, soil loss and desertification in much of the world; to reduce grand-scale pollution in outsize cities; to confront the horror of climate change; and to tackle all manner of other front-rank environmental problems (Strong, 2001).

Since Rio and WSSD, indeed, there has been all too little mention of the environmental cause as a whole (climate change excepted) in the councils of power, in the media or in most other sectors of the public arena. National elections come and go, but voters seem unconcerned that pollsters' survey show limited interest in the environment ("Oh yes, I care all right, but I care more about 10 other issues.") If the road to Rio and WSSD was difficult, how much more so is the road from Rio and WSSD in face of gross indifference and implicit readiness to foster institutional inertia (Karl and Trenberth, 2003; Robertson and Bunzl, 2003; Strong, 2001). The longer we delay with measures to counter the inertia that infects the body politic, the more the present patterns of dead-in-the-water government will become institutionalized.

In addition, institutions can display an aptitude for absurdity. Note the green Customs form that one has to fill out while flying from Europe to the United States on business. On the back of the form is a series of questions, posed by the U.S. Immigration and Naturalization Service. They ask the visitor if he seeks entry to the United States in order to engage in narcotics. Was he ever associated with the Nazi party in Germany? Does he propose to practice "moral turpitude"?

Several prominent sectors display all manner of institutional roadblocks. For instance, government is blighted by the artificial divisions of "compartmentalization by ministry", a world apart from the integrative formations required for "joined up" government. Politics often features outright ignorance. Businesses tend to be overly preoccupied with profits and quarterly reports, disregarding the two other "bottom lines" of environmental and social values. Science often suffers from undue reductionism to the detriment of integrative research; and scientists are apt to overlook the imperative of taking their findings to the policy community and the general public. Many organizations of whatever sort are characterized by hierarchical structures that militate against flexibility.

As an exercise in masterful incompetence, consider the British Civil Service. An expert on government practices, Zenna Atkins, has commented (2008) that "The machinery of U.K. government is not even in the 20th Century, never mind the 21st Century." While sections of the Civil Service are "modern and slick," many others are operating like a "horse-drawn buggy." "I have never met such bright people who really care about what they are doing, but they are working in a machine with a set of customs, cultures, values and practices that are utterly antiquated. A lot of the time the process is more important than the outcome." The Civil Service is "over-populated with highly

intelligent people who can't do simple, menial tasks." The Civil Service is also full of fiercely risk-averse people because "no Civil Servant ever got fired for doing nothing" (Asthana, 2008).

In summary: we need an in-depth assessment of the entire issue of institutional roadblocks: how they arise, why they become entrenched, and what can be done to reduce them, to side-step them, or even to eliminate them outright. For some salient questions in the government arena alone, consider:

- How to ensure that government operates as an organic whole, with policies that are consistent throughout the entire system? Translation: how to tackle the imperative of integration? How to persuade individual sectors and departments to coordinate rather than compete? How to counter turf rivalries and empire building? It is one thing to formulate policy interventions to promote integration, it is another thing to establish them as a working reality in governmental systems (plus many other systems, from business enterprises to households).
- How to overcome the super-preoccupation of governments with the short term ("A week in politics is a long time")? Related topic: how to institutionalise the rights of future generations extending for centuries if not millennia (even millions of years with respect to planet-wide impoverishment), especially now that these rights are severely threatened?
- How to tackle the tendency of governments to react rather than act (the squeaking door syndrome of special interest groups with their lobbyists)? Shall we need a suitably-sized catastrophe before governments see that they cannot carry on with myopic measures, before businesses see that they cannot persist with business as usual, and before the public sees that it cannot continue to suppose that the future will be merely an extension of the past—even though those options are increasingly foreclosed by force of circumstance that is becoming ever-more forceful?
- How to persuade governments that to do nothing is to do a great deal in a fast changing world? How to educate governments on the new nature of change, often arriving in non-linear manner, i.e., in jumps and jerks rather than straight lines and curves? How to persuade governments that they can never do only one thing ("If we jiggle over here, something will wiggle over there")?
- What is the role of the media? Who are the main moulders of public opinion and establishment thinking (not the same at all)? How far are they accountable for their impacts?

The longer we delay with measures to counter the inertia that infects the body politic, the body corporate and the body public, the more deeply the present patterns of policy incompetence (especially of departmentalised government) will become institutionalised. Fortunately there can be productive inertia triggered by a turn-around in our institutional systems, generating multiple benefits of progressive scale and inducing a constructive form of momentum. The more that governments engage in policy measures to promote e.g., the grail of Sustainable Development, the more the benefits will become plain, percolating through every sector of government and segment of society. When once the disruptive change in direction is achieved, traditional resistance can quickly give way to organic support. Meantime, it is a measure of inertia's power that our institutional systems show scant sign of the far-reaching adaptations needed to address the problem. In the main, and alas, much policy power today continues to rest with institutional inertia.

Failed decisions

As a startling instance of institutional shortcomings, consider the phenomenon of "failed decisions", being decisions that do not match up to the situation or are plain wrong. Such decisions proliferate in organizations both public and private. They fail to manage the forces at work. They prefer the quick fix. They jump at the first idea that comes along before spending years trying to make it work. They are inclined to ignore ethical factors among a slew of social constraints. They reflect an inability to learn from experience. Yet in big-picture terms they have a constructive role to play, and we would surely be worse off without them (Delbeque, 2001).

A study of 400 decisions made by top managers in public and private organizations in the United States, Canada and Europe (Nutt, 2002) concludes that "Decisions fail half of the time, [and] vast sums are spent without realizing any benefits for the organization." If there is one common reason why decisions fail, it is that the perpetrators do not practice systems thinking (or multi-lateral thinking), thus blocking out the many non-linearities that characterize the real world (Dorner, 1989). Examples range from the EuroDisney debacle in France, Beech-Nutt's mis-labelling of its apple juice and Shell's plans for disposal of its Brent Spa oil rig, to Nestles' damaging marketing of its infant formula, the recall of Ford Pinto cars, the police plan for the Waco siege, and the new Denver international airport (where benefits were greatly overestimated and costs were equally underestimated) (Nutt, 2002; see also Homer-Dixon, 2000; Schwartz, 1998). All share the same trait: How come that so many intelligent people managed to goof up so spectacularly?

Failures abound indeed, especially in the form of hugely mistaken decisions. Consider two organizations with ostensibly eminent expertise in making correct

decisions. In the early 1950s the 20th Century Fund forecast that by 2000 the world's population would be 3.6 billion—it turned out to be 6.1 billion. In 1980 IBM forecast total sales of personal computers would not exceed 280,000, a total so small that the firm sub-contracted the software to Bill Gates and the chips to Intel. Subsequent sales by 2000 topped 30 million (Cooper and Layard, 2002).

Not that failure need be outright disaster. To understand how economies work, for instance, we need to understand the Iron Law of Failure. "Failure is all around us. Failure is everywhere across time, across place and across different aspects of life. More than 10% of all the companies in America disappear each year" (Ormerod, 2005). Is this a case of institutional incompetence run riot, or new breakthroughs emerging? The plus side, in one respect at least, is that failure appears to be essential to the workings of markets. Sometimes we need a measure of "creative destruction", to use an expression by the Austrian economist Joseph Schumpeter, under which old ideas, technologies, skills and equipment become obsolete and are swept away, so that they can be replaced by "continuous progress and improved standards of living for everyone" (Ormerod, 2005; see also Dorner, 1989; Watkins and Bazerman, 2003).

Inertia: how to beat it

It is a measure of inertia's power that our institutional systems show scant sign of the structural changes needed to address environmental problems. At the same time, inertia tends to feed on itself and thus to enlarge its grip. Note the insight of expert analyst John MacNeill (2000): "The essence of inertia is that there can be increasing returns to scale. When an idea becomes successful, it easily becomes even more successful: it becomes entrenched in social and political systems, which assist its further spread. It then prevails even beyond the times and places where it is advantageous to its followers: a case of "ideological lock-in." Big ideas often become orthodoxies, enmeshed in social and political systems, and difficult to dislodge even if they become costly."

This thesis is exemplified by the global hegemony of consumerism—a hegemony that has become economic, political, social and cultural. It has developed the power to squeeze out alternative lifestyles and value systems. Consumerism has become so embedded in the United States, the European Union, Japan and other long-affluent countries that government systems themselves serve to promote consumerism still further afield (Ehrlich and Ehrlich, 2004; MacNeill, 2000).

Furthermore, many institutions are simply reluctant to learn. Senior executives remain in their jobs too long and resist ideas from outside. Recall the weaknesses in corporate governance or the inward-looking character of many universities and the civil service. Solution: rising executives should move around more frequently, and established institutions should adapt themselves to learn more from outsiders. These

are not new lessons to be learned. Thomas Jefferson was on target as far back as 1816 when he pronounced "Laws and institutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths discovered and manners and opinions change with the change of circumstances, institutions must advance also to keep pace with the times."

Consider, by contrast, an exceptionally creative initiative, the European Union, operating in the tortuous institutional field of international government. The Union has long demonstrated that we know how to devise complex institutions that, surprise!, actually work despite, or conceivably because of, their sheer complexity. The Union has grown from an original six nations to 27 nations, with more knocking on the door. It reaches from the Irish Sea to the Black Sea, with a population of half a billion. No doubt about it, as an experiment in institutionalized internationalism it has proved a remarkable success. It has taken in 10 once-communist states, thus precipitating the finest spread of democracy and capitalism since the end of the Cold War. To cite a Newsweek journalist, Andrew Moravcsik (2007), it has become the "largest trading and investment partner of every nation in the Middle East", opening the way for all manner of "quiet superpower" activities; "almost all the world's peacekeeping and policing forces, outside of Iraq, are staffed or funded primarily by Europeans." Moreover the Union has enjoyed higher economic growth than the United States for most of the past several decades. A single currency, the Euro, serves well over 320 million people in 15 countries. Most Europeans live nearly four years longer than their counterpart Americans. The task of coordinating so many political entities, economies, cultures, societies, etc. into a single cohesive unit would be tough enough without its 20 official languages (Moravcsik, 2007).

Overall the steady expansion of the EU has been a force for peace, prosperity and stability (plus more international and hence better football). Western Europe has enjoyed its most peaceful half century ever (Moraccsik, 2007). Not surprisingly, however, some of the Union's institutional structures need urgent overhaul. After all, this is basically the same organization that was established by the original six member nations, also an organization that has tried to swallow one enlargement after another. Like those many institutions that become so hell bent on their own survival that they end up contemplating multiple navels, the Union needs to play Catch Up, even though its leaders frequently seem reluctant to give it an inspired shove. In fact the Union's Commission HQ in Brussels has occasionally seen fit to busy itself with such momentous issues as the shape of bananas: they should be 13.97cm long (not, you'll note, a simpler 14cm) and 2.69cm round; nor should they feature "abnormal curvatures." The classiest cucumbers should curve less than 10mm per 10cm of length; the finest plums must be at least 3.5cm across; peaches must exceed 5.6cm in diameter during the strategic period July to October; the thick end of carrots must exceed 1.9cm; and the surface of "red"

apples must be at least one quarter red. Also standardized are condoms. All these injunctions are issued ostensibly to make Icelanders and Cypriots just as European as Portuguese and Finns. Or are they devised primarily to justify some official's job? (has it all gone bananas)? After much careful pondering, the Commission has decided to relax the regulations a bit—but only a bit, let's not get reckless.

Finally there is the sheer speed of change, of change piled upon change, all of which tends to breed an attitude of "safety first, slow down." Today's changes are far more rapid than we have ever known. Indeed we have surely witnessed more changes in the past 50 years than in the previous 500, and the next 50 years could witness more changes than in the previous 5000, even since the start of civilization. As the Harvard University biologist Edward O. Wilson warns (2002), "We are about to pass through a period of unprecedented pressure on numerous resources, notably our environmental supports." But at least as important as the environmental bottleneck is the socio-political bottleneck of institutional mismatch and breakdown.

Another leading analyst, Richard Posner (2004), offers a gloomy projection that reflects "the spectre of ever-more people able to exploit ever-more powerful science and technology, without an equivalent growth in societal controls." Hence Posner believes that "The risks of global catastrophe are greater and more numerous than commonly supposed, and they are growing, probably rapidly." He urges that we prepare for disasters including not only the obvious candidate of abrupt climate change but extending to bio-terror-induced pandemics and runaway reactions from particle physics experiments—and perhaps several disasters arriving simultaneously. A growing number of other scientists (e.g., Brown, 2007; Ehrlich and Ehrlich, 2004; Martin, 2006; Rees, 2005) offer similarly downside prognoses about the foreseeable future.

Institutional roadblocks and the environment

We shall meet many instances in this book of Institutional Roadblocks (IRs) with respect to the environment. Why should it be that the environmental cause so often features IRs? Well, during the past several decades the amount of money going to tackling environmental problems has (say) tripled, and the same for the amount of scientific understanding, the amount of government involvement, and the amount of citizen activism. Yet, and despite many success stories, the overall environmental cause declines faster than ever. While our attention has been fixated on what we suppose are problems, we have actually been tackling **symptoms** of problems for the most part. Conversely we have given all too little attention to **sources** of problems. Pollution is not so much a problem as a symptom of a problem, the problem being the vehicle or factory or power plant that causes the pollution. We need to address the source of the problem:

why do we allow so many vehicles, etc., to arise in the first place? Why not attack the root causes of problems before problems become problems at all?

Thus the meta-problem does not lie with our ignorance, myopia or sheer stupidity. Rather it lies with IRs in the form of deep-seated deficiencies in our modes of government, governance, economies, business, research, and whatever other institutions we have devised to run our societies. Specifically the deficiencies reside in the lack of political leadership (many politicians are so ecologically illiterate they would think a food chain is a line of supermarkets). Then there is a lengthy list of associated factors: the grand-scale lack of environmental involvement by business; fundamental mis-perceptions on the part of the media; insufficient cohesion on the part of the NGO community; and a lack of funds on a scale to compete with those bodies (special interests, lobbyists, etc.) that foster the forces degrading the environment.

While much of this is recognized, not nearly so recognized is the failure of our institutional systems to tackle environmental problems with the "ahead of the game" measures they warrant. At a time when we need incisive and urgent action for all manner of front-rank problems, our institutions seem singularly unresponsive, at least in relation to the scale of the problems in question. Indeed they reveal features—for instance, lack of speedy and sensitive feedbacks (sometimes known as lack of space between stimulus and response)—that leave them incapable of the instant adaptiveness that is at a premium in a fast-changing world. Yet this generic issue of IRs, super important as it is, has received scant attention by researchers in academia, think tanks, and especially by environmental NGOs—scant attention, at least, in proportion to the size and scope of problems rooted in IRs (Ehrlich and Ehrlich, 2004; Speth, 2004).

Above all, there is a marked lack of integration among agencies dealing with the environment. In the United States, for instance, the ultimate locus for environmental responsibility does not lie with the U.S. Environmental Protection Agency (EPA). Even if the agency's head were to enjoy Cabinet status, true authority for environmental concerns would still rest with those charged with running the economy, viz. the President's Council of Economic Advisors, the Office of Management and Budget, and the U.S. Treasury—also the Departments of Trade, Energy, Transportation, Agriculture and whoever else calls the final shots on the workings of the American economy. It is heads of these agencies, not an environmental czar, who finally determine the role for environmental factors in the U.S. economy. They have the political power, if they ever feel inclined to use it, to make the marketplace work so that it enhances rather than depletes its environmental underpinnings, to replace destructive subsidies with supportive subsidies, and to mould the economy in a manner that generally propels it toward sustainable development. But surprise, the agencies rarely feel so inclined. Meantime, all the EPA chief can do is to contain environmental damage after the fact, rather than to change those economic practices that cause the damage in the first place.

The basic governmental system remains the same, and it thus serves to defer the day when reforms will be introduced with a scale and scope to match the system-wide problem.

There are further structural problems with regard to policy integration, and in virtually all countries. Government fiefdoms of Transport, Agriculture and Energy often pursue activities that are directly opposed to their official policies, and thus cause much environmental damage. Whatever may be proclaimed to the contrary, transport policy encourages the highly polluting car culture to the detriment of alternative modes of transportation. Agriculture policy promotes unsustainable forms of farming based on high-energy inputs and over-use of fertilizer and pesticides. Energy policy amounts to a fragmented approach to energy supply, instead of a coherent framework with emphasis on reducing both supply and demand.

Moreover transport policy tends to be pursued with indifference to energy policy; agriculture policy with indifference to land conservation; and both with indifference to climate constraints. On top of this, the ministries in question have their own interests and agendas, which frequently induce them to subvert environmental imperatives, whether wittingly or not. Energy policy is at least as much of a factor in ultimate food security as is agricultural policy. In addition food security includes policy sectors as diverse as transportation, public health and population, yet how often do we hear of a food conference when all sectors involved have attended the planning table? Linkages are all—as is demonstrated by the objective world of the environment, whether at local, national or global levels (for a detailed treatment of linkages, see Chapter 3).

In sum, the environmental cause is often blighted by a historic division of government into rigorously defined sectors, a division that is antithetical to the types of changes required to integrate environment into policy making throughout government systems. The result is that the Environment Ministry, being the newcomer agency, finds its policies are effectively set by the long established and hence more powerful ministries which determine patterns of resource exploitation, land use, and pollution that undermine environmental needs.

There is a story, only partly apocryphal, about Prime Minister Thatcher, a leader reputed to know how to get her own way. When she learned of the dangers of global warming, she convened a Monday meeting of her ministers to require them to devise initiatives to resist the new threat forthwith. Yet on Tuesday the Ministry of Transport announced a major plan to expand Britain's freeway system. On Wednesday the Ministry of Energy announced plans to increase pumping of oil in Britain's sector of the North Sea. On Thursday the Treasury slashed the research budget of the energy efficiency agency. On Friday the Treasury increased the business subsidy for executives' outsize cars.

As an indication of how far the environmental cause has declined in the palaces of power, note that the World Summit on Sustainable Development in 2002 gave far less prominence to environment than did the Rio Earth Summit in 1992. This was all the more remarkable in that the very concept of sustainable development means, front and center, development with emphasis on its environmental underpinnings.

Thus a further fundamental question arises. Why are SD concerns not better translated into public policy in light of their strong intellectual rationale and their blazing common sense? This raises an even more basic question: Why are rational policy initiatives in whatever field not a more frequent phenomenon of our institutional systems? To which one might respond that if policy processes are prone to built-in deficiencies, why aren't they regularly upgraded to meet new needs? Is inertia unavoidable? A perceptive response was offered 500 years ago by that arch expert of policy making, Nicolo Machiavelli: "There is nothing more difficult to carry out, more doubtful of success, nor more dangerous to handle, than to initiate a new order of things. For those who would institute change have enemies in all those who profit by the old order, and they have only lukewarm defenders in all those who would profit by the new order."

Moral sources (if any) of institutions

Let us end this review of institutions by asking how they ever came into being in the first place, i.e., among Stone Age societies—plus the abstruse issue of the moral underpinnings of today's institutions. How did cooperation evolve, and how can it be maintained today? Some scientists (May, 2005; Ehrlich, 2000; Shermer, 2004) believe that the sources of moral behavior can be traced to humanity's evolutionary origins. During the 250,000 years while humans operated in hunting bands of perhaps 50 persons, there would be survival value for those individuals who submerged their own needs in favor of the community's needs during the hunt. They would be likely to live to another day and pass on their collaborative genes. This process persisted for 99% of humanity's existence as a species, until around 10,000 years ago people began to settle in villages of maybe 500 individuals. Again the people who lived long enough to pass on their genes would be those who preferred to make common cause with others—except that individuals had to expand their sense of community to embrace a far larger number of people while doing so without any lessening of their loyalty to the earlier groups of 50. Another 500 years on and human settlements enlarged into towns and cities, numbering perhaps 5000 citizens; followed by true cities with 50,000 members, and finally nation-states with 500,000 people. In today's world with its interconnected societies all around the planet, we live as a latter-day hunter-gatherer band with 6.7 billion people—and we must try to manage our collective affairs with the evolutionary equipment of the Stone Age and other far-back times. While our brains have not grown

bigger since we came out of our caves, we have learned a vital art that smoothes our collective endeavours: institutions.

As society evolved, then, humans needed rules governing survival prospects, notably traits such as cooperation, loyalty, fealty, altruism, sympathy, reciprocity, mutualism and community concern. Even the various versions of "Do unto others as you would have them do unto you" requires that we create institutions to articulate the Golden Rule and its offspring. Without such institutionalized morality, life would become, as Hobbes proclaimed, a matter of all against all, with an outcome that would be nasty, brutish and short. (For further assessment, see Carter, 2005 Midgley, 2002; Rogers and Ehrlich, 2008).

In this circumstance, heed Paul Ehrlich (2000) when he asserts that we need a new evolutionary step, a.k.a. "conscious cultural evolution", that will enable humankind to function as a responsible societal whole. "The potential for this innovative form of conscious evolution has been manifested in the great social movements that societies have developed, such as the abolition of slavery and the civil rights movement. Could it be that we are seeing the birth of still another revolution, a change of consciousness, as witness the explosive growth of Non-Governmental Organizations, in scientists speaking out, in the anti-globalization protests, in the many environmental initiatives by the religious community, and in the pervasive and profound environmental initiatives being undertaken by a good many businesses? "

The Ehrlich message is well and good, no doubt about it. But what sort of practical morality, i.e., morality translated into action, shall we need when we confront the challenges of e.g., climate change? By the end of the first 10 days of January 2008, the average Briton had caused as much global warming as a typical Kenyan over the whole of the year. Yet in a globally warmed world, Kenya would probably suffer more than Britain. In fact 164 countries in the world have a smaller "carbon footprint" than Britain. While the poorest countries (with 800 million people), make virtually no contribution to climate change, they will face the worst consequences (Smith, 2006; Southworth, 2007; Thornton, 2007).

Conclusion: an outsize "oops"

Let us end this chapter with a cautionary tale that illustrates the view of President John Adams two centuries ago, that "Government is little better practised now than three or four thousand years ago." In "The March of Folly" by American historian Barbara Tuchman (1985), we read of a lengthy list of episodes in history that demonstrate how the best institutions—or rather the best practitioners—have consistently failed their societies. The book describes numerous instances of "folly", being "the pursuit of policy contrary to self-interest, deriving from wooden-

headedness." Tuchman postulates that wooden-headedness fosters institutional "rigidification and the need to protect egos ... To recognise error, to cut losses, to alter course, is the most repugnant option in government. ... Power breeds folly; the power to command frequently causes failure to think; the responsibility of power often fades as its exercise augments; it means protective stupidity."

Tuchman begins her analysis with the wooden horse of Troy and other ancient blunders. She then goes on to consider Caesar's loss of Britain, Montezuma's loss of the Aztec Empire, Philip II's Armada attack on Britain, Charles XII's campaign against the Russian winter, Napoleon's ditto, and Britain's loss of the United States. Tuchman winds up with a few recent follies such as the German "final fling" in mid-1918, the Japanese attack on Pearl Harbour, and the Vietnam War. Plus lots of other calamities in between. In each case, the politician decision-makers knew that they faced two opposed policy options—and that if they chose the wrong one they would not only precipitate disaster, they would end up with catastrophe unbounded. The experts advised go This Way. The policy wonks opined the same, as did the establishment, the media, public opinion, in fact everyone except the political leaders—who chose to go That Way, and brought the roof down on everybody's heads.

Why, asks Tuchman, should such a dismal outcome afflict so many different societies at such different times? The supersize bloopers arise regardless of type of regime: "monarchy, oligarchy and democracy produce them equally. Nor are they peculiar to nation or class. Why hasn't our species erected institutional safeguards against folly? Mankind makes a poorer performance of government than of almost any other human activity: why?" Answer: because the institutional means to formulate correct responses are too convoluted, too slow, too sclerotic, too indifferent, and in too short supply all round. Sounds familiar?

This chapter has denoted many instances of how Homo sapiens does not display much talent for the sapiens bit. But there is actually much evidence that people can sometimes make like giants of the human condition. To cite Barbara Tuchman again (1982), "Mankind has accomplished many brave and beautiful things, exerted stupendous endeavors, explored and conquered oceans and wilderness, achieved marvels of beauty in the creative arts and marvels of science and social progress, has loved liberty with a passion; has pursued knowledge, exercised reason, enjoyed laughter and pleasures, played games with zest, shown courage, heroism, altruism, honor and decency, experienced love, and known comfort, contentments, and occasionally happiness."

The Bureaucrat's Hymn

O thou who seest all things below,
Grant that thy servants may go slow,
That they may study to comply
With regulations till they die.
Teach us, Lord, to reverence
Committees more than common sense.
Impress our minds to make no plan,
But pass the baby when we can.
And when the temptress seems to give
Us feelings of initiative.
Or when alone we go too far,
Chastise us with a circular.
Mid war and tumult, fire and storms,
Strengthen us, we pray, with forms.
Thus will the servants ever be
A flock of perfect sheep for thee.

Sir Francis Lindley, British diplomat

3. LINKAGES: THE CONCEPTUAL LINK-UP

"Globalized markets mean that whenever you buy a T-shirt made of Pakistani cotton, eat Thai rice or drink coffee from Central America, you are influencing the hydrology of those regions—taking a share of the River Indus, the River Mekong or the Costa Rican rains."

David W. Pearce, 2006

"Every day millions of people look at an aeroplane and see an aeroplane. The 9/11 terrorists looked and saw a missile."

CNN commentator, 9/2001

We live in a world where linkages are all. As our economies, our communications, societies, etc., become ever-more complex and integrated, we find ourselves inter-linked with each other through myriad activities that may have become too numerous to comprehend. When we enjoy a banana for breakfast, we might ponder that we are thereby supporting the activities of a smallscale farmer or a plantation owner in the Caribbean, followed by an on-the-spot crop buyer, then a shipper together with an insurer and his associates, then a port/airport authority (customs and other trade people), then a haulier who transported the banana to a warehouse, then a wholesaler, and finally a retailer, plus a host of smaller adjunct operators along the way. Little though we may have been aware of it, we have likewise supported bankers and other lubricators of commerce, many of whom may never have been near the Caribbean. We have been involved, transiently but significantly, with scores of people, all for the sake of one banana and one consumer at breakfast.

Thus an important part of the price of a food item is the distance it has travelled from farm gate to meal table, a cost known as food miles. A typical dinner portion in the United States may well have travelled 3000 kilometers, which can deliver pleasure via the array of goodies for dinner but with sizeable pollution costs from transportation (Murray, 2005). Or consider the saga of a strawberry yoghurt in Germany. The milk may well have been supplied from Austria and the strawberries from Poland before being processed in northern Germany, whereupon the whole lot is transported back to a factory in southern Germany where further ingredients, notably sugar, are likely to have been added from eastern Germany. Corn and wheat flour arrive from the Netherlands and jam from Belgium, while the labels and aluminium covers are supplied by still more distant manufacturers. Only the container is local to the southern Germany city of Stuttgart, which is where the yoghurt officially originates. All in all the various ingredients will have travelled as much as 8000 kilometers, thanks to artificially cheap (heavily subsidized) transportation (Boge, 1995; see also Clay, 2004; Marks et al., 2006). In similar style, farmed salmon from Alaska are shipped to China to be processed, then

sent back to the United States to be sold as “wild” salmon; Scottish prawns travel to Thailand where they are hand-peeled for half a dollar an hour, before being shipped back to Scotland for sale as scampi (Kuperus, 2006; Simms et al., 2006). Globalization, anyone? Or are these instances a case of institutionalized absurdity?

Indeed the entire process has virtually no institutional framework to regulate its many participants, except of course the marketplace. That marketplace tells us the final price of the banana or the yoghurt, but it says nothing about possible costs in e.g., the working conditions under which the suppliers operate. Indeed the end-product consumer is altogether ignorant about the many persons who have brought the banana to his breakfast table. Nor need he know, you might reply, why should he know, what difference could that make? Well, all manner of factors come into question, not just working conditions (over-exploitative?) but gender issues and environmental concerns. In all the instances cited above, a pivotal factor lies with transportation, which is overly cheap given the powerfully pollutant impacts of fossil fuels, largely left unpaid for. Were this covert transportation cost to be incorporated into the overall calculus, we would find that the meal table items that feature excessive “food miles” would become far more expensive and make e.g., strawberries in February for diners in London and New York an ultra-luxury. In fact it would trigger a shift to local as opposed to international food, opening up a marketplace demand for kale, sprouts, swedes and other winter-type foods. (For more on this theme, see below on Institutional Indifference.)

Note some further impacts on costs and prices. The United Kingdom imports more than 500,000 tonnes of apples, 80% of its consumption (as if there isn't scope for more apple orchards within the country). Many of the apples come from South Africa, where the farmer receives a mere 4% of what the U.K. customer pays. Farm labor absorbs another 5%, and farm inputs (fertilizer, pesticides, etc.) another 17%. Transport and customs duties take 6% and shipping 12%. U.K. handlers want 7%, and importer's commission and duty 7% again. Finally, the supermarket takes 42%. Everybody gets a larger slice than the original farmer (Oxfam, 2004).

Note a further international linkage, this one reflecting British people’s liking for lettuce from Spain. Lettuce is one of the thirstiest crops ever, and southern Spain has suffered the worst droughts in more than half a century. When a British consumer eats a Spanish lettuce, he or she is really drinking Spanish water, and his/her demand is partly responsible for southern Spain’s shortages. That same Britisher might also consider that if he/she spends a vacation in southern Spain playing golf, a golf course in question is likely using as much water in a year as a town of 10,000 houses—and more than 40 new courses are planned for just a single sector of southern Spain. There is much “virtual water” in other products too (Box 3.1). Who would have thought that a hamburger can account for 2400 liters of water and a cotton T-shirt for 4100 liters (World Water Council, 2004)?

Box 3.1: Virtual Water Requirements of Everyday Items (in liters)	
Glass of milk, one fifth of a liter	200
Glass of beer, one quarter of a liter	75
Glass of wine, one eighth of a liter	120
Cup of coffee, one eighth of a liter	140
Glass of orange juice, one fifth of a liter	170
Packet of potato crisps	185
Egg	135
Hamburger	2,400
Cotton T-shirt	4,100

There can also be travels of cyber sort. Note the observation of Professor James Martin (2006): "A person placing an order with a local phone call in, say, Sydney may think he is talking to an order-taker in Sydney, but in fact the call may have been automatically routed to a person in Sri Lanka who enters it into an order-entry computer in France, which triggers manufacturing planning software in New York to place items into a manufacturing schedule in Singapore, which requires chips from Japan to be built into circuit boards in Shanghai, thence a computer-controlled shipment from a warehouse in Milan, and the fast software modification to be made in Bangalore, with final assembly in a robotic factory in Singapore—whereupon the Taiwanese American Express office arranges shipment to Sydney on a Malaysian Airline."

Global-scale linkages proliferating

The above are instances of the thousands of "relationships" we engage in with our fellow citizens (some round the back of the world) during the course of a day, if only through the use we make of cars, buses or trains and the fossil fuels that propel them, plus the many pollutants they emit. Just carbon dioxide effectively makes us join hands with all people on Earth, courtesy of climate change. Nor is it a case of the more prominent ways that each of us generates carbon dioxide. Recall the mundane matter of a cup of coffee and twice as much water in the kettle. Even if we were to take the exceptional step of thinking about the climate change linkage as we put water into the kettle, we should reflect that just a single cupful of warm water emits its carbon dioxide. Suppose then that we want to feel sufficiently like a global citizen to offer compensation for our coffee drinking to the Bangladeshis in question; we shall find there is no institutional mechanism to enable us in Britain to get together around a table with the Bangladeshis and negotiate a resolution to the problem. Our institutions simply are not

up to the job, not remotely so—and we citizens do not seem remotely capable of devising better ones right now, even as the sea rises.

Upshot: we can no longer afford to split the world into sectoral and departmental components. Our environments, both ecological and economic, with their complex webs of interactions operating in a continuum, reveal that everything is connected to everything else. The phenomenon is a salient feature of our world, where environmental connections are manifested through multiple linkages as people's activities in one locality impinge on people in another locality, often far beyond the horizon, sometimes in the farthest reaches of the Earth. There are multiple linkages, too, in the development processes of our world, especially as concerns the relationships of an increasingly integrated global economy. Each day some $1.5 trillion shuttles back and forth through the stock exchanges of the world. In fact, it is no longer a case of a stock exchange in each of New York, London, Zurich, Tokyo and so forth, rather there is a single stock exchange that never sleeps. Many readers of this book will have savings lodged with investment bodies, and they cannot possibly keep track of every last dollar, even though some might inadvertently be used to over-log a forest in Amazonia, Borneo or Siberia, or to otherwise militate against Sustainable Development.

In sum: linkages have become a proliferant fact of life. The more they multiply, the more we shall find that they add to the complexity of our 21st century world, and the more our institutional responses, as presently devised, will fall short of what we need. Leaders of governments, international agencies, corporations, scientific bodies, nongovernmental organizations, households, common citizens, and whoever else contributes to the running of the world—cannot yet manage the world as a single indivisible unit. We split it up into manageable packages, such as nations, economic sectors, ecological zones, and scientific disciplines. This approach is acceptable so long as we remember the overriding rationale: that each package derives its intrinsic justification and makes final sense only through the bigger-picture context. Yet we often become so preoccupied with a single portion—the sector, zone, department, discipline, etc.—that we lose sight of the larger perspective. Much as we talk about linkages as a key factor of both environment and development, we tend to be programmed through our professional backgrounds to overlook the myriad linkages that relate the part to the whole. The result is that we try to over-compartmentalize that which cannot be truly compartmentalized. (For a book-length treatment of this generic issue with its multiple complexities, see Myers and Kent, 2005.)

Hence the need for measures—institutional changes such as policy interventions, economic incentives, legal instruments and personal inducements, among many others—that reflect the phenomenon of linkages in our daily activities. These measures are critical if our planning and management practices are to respond to the way the world works. In short, we must mobilize a comprehensive spectrum of link-up

devices that ensure the whole operates as a whole, rather than mis-operating as a series of disjunct parts.

Thinking sideways

This all implies a premium on "thinking sideways", or thinking in ways opposite to the tunnel-vision thinking that bedevils many of our policies and practices. For instance: we have been inclined to suppose that the population explosion in Sub-Saharan Africa—more explosive than in Latin America or developing Asia—has been due to the proclivity of Africans to have large families regardless. That is far from the whole story. In the early 1960s a good many countries in Sub-Saharan Africa were becoming independent, and one in particular, Kenya, attracted unusual interest from both the United States and the Soviet Union because of its strategic position on the Indian Ocean and alongside the oil tanker shipping lanes heading from the Persian Gulf toward the industrialized countries of Europe and North America. Both superpowers wanted to cultivate influence with Kenya by offering exceptional amounts of foreign aid. Would Kenya like funds to build up its industry, or to expand its agriculture, or to promote education, or to enhance communications—or what?

Kenya's new leaders featured only a dozen persons with advanced education. They had to admit, behind closed doors of course, that they simply did not know how to set priorities for a modern nation-state. So what could the outsiders propose? Well, said the Americans, they could offer the wherewithal to cut the horrifically high mortality rate among children; one in four failed to reach its fifth birthday. Kenya responded "Yes, go for it"; after all, who could possibly say that saving children from early death could be anything but a Totally Good Thing? Alas, the "keep alive" efforts were not matched by equally vigorous family planning campaigns. Kenya's family size soared, and that was the start of the country's population explosion. The American aid experts should have figured that each child kept alive would need food, housing, schooling, etc., and eventually a job. For all these unconsidered consequences, the outsiders' aid program should have made funds available, even if that meant fewer funds for the child survival effort. Above all, the terms of reference for the aid program should have specified the imperative of "all things considered" rather than the tunnel vision that limited action to a single isolated purpose. There was a gross lack of institutional back-up in the form of inter-sectoral planning.

A similar lack of sideways thinking in Kenya arose a few years later when another foreign aid initiative supplied a special facility for the country's main hospital in Nairobi, in the form of a heart surgery unit. Heart operations were extremely expensive, and the unit catered only for the few hundred persons in the country who could afford such a luxury. The first author of this book undertook an economic analysis of the

"opportunity costs" of the heart unit, and concluded that a far more productive use of the funds could have been achieved by constructing several thousand stand pipes for clean water in the hospital's hinterland with its many people suffering the potentially lethal effects of dirty water. Again, the institutional context, viz. the economics at play, was basically faulty.

Types of linkages

In summary of this chapter so far, we find there are multiple types of linkages, with multiple scope and impacts and operating at multiple levels. Some work directly, some indirectly. Some operate in only one direction, some in both. There are not only first-order linkages, but second- and third-order linkages.

The best-known linkages are those of programmatic and technical sort. They occur largely with respect to inter-sectoral activities, e.g., between forests and agriculture and between energy and climate. Less readily perceived but far more significant overall are those that span over-arching spheres of human activity, e.g., the ones between environment and development generally, between the developed and developing worlds, between natural resources and basic human needs, and between ecology and economics. Then there are still broader-scope linkages, such as those between economic efficiency and social equity, between the biosphere, the techno-sphere and the socio-sphere, and between the present and the future. For abundant illustrations, see Myers and Kent, 2005.

To reiterate a pivotal point: as a pervasive and profoundly important feature of everyday life, linkages are becoming more numerous and more significant as more people engage in more activities of more sorts. Indeed, they can be viewed as endemic to all spheres of human activity, especially in a world where those activities are becoming more complex and integrated by virtue of interdependency relationships of both environmental and economic sorts. It is virtually axiomatic that linkages will become an even more salient feature of our world as our economic systems interact more closely with Earth's environmental systems, generating feedback responses in both directions (MacNeill et al. 1991; Myers and Kent, 2005).

To illustrate with a linkage at international level, consider the connection between U.S. presidential elections and species extinctions in southern Mexico. Mexico has been growing corn for 10,000 years, but cheap corn imports from the United States put the sector in acute crisis (under the North American Free Trade Agreement, Mexico has had to rapidly open its markets to U.S. exports, notably corn; since the early 1990s these exports have expanded three-fold, and in 2006 they accounted for one fifth of Mexico's domestic market (Campbell and Hendricks, 2006)). The surging imports were associated with a 70% drop in price during 1994/2003. American farmers have been receiving $10 billion a year in subsidies, including an export subsidy to the Mexican

market of $105-145 million (a sum that exceeds the total household incomes of the quarter of a million corn farmers in the southern Mexican state of Chiapas alone, leaving the great majority of them in absolute poverty) (Oxfam, 2003). Ironically, most of the American corn subsidies have gone to the biggest farmers, meaning that they hurt both the rural poor overseas and the rural poor at home (Pollan, 2006). There's a further linkage too: as Mexican rural incomes decline and malnutrition rises among 15 million Mexican peasant farmers, the crisis propels millions of impoverished peasants northwards across the Rio Grande. Well might we recall the saying "Poor Mexico: close to God but closer to the United States." One U.S. president after another, regardless of party, has paid out huge subsidies to farmers in the corn belt in part because Iowa is one of the first states to run primary elections en route to selecting a candidate to contest the presidency. Impoverished farmers in the southern Mexico state of Chiapas feel driven, in the wake of plunging corn prices, to practice slash-and-burn cultivation in the Lacondes forest with its shrinking habitats for exceptional concentrations of species.

Upshot: stronger World Trade Organization (WTO) rules are needed to regulate all forms of export subsidies, whether direct or indirect. Unfortunately WTO rules are designed to accommodate, rather than reduce, trade-distorting subsidies provided by the United States and the European Union with their powerful political leverage.

Linked linkages

Often enough there are linkages between linkages. These arise in circumstances where, for example, economic linkages serve to reflect or reinforce environmental linkages, and vice versa. These linked linkages are significant in part because one set of linkages often exerts a compounding impact on the other, making for synergized linkages (see below). The impact is far more important than a merely additive affair, in part because the amplifying effect is more likely than is a single-type linkage to carry sizable consequences for communities far removed from the site of original activity. For illustration, see Box 3.2 with the many linked linkages at work in Sub-Saharan Africa.

Box 3.2: Linkages at work in Sub-Saharan Africa

Food shortages impact on:
- malnutrition and hunger
- land degradation via unsustainable farming practices
- water deficits via unsustainable demand in dry areas
- diseases via potentiating effects of malnutrition

Cropland shortages impact on:
- food production, hence on malnutrition and disease
- forests through clearing of forestlands for agriculture

Forest shortages impact on:
- fuelwood supplies, hence on disease and malnutrition

- women's education, hence fertility too, through time spent on seeking fuelwood from distant stocks
- agriculture through the food-growing opportunity costs of women seeking fuelwood from distant stocks
- watershed functions via upland erosion

Water shortages impact on:
- cropland productivity via lack of soil moisture
- diseases via lack of safe water and sanitation
- women's education, hence fertility too., via time spent on seeking water from distant sources
- agriculture through the food-growing opportunity costs of women seeking water from distant sources

Population impacts on:
- cropland supplies via sheer pressure of growing numbers
- land degradation via demands beyond carrying capacity
- food consumption via demand to feed growing human numbers
- malnutrition via insufficient food for growing numbers
- poverty via unsustainable economic demands from over-rapid growth in human numbers
- fuelwood shortages via excessive consumption
- water shortages via excessive demand
- other resource shortages via population “longages”
- disease via infections in over-crowded communities
- violent conflicts via shortages of land and other resources

Disease impacts on:
- population via incentives for large families to compensate for child mortality
- malnutrition via potentiating effects
- economic development in general and agriculture in particular, via reduced worker productivity

Malnutrition impacts on:
- farm production via physical incapacity
- disease via potentiating effects
- poverty via reduced productivity
- economic development via retardation of children's physical and mental capacities

Poverty impacts on:
- malnutrition via shortage of means to purchase food
- disease via lack of health care
- food production via shortages of agro-inputs and know-how of modern farming
- forests via over-exploitation of fuelwood stocks

Violent conflict impacts on:
- farmland degradation via military activities
- food production via abandoned farmlands
- malnutrition via disruption of food supplies
- disease via rundown of health services
- economic development generally and poverty in particular via funds diverted from development

Economic development impacts on:
-all of the above—just as all of the above impact on economic development.

As the global economy becomes more integrated and as the global ecosystem becomes more stressed, the repercussions of these linked linkages will surely become more marked and widespread: some could soon become a pervasive aspect of international relations. Recall some instances that have been widely documented (starting with e.g., Myers, 1986), and so are not dealt with further here: the hamburger connection and the songbird connection between the United States and Central America, the cassava connection between Europe and Southeast Asia, the cash-crop/desertification connection between Europe and the Sahel, and the debt/development connection between the rich world and the developing world.

For still further detail, consider the international soybean trade. The largest importer is China and the second largest exporter (after the US) is Brazil. China purchases soybeans as livestock feed to meet the soaring demand for meat on the part of its 400 million newly-arrived middle class people. Indeed China has become the carnivore capital of the world. Soybean plantations are established in Brazil through clearing of Amazonian forest and Cerrado woodland. Thus the hamburger addict in China effectively has his hand on the chainsaws at work in Brazil's forests and woodlands (Kaimowitz, 2004; Laurence et al., 2004). During just the brief period 2003-2005, at least 71,000 square kilometers of forest were destroyed. Moreover the burning of Amazonia releases large amounts of carbon dioxide and other greenhouse gases (GHGs). In 2004 one third of Brazil's GHG emissions stemmed from Amazonia deforestation, putting Brazil among the 10 largest climate polluters worldwide (Santilli et al., 2005).

Consider too an example of a Europe/Africa linkage, an economic/environmental linkage as well, and revisiting the matter of winter-time strawberries. Kenya's Lake Naivasha has been losing its waters to irrigation schemes around its shores until it has shrunk from its former 140 square kilometers to only half as much; it is now a mere one and a half meters deep on average, three meters lower than it used to be. Irrigated farms feature an expanse to equal the lake's, sustaining some of the largest flower, fruit and vegetable farms in the world. The main industry lies with cut flowers, especially roses and carnations, together with fruit and vegetables, notably strawberries and beans. Kenya's horticultural industry earned well over $700 million in 2007, making it the country's best source of that vital lubricant for development, foreign exchange (Obulutsa, 2008). The produce is dispatched by each evening's freight jumbojets some 5,000 miles to Europe, making for a year-round business (Food and Water Watch, 2008). Europeans reckon they could not get by without strawberries, carnations and other luxuries in winter time—provided they remain cheap enough in European shops.

But how many Europeans realize their strawberries etc. reach them at cost of a far-off lake being drained, and because aviation fuel is subject to zero tax (airplanes are

the fastest growing source of carbon dioxide emissions, hence they should be taxed to the hilt)? Over-cheap aviation fuel amounts to another gross institutional failure: we should design an international pricing mechanism that takes care of such marketplace bloopers. And who among the Europeans enjoying a breakfast of Naivasha's goodies realises that until recently the lake ranked as one of the world's top 10 sites for birdlife, with more than 350 species or almost as many as the 2,000-times larger British Isles (Minot and Ngigi, 2004; Hughes, 2001)?

Such is the nature of linked linkages that serve to highlight three dimensions of the environmental prospect in the 21st century. First, it is all too easy for a nation to export its problems, whether economic in cause and environmental in consequence, or the other way around. The United States has sought to counter inflationary trends in its fast-food markets by buying artificially cheap beef from Central America; the European Community subsidizes similarly cheap-seeming beef imports from savannah Africa. The United States, Britain, China and several other nations have in effect been dumping their coal-fired power stations' pollution onto neighboring nations in the form of acid rain; and all communities that burn large quantities of fossil fuels are enjoying a free ride on everybody's climate by virtue of global warming. The winds carry no passports.

Second, and by extension from the first factor, it is not always sufficient for a nation to seek to safeguard its own environmental endowment through its national policies—just as it becomes increasingly difficult for a nation to safeguard its economic interests through unilateral action. Rather, the entire community of nations, reflecting a sort of emergent global constituency, needs to consider its joint needs as an indivisible objective of collective global wellbeing.

Third, and most important of all, the situation illustrates a new version of "the tragedy of the commons" (Hardin 1968), this time on an international if not a global scale. The actions of one nation, as perceived by that nation within the context of its own sovereign interests, may appear rational and productive, as illustrated by developed nations' search for cheap beef, cassava, peanuts and hardwood timber from developing nations. It is only when these actions are perceived within the context of the international community that they turn out to be irrational and destructive—and ultimately harmful not only to the overall interests of the international community, but to the separate interests of the individual nations.

Grandscale example: the oceans

The human activity sphere of the oceans obviously includes sectors such as fisheries, biodiversity, pollution, technology, climate and energy. Less obviously, though inevitably insofar as the oceans extend to coastal zones, the sphere includes human settlements (four people out of 10 live within 100 kilometers of coastlines), plus

agriculture and industry, all being major sources of pollution. The sector can even include forestry insofar as deforestation of inland watersheds leads to siltation of port facilities. Deforestation also leads to a smothering impact from soil, silt and other debris washed off watersheds onto in-shore fisheries (Myers, 1993; Postma and Zijlestra, 1988).

Yet our analytic response to oceans issues is typically scientific and technical for the most part, whereas the economic and political dimensions should receive at least as much weight. Equally to the point, the policy approach to the oceans is generally specialized and categorized rather than integrative and holistic, even though the latter is surely required for an entity with a continuum of human activities that recognize few boundaries. Still more significant, the institutions deployed to tackle ocean questions usually enjoy scant mandate to address questions in systemic manner, even though ocean problems tend to be systemic in both scope and scale. Among institutions grappling with ocean problems are the International Maritime Organization, the Intergovernmental Oceanographic Commission, the Food and Agriculture Organization's Fisheries Department, and the United Nations Environment Programme's Regional Seas Programme. Yet because they are constitutionally little concerned with questions of linkages, these specialized bodies are inclined to respond in competitive if not contradictory fashion—quite the opposite of the collaborative response postulated by the phenomenon of linkages (Myers and Kent, 2005).

It is precisely because of in-built disregard for linkages that many ocean problems are increasing in size and number. When land-use planners decide to site industries in coastal zones, they unwittingly foster use of the marine realm as a costless sewer, whereupon pollution depletes ecosystem health in the oceans with adverse effects on fish stocks and biodiversity generally. When fisheries experts develop plans for sustained-yield harvests in developing-nation waters, they tend to limit their analyses to scientific and technical factors, overlooking the often impoverished status of fisheries communities that fosters over-harvesting. When human-settlement agencies encourage the buildup of ever-larger numbers of people in coastal zones, they often act with indifference to climatologists' warnings of sea-level rise that will surely inundate some of the most densely settled areas of Earth's surface. Most of these instances of linkages myopia apply in developed and developing countries alike. The problems arise because planners do not automatically take cognizance of all the “sideways” consequences stemming from their activities.

Synergized linkages

There is a special case of linked linkages, viz. when the impacts of one are compounded by the impacts of another, making the outcome all the more significant.

Alternatively stated, one linkage can work in conjunction with another to generate a synergized or mutually amplified impact. The impact is not doubled, it is increased several-fold because the consequence is not additive but multiplicative (Steffen et al., 2004). To put it another way, one problem interacting with another problem does not produce a double problem but a super problem. To cite a well-known illustration, a plant's tolerance of one stress tends to be lower when other stresses are at work. If low sunlight reduces a plant's photosynthetic activity, the plant becomes more susceptible to cold weather; conversely, cold weather increases a plant's vulnerability to low sunlight (Graham and Paterson, 1982; Myers, 1996). The result of compounded interactions can be an order of magnitude greater than the sum of the component effects.

We know all too little about environmental synergisms. Ecologists cannot even identify many of their natural manifestations, let alone document their impacts. If we can discern potential synergisms in the environmental upheavals ahead, we shall be better able to anticipate, and even prevent, some of their adverse repercussions.

As an example of a compounded-impact linkage, consider ozone-layer depletion in synergistic combination with global warming. The oceans serve as a significant sink of carbon dioxide, due largely to the role of marine phytoplankton which absorb a sizeable share of annual emissions of atmospheric carbon dioxide. Yet the phytoplankton are specially sensitive to enhanced UV-B radiation from ozone-layer depletion. Were marine phytoplankton to be markedly reduced, the oceans' capacity to absorb carbon dioxide would likewise decline, thus accelerating global-warming processes (Houghton, 2004).

Global warming is also linked synergistically with genetic depletion through each phenomenon's interaction with agriculture. The higher temperatures and reduced soil moisture expected in certain parts of a globally warmed world will not be appropriate for most agricultural crops insofar as these are finely tuned to current climatic regimes. So the need to expand the genetic adaptability of our crops places a premium on germplasm variability to increase drought resistance. Yet this is precisely a time when the gene reservoirs of many crop plants are being depleted due to broad-scale elimination of biodiversity.

Global warming will also interact synergistically with population growth. Consider the case of Bangladesh, already one of the most overcrowded nations on Earth. Within another few decades, Bangladesh may well lose a sizable portion of its territory to sea-level rise (Myers and Kent, 2009). Bangladesh's population is projected to increase from 147 million (2008) people to as many as 215 million in 2050. Each of the two basic problems will make the other more severe in its impact. In fact, population growth is one of the issues most likely to be affected by synergisms, as is apparent in its linkages to food, agriculture, water, energy, urbanization, employment, and a host of other sectors (Ehrlich and Ehrlich, 2004). Yet many population projections are still made in a vacuum with regard to natural resources, as if demographic processes operate

independently of the numerous linked factors that are essential for the survival of potential parents of the future.

When we consider all environmental disruptions together, we find there is potentially a multitude of synergistic interactions that could exert pronounced adverse impact. To this extent, we should anticipate a greater environmental debacle overall, and overtaking us more rapidly, than is often anticipated. Thus synergisms merit detailed and methodical attention if we are to comprehend all the crucial factors at work in our environmental predicament. Each time we fail to discern a synergism at work, our best efforts to tackle environmental problems may fall far short. Regrettably, the amount of synergism-related research planned or underway is all too limited, and almost entirely uncoordinated. Could this be a major (synergistic?) challenge for environmental scientists (Myers and Kent, 2005)?

At the same time, let us bear in mind there can be constructive synergistic interactions, particularly as concerns management interventions. For example, grand-scale tree planting in the humid tropics, undertaken to generate a sink for atmospheric carbon dioxide to counter the greenhouse effect, can supply many spinoff benefits through, for example, commercial forestry plantations that relieve excessive logging pressure on remaining natural forests (Myers and Goreau, 1992). In turn, reduced deforestation will help to safeguard the uniquely abundant stocks of species and genetic resources in tropical forests, with sometimes large economic benefits (a wild rice from India's forests has saved much of the Asian rice crop from a blight disaster). Both tree plantations and surviving natural forests supply many hydrological functions, e.g., their capacity in upland catchments to regulate water flow and reduce downstream flooding.

Present/future linkages

Thus far we have considered linkages largely within the context of the present time. But some of the most important linkages concern interrelationships between the present and the future, thereby reflecting on the divergence between certain forms of current economic growth and long-run prospects for sustainable development. Apart from the fact that development connotes many processes that are non-economic in nature, e.g., social, political and cultural development, much economic growth of the present is clearly not sustainable, for both economic and environmental reasons. In fact, it may well turn out that we are achieving economic advancement today at a cost to the future's capacity to supply still more advancement, and at the more serious cost of an actual decline in human welfare.

Consider the case of Green Revolution agriculture, which has enabled growth in grain production to keep ahead of growth in human numbers for most of the past several decades (as one might also express it, the plough has kept ahead of the stork). It

is now becoming apparent there have been a number of covert costs in the form of e.g., over-exploitation of cropland soils leading to erosion, depletion of natural nutrients and salinization of irrigation systems. (These costs apply in Indiana as well as in India.) The costs, although often unnoticed through disregard of the linkages factor, are already levying a price in terms of cropland productivity. In India at least one third of irrigated lands have become so salinized that they have lost much of their productivity (Brown, 2004), yet the country has often been hailed as an exceptionally successful exponent of Green Revolution agriculture.

Worldwide, the environmental underpinnings of agriculture are becoming so severely depleted that many apparent advances in agricultural output are being critically cut back. Environmental problems (soil erosion, salinization, desertification, etc.) have curtailed gains from increased investments in irrigation, fertilizer and other inputs. This loss is the more serious in light of the fact that we need an additional 24 million tonnes of grain each year just to feed the extra mouths, let alone to meet the demands of economic advancement and nutritional improvement. In 2007 the per-capita global grain harvest averaged little more than in 1977 (Brown, 2008; Worldwatch Institute, 2007). Recall too that recent years have seen much more grain being fed to livestock, to the detriment of human nutrition—a linkage that is often overlooked by development agencies and other institutions.

Institutional indifference to linkages

Despite their great and growing importance, linkages are increasingly tuned out by our institutional limitations. At a personal level, we often remain indifferent to linkages because an effort to recognize that everything is interconnected ("we can never do only one thing") runs counter to much of our professional background, single-disciplinary as that is likely to be. As a measure of how far we balk at the prospect, consider some of the organizations that are engaged in activities extending far into the future. Certain of these organizations ostensibly suppose the long-term future will feature climate conditions little changed from today's, even though it is becoming certain that will not be the case. Many foresters worldwide continue to plant tree species that reflect present conditions of warmth and moisture, even though the trees will surely experience radically different conditions by the time they reach maturity. Dam-construction planners anticipate huge investments for installations in localities that are likely to encounter marked declines in rainfall during the course of the dams' operational lifetimes. In the southeastern sector of Britain there is less rainfall than formerly, yet the government plans to build half a million new houses there, even though these houses will have no "grey water" requirement to recycle water that has already been through the house via the clothes washer, dish washer, shower or sink.

Similarly, we have difficulty in recognizing the concealed costs of inaction on the linkages front. For decades, we have supposed we can burn fossil fuels without major environmental repercussions. Yet it would have required only a modicum of anticipatory analysis via linkages thinking to recognize that fossil-fuel emissions were likely to lead to environmental disruptions such as acid rain; and we were warned over a century ago (Arrhaneus, 1896) about the prospect of global warming. The threat of ozone-layer depletion through chlorofluorocarbons was acknowledged at the 1972 Stockholm Conference on the Human Environment, yet our blinkered recognition precluded preventive action for more than 10 years. What other super-scale surprises are in store for us as we persist with indifference to linkages, thus setting up precisely those circumstances that all but guarantee a plethora of surprises?

Conclusion

Linkages are not something we should tackle when the time is finally ripe. They are a central fact of the world we live in right now, and they are growing more numerous and significant all the while. The gray areas of dynamic interactions between sectors are sometimes as important in strictly economic terms (let alone other development considerations) as are the sectors themselves. The more we overlook the linkages, the more we shall find the sectors fail to function efficiently and productively, with all that implies for sustainable development. In many cases, we shall increasingly find that linkages are all.

Yet linkages tend to be ignored because our view of the world is traditionally grounded in a practice of splitting it up into manageable components. In an ever-more interdependent world by virtue of proliferant relationships—whether environmental, economic, political or social relationships—we can no longer afford the luxury of supposing that linkages are an incidental factor that is too complex to be reflected (operationalized) through institutional responses. We still try to direct our affairs with institutional systems that reflect a bygone and far less integrative era. These institutional systems are singularly unsystematic in that they disregard what is now a predominant phenomenon of the planetary ecosystem and the world order. Far from adapting in accord with objective reality, they remain static and out of tune with the times. Of all the proliferant features of an interdependent world, institutional systems exert a profound impact by virtue of their deficiencies.

Bottom line: we will respond to linkages either by reactions of sufficient scope and character, or by salvage measures in a world impoverished by our disregard for linkages. Linkages will eventually be addressed, whether by institutional design or by tunnel-vision default.

4. SURPRISES

"The only real surprise ahead will be if there are no surprises."

Anon.

Our societies are prone to stumbling when they run up against the abrupt arrival of some new event. We tend to react with surprise—even though, often enough, the truly surprising thing is that we were surprised by an event that could have been anticipated, as with the notable case of AIDS. It is the surprise element that causes us trouble. (Footnote: In technical terms, surprises can be defined as events whose effects diverge from the expected extension of established trends. Strictly speaking, of course, we cannot say much at all about surprises, because if we had even a preliminary grasp of a surprise ahead, it would no longer be a surprise.) Humans seem to be programmed to the notion that things change in a gradual, systematic and pretty predictable fashion, with tomorrow largely like yesterday and nothing much really new. We think the main feature of our lives lies with patterns and trends, leaving surprises to be very much the exception. Yet that same world is actually beset with surprises, and history tells us that change often arrives with little or no apparent warning and in sudden jerks. Experts assert that the future will be a "surprise rich" affair, hence there is a need to develop institutional capacities (research centers, think tanks, government bodies, business communities, specialized agencies, etc.) to help us look down the road ahead and foresee surprises that will otherwise catch us unawares (Anderson, 2004; Heal and Kristrom, 2002; Low, 2004; Schwartz, 2003; U.S. National Academy of Sciences, 2004).

Let's note some outsize examples. The Internet took the telecom giant AT&T by surprise. The resurgence of once-conquered diseases took the World Health Organization by surprise. The decline of the worldwide nuclear industry took electric utilities, governments and the industry itself by surprise. The fall of the Soviet Union took the CIA and other intelligence agencies by surprise, and the same with the 9/11 attack on the World Trade Center. Who would have anticipated the Cuban missile crisis, the Three Mile Island meltdown, the fall of the Berlin Wall, the collapse of apartheid in South Africa, or the Asian financial crisis of a decade ago? Then there is China's lifting 600 million people out of absolute poverty during 1981/2004, an instant advance that took development-crats by surprise. On October 16th 1987 Britain's leading weather forecaster told millions of television viewers that warnings of a hurricane hitting southern England could be totally discounted, whereupon a few hours later a hurricane destroyed 15 million trees—and three days later, a crash on the London Stock Exchange wiped £50 billion off share values.

Not surprisingly (sic), surprises have always been with us. As Francis Bacon observed 400 years ago (Bacon, 1620), "The most important advances are the least

predictable. ... Gunpowder, silk, and the mariner's compass: these things were not discovered by the arts of reason, but by chance and occasion. No preconceived notion could possibly have conduced to their discovery." Nor have our predictive skills advanced as much as one might suppose. The ozone layer hole was not discovered until long after the culprit data had become available. The mass extinction of species was not identified until it was well underway. The phenomenon of environmental refugees was not demonstrated until they had become so prominent that their numbers exceeded all other refugees put together. In 1937 a U.S. National Academy of Sciences study predicting scientific breakthroughs overlooked such leading items as nuclear energy, antibiotics, jet aircraft, rocketry, computers and even transistors, plus other technologies that have dominated our lives during the past half century (Rees, 2004; Townes, 1995).

Part of the prediction problem lies with the speed with which technologies appear and impose themselves on our lives. In the United States of the late 1800s the length of time it took for electricity to move from discovery to mass use (one quarter of the U.S. population) was almost half a century; from the mid-1920s television took 26 years; from 1975 the personal computer took 16 years; and from 1983 the mobile phone took 13 years (Hawken et al., 1999). According to Professor Sir Martin Rees (2004) when commenting on the speed at which personal computers have been improved, "The density with which circuits are etched on computer microchips has been doubling every eighteen months for nearly thirty years. ... In consequence, there is far more processing power in a computer-game console than was available to the Apollo astronauts when they landed on the Moon."

The road ahead

All this raises a vital question: What major occurrence(s), totally unpredictable and arising during the present century, might be staring us in the eye right now? Recall the story of the English detective Sherlock Holmes. He was called out to a crime scene that had left the police baffled. "How strange about the dog", commented Holmes. "What was so strange?", asked the police, "It didn't bark or anything." "Precisely", answered Holmes, "What was strange was that it didn't bark, presumably because it recognized the intruder"—a reflection that led to a swift resolution of the crime. Question: What non-barking dogs today are we failing to hear? What new inventions are we failing to devise, what new knowledge are we failing to discover, what new understanding are we failing to attain? In the year 2020, will our descendents look back and say of some item that has become a predominant phenomenon of their age, "How could those people of year 2008 have managed to overlook this (whatever)?"

All the more, then, we need to keep our minds open to "concepts that now seem on the wildest shores of speculative thought" (Rees, 2004), e.g., super-human robots and nanotech assemblers; malleable human characters and physiques; the reverse engineering of human brains to download thoughts and memories into machines; the singularity circumstance where technology races toward infinity; the spread of nuclear weapons and their potential doomsday outcomes; nuclear mega-terrorism; and the burgeoning technology of designer viruses (Rees, 2004; see also Martin, 2006). Our future world may be so far different from our present world, and so far different from what we "realistically" anticipate, that it could soon border on the unrecognizable.

On a much more prosaic level, we should all be making plans for the end of the oil era. We should reckon that everything about our lives will change in a post-oil world—not just how we get from here to there, but downscaling and re-scaling virtually everything we do and how we do it: the kind of work we do, the place where we do it, and how far we travel from home to work. Plus: what we eat, how it is produced/grown and how it makes its way from crop field to meal table; plus again: how we maintain relationships; how we enjoy our free time; and how we spend our retirement years (Kunstler, 2005).

Discontinuities

A frequent source of surprises lies with what are technically known as discontinuities. They reflect non-linear processes that are often difficult to understand and are still more difficult to plan for. They arise when an apparently smooth process of change is interrupted by a drastic switch to an altogether different state. For example, water remains a liquid until its temperature falls below 0°C, when it suddenly, and surprisingly, changes into a solid. There is another equally swift change when the temperature reaches 100°C and the liquid instantly becomes a gas. There are many such discontinuities around us; indeed we shall all have a close personal experience of two formidable discontinuities during our lifetimes.

Experts in many fields base predictions of the future on a linear projection of the past, looking for a case of "The same as before only more so and hopefully better so." They do this even though they may suspect their prediction will often be disrupted by discontinuities. Moreover a discontinuity can produce an effect that is disproportionate to its size. Large changes can produce small effects and small changes can produce large effects—the final and tiniest incremental change can be the straw that breaks the camel's back. Or: leaning slightly over one side of a canoe causes merely a small tilt, while leaning slightly more may roll you into the water. Hence the importance of "tipping points," or stages when one situation flips over into another and basically different situation (Brashares et al., 2001; Gladwell, 2000; Scheffer et al., 2001; Weiss

and Bradley, 2001). Such a tipping point was reached by the mis-functioning of the Chernobyl nuclear plant, leading to a sudden meltdown. Another tipping point occurred when the Aral Sea in central Asia suffered such prolonged withdrawal of water for cotton irrigation during the relatively brief period 1960/1990 that it eventually collapsed into a few separate lakes (Micklin, 2000). The most famous tipping point of recent years was probably the fall of the Berlin Wall, which was not really brought down on that single famous night in November 1989, however much it might have seemed that way to many casual observers (see Chapter 10).

Probably the biggest discontinuity we can foresee is climate change, which will in turn generate a host of mini-discontinuities (albeit exceptionally large when compared with most human experiences to date). For example, a globally warmed world will cause ice shelves to retreat slowly up to a certain point, whereafter they will disintegrate at ever-more rapid rates. In the case of the Larsen B ice shelf in Antarctica, this could trigger a glacier surge causing a substantial and sudden increase in sea levels worldwide, culminating in a "catastrophic surprise" (Schneider, 2004; Spash, 2002). Much the same applies to the Arctic Ice Cap and the Greenland Ice Sheet. A globally warmed world could melt enough of the Greenland's ice to dislocate the deep-ocean currents of the North Atlantic, and as a result, the Gulf Stream could shift southwards and leave Britain turned into another Iceland. While this would not happen overnight, the prehistoric record shows it could occur in just a few decades—lightning speed in terms of the economic traumas implied (Mastny, 2000; McCarthy, 2005).

To cite a prehistoric precedent, 14,500 years ago several ice sheets catastrophically collapsed into the ocean, causing sea levels to rise by 20 meters in just 400 years; and 6500 years ago the Sahara was suddenly turned from lush vegetation to arid desert (Steffen et al., 2004). And for an example from today's world, note that the water temperature in the tropical Atlantic can grow warmer without causing any severe storms, but once it passes 27°C it starts to generate hurricanes. Even though the increase is marginal, it is enough to trigger a discontinuity of exceptional impact. What if, as is all too possible, a Caribbean hurricane no longer bypasses Miami but lands on top of the city? The damages (as with Katrina) could easily exceed $100 billion—whereupon the discontinuity would immediately become economic as much as environmental.

In sum: a principal feature of both surprises and discontinuities is that they have the capacity (1) to be profoundly disruptive of systems whether natural or socioeconomic/political, and (2) to catch us unawares by overwhelming our anticipatory and preventive capacities. Moreover both are specially frequent in the environmental field, though they occur with disconcerting regularity in the socioeconomic and political fields too. Both sets of phenomena deserve priority attention from scientists in general and environmentalists in particular, yet the

professional literature (learned journals, scientific textbooks) has done all too little to assess them. Many ecological texts do not even list the phenomena in their indexes, and there are few substantive efforts to broach them even in exploratory terms (Anderson, 2004; Ayres, 2000; Heal and Kristrom, 2002; Schwartz, 2003).

Despite our ignorance about them, such super-surprise phenomena are likely to proliferate in the fast changing world of the future. Already they seem set to present more complex challenges than human ingenuity has faced thus far (Ayres, 2000; Homer-Dixon, 2000; Smil, 2005). Hence a major challenge ahead for us: how can we modify our institutions to make them adaptable enough to match the hosts of surprises that surely await us? We shall return to this "action angle" in Chapter 10 on the scope for policy leverage.

Health surprises

To illustrate the capacity of surprises to proliferate, consider the health arena. The AIDS pandemic is less than three decades old and it has already killed 25 million people. Over 30 million people are living with HIV. Every day in 2007 another 7400 became infected and 5500 people died (UNAIDS, 2008). By the time the virus is half a century old and into its probable decline, as many as 150 million people could have become infected, especially insofar as the pandemic is now raging across China and India as well as Sub-Saharan Africa.

We claim to have been surprised by the emergence of AIDS. Yet from the early 1960s onwards, multitudes of people started to press deep into tropical forests with their vast reservoirs of new pathogens. It surely became inevitable that a virus would eventually make the jump from a wildlife species, probably a primate, into humans. Once these human hosts were infected, the virus would find itself in a bug's paradise as hosts travelled across extensive landscapes and even around the world by courtesy of air travel. Not that AIDS is the only pandemic disease to have suddenly jumped out on us. Since 1970 there have arisen 32 new diseases previously unreported in humans (including Hepatitis C, Legionnaires disease, Ebola, SARS and avian flu (Bloom et al., 2006). We should face the prospect that as ever-greater multitudes of humans encroach onto ever-broader natural environments (there are plenty apart from tropical forests), more pathogens will attack more humans and more new diseases will assail us (Garrett, 1995; Levy and Fischetti, 2003; McMichael 2001). Will that "us" still be a "surprised us"?

Since 1960, an average of 2-3 new viruses affecting humans have been discovered each year. While most have been transmitted from other mammals, a significant number have been from birds/wildfowl (McKie, 2008; Woolhouse, 2008). In 2002 hundreds of people died from SARS; and Ebola (linked to fruit bats) has caused several disease outbreaks since the mid-1970s. As areas open up in Africa and South America, so more people encounter animals with which humanity has had little previous

contact. Several hundred new varieties of viruses may still be lurking in the wild or in remote populations (McKie, 2008; Woolhouse, 2008; World Health Organization, 2007).

The 1918 flu pandemic was a fearsome affair, killing more than 100 million people worldwide. More people succumbed in 24 hours than AIDS has killed in 27 years; and it killed more in one year than the Black Death killed in one century (Barrie, 2004). But some experts believe that it could be matched or even surpassed by a full-scale outbreak of bird flu (Weiss and McLean, 2004). To quote the World Health Organization et al. (2007) "We at WHO believe that the world is now in the gravest possible danger of a pandemic." Many medical experts have come to believe it is only a matter of time until a new and deadly strain of bird flu erupts. The British government views a pandemic as not a question of "if" but "when"—and so severe that it could eventually match the flu pandemic of 1918 (Weiss and McLean, 2004).

Suppose a bird flu pandemic were to strike today—a threat that, in the view of some experts, is even more likely than a 9/11-style terrorist attack. The ensuing socioeconomic and political impacts could rapidly multiply until they trigger widespread panic. Yet this could pale in comparison with a bird flu episode featuring an unusually virulent version of the disease. The flu kills at least 70% of humans infected, by contrast with only 2.5% of flu sufferers in 1918-19 (Brahmbhatt, 2005).

What response could we offer? A crash program using the world's entire flu vaccine-making capacity could probably immunize only about 450 million people or less than 7% of the world's population (World Health Organization et al., 2007). Faced with a flu crisis, many governments might close their national borders, the globalized economy would shut down in part at least, vaccine supplies would likely run short from the outset, and health-care systems would be speedily overwhelmed. Confusion would soon spread to dominate the world order (Garrett, 2005; Osterholm, 2005). Moreover the flu virus might evolve so rapidly that a shot protecting us today could prove useless six months hence. Most significant of all: the first warnings of a bird flu pandemic arose in mid-2004; since then the warnings have become steadily more strident, yet today we are little better prepared than we were then (World Health Organization et al., 2007).

There are other "surprise nasties" assailing our health, notably the endocrine disruptors which may prove to be "reproduction time bombs" for several generations ahead (Colborn et al., 1997; see also Garrett, 1995; Levy and Fischetti, 2003; McMichael, 2001). Only a few of the 100,000 synthetic chemicals in commerce and the unknown thousands of other industrial chemicals produced as by-products have so far been screened for possible adverse impacts on human health, especially for their carcinogenic impacts (Bright, 2000; Howard, 2002; Patz et al., 2000; Tickner, 2002). All this implies plenty of scope for surprises, as unwanted as unexpected.

Fortunately we have a success story to hearten us on our way as we grapple with putative problems such as a flu pandemic. In 1977 we finally eradicated smallpox in the

wild after it had caused untold suffering over the centuries, killing 300-500 million people. Just 10 years before its final demise in the wild, it infected 15 million people and killed two million. If the virus had not been backed into a corner in the form of a few laboratory containers, it could still be causing over one million deaths and costing billions of dollars a year (Heymann, 2000).

In summary of this chapter so far: Our future will surely feature stacks of surprises, arriving in many shapes and sizes (Brashares et al., 2001; Schwartz, 2003; U.S. National Academy of Sciences, 2004; Watkins and Bazerman, 2003). They will often be more complex than we have known so far, and thus more challenging to be accommodated through institutional responses such as more accurate forecasting (Martin, 2006). Of course complexity itself should not be a problem, it's how we handle it that counts. We do not need to understand the intricacies of a car engine in order to drive it serenely along the road.

Environmental surprises

Let's take a closer look at environmental surprises. Ecological discontinuities usually occur when ecosystems absorb stress over long periods without outward sign of damage, but eventually are pushed to the limits of their resilience. They reach a disruption level at which the cumulative consequences of stress finally reveal themselves through systemic change of critical scale. Or: while ecosystems often change gradually because of long-term trends in e.g., nutrient loading, habitat fragmentation, biotic exploitation or climate fluxes, changes are not always gradual. Slow and steady change can be interrupted by sudden drastic switches, moving the ecosystem to a basically contrasting—and often impoverished—state. Examples include the collapse of the Peruvian anchovy fishery in the mid-1970s and of the New England cod fishery in the early 1990s. Such "jump effects" could well become more common in today's world as many ecosystems lose their ecological resilience (Scheffer et al., 2001; and for general reviews, see Cairns, 2004; Myers, 1996).

A more widespread instance of a jump effect is that of acid rain. It was well described more than two decades ago by Bormann (1985): "Often enough, a forest ecosystem can successfully buffer stress for long periods, with the result that biotic regulation is scarcely affected and ecosystem changes are little perceptible. Yet even while the ecosystem remains apparently unchanged and healthy, its inherent complexity may mask systems of damage. As the buffering capacity is depleted, so the ecosystem moves nearer to the limits of its resilience—and thereafter toward a potentially abrupt collapse to a state with lower productivity and markedly less biotic regulation of energy flow and biochemical cycles." Or, to state it differently and with Scheffer et al. (2001), "Gradual changes in vulnerability accumulate until eventually you get a shock to the

system—a flood or a drought—and boom, you're over into another regime. It becomes a self-sustaining collapse."

There are numerous examples from the natural world to warn us of surprise troubles ahead, most of them unexplained. Many amphibian species are undergoing marked decline in several areas of the world (McCallum, 2007). There has been extensive coral bleaching since the early 1980s in most coral reef areas (Goreau and Hayes, 1994; Hodgson, 1999; Myers, 1996; Strong et al., 1998; United Nations Environment Programme, 2006a). There have been mass die-offs of dolphins and seals. The black sea urchin, once ubiquitous in the Caribbean, has all but disappeared. Several near-shore plankton blooms have erupted in recent years. There are emergent cancer epizootics in fish, while half of all marine turtles in the Caribbean and Pacific reveal tumors. Birds migrating between the United States and Central America have shown a 25-50% drop-off in numbers since the mid-1960s. Saguaro cactuses in the southwestern United States and northern Mexico have lost half their numbers in some areas, and many other are showing "browning" with loss of spines. Perhaps most serious of all is the emergence of "dead zones" in the oceans, caused by nitrogenous fertilizer, sewage and fossil fuel pollutants that kill every last oxygen-dependent marine creature. In 2006 there were over 200 such zones, one quarter more than just two years previously. They included Chesapeake Bay, the Gulf of Mexico, Scandinavian fjords and the Western Indian Shelf (United Nations Environment Programme, 2006b). The largest ones can encompass well over 11,000 square kilometers.

These covert environmental processes surely add up to a whole flock of miner's canaries singing with decibels of warnings. What should we do about it? For an immediately practicable measure, consider that the 4200-plus amphibian species are distributed throughout the world, they are well known, and they are generally easily observed and readily recognized. They could lend themselves to an initiative enlisting the support of amateur naturalists and wildlife enthusiasts, who through appropriate research protocols could be mobilized to engage in a worldwide effort to watch out for declining populations. There is already a start on what might be called an Amphibians Alert program, offering a fine institutional initiative.

We should anticipate that as human communities continue to increase their numbers and their consumption demands, together with over-exploitative technologies (a redoubtable triad), they will exert ever-expanding pressures on ecosystems and natural resources. In turn, certain of these ecosystems and natural resources will prove less and less capable of supporting the growing needs of humankind. The plausible upshot is that environmental discontinuities, together with their surprise impacts, will become more frequent and with profound repercussions for the biosphere and the sociosphere alike (Brashares et al., 2001; Scheffer et al., 2001; Spash, 2002; Steffen et al., 2004).

Finally, consider a surprise discontinuity that has hardly been noticed outside the realm of experts. Last century's ocean fishing, especially since 1950 when traditional fishing shifted into "industrial" fishing (or, rather, massive over-fishing), reduced the aggregate biomass (living animal) of adult cod in the North Atlantic, mostly off New England and Newfoundland, to a mere 4% of what it had been in 1850. There has been a similar extreme depletion of other large predatory marine fish, including tuna, swordfish, rock fish and sharks. Open-water sharks in the Gulf of Mexico have fallen to 1% of their 1950s abundance. The global abundance of nearly all these top-of-the-food chain species has dropped to one tenth of what it was before the onset of commercial fishing. Although individual Atlantic swordfish used to grow to more than 450 kilograms, the average landed in 1995 was only around 40 kilograms and almost surely a couple of years short of its first chance to reproduce (National Coalition for Marine Conservation, 1998; Safina et al., 2005). Meantime the creatures on which large fish prey have thrived, with the numbers of stingrays, pomfrets and snake mackerels mushrooming by 10- to 100-fold and precipitating massively cascading changes throughout their ecosystems. It's not simply a case of one species replacing another, but a "complete change in the architecture of the community" (Bascompte et al., 2005; see also Rosenberg et al., 2005). Plainly there has been no institutional device in place (laws, management systems, monitoring protocols, etc.) to prevent this absurdly destructive over-fishing.

Political surprises

Already cited above are such instances as the fall of the Berlin Wall and the demise of the Soviet Union, together with the end of the Cold War. Also profound in its impacts was the end of apartheid. Less momentous examples—though largely unanticipated events—include the peaceful separation of Slovakia from the Czech Republic; the democratization of Argentina, Brazil and several other South American nations, also South Korea and Taiwan; and the (relatively) peaceful collapse of the Suharto regime in Indonesia and the bloody military dictatorship in Nigeria (Ayres, 2000; see also Cairns, 2004).

Alongside these political surprises are numerous economic surprises. They include the OPEC-inspired oil price hikes. In 1987 there was Black Wednesday on the U.S. Stock Exchange, followed in 1989 by the major financial crisis marking the end of Japan's "bubble economy" and depreciating stock and real estate by 60%. Thereafter came a number of sizeable though less than seismic upheavals around the world: the Mexican peso crisis of 1993, the financial panic-cum-devaluation emerging in Thailand in 1997 and spreading to Indonesia, South Korea and Brazil in 1998 (coincident with another form of financial collapse in Russia). Other pre-eminent crashes in history have included the German inflation of 1919-20 and the Wall Street crash in October 1929. In

2000 when a "bubble" in U.S. high-tech stocks burst, the NASDAQ index, being an indicator of the value of these stocks, plunged by fully three quarters. The latest major event has been the financial crash around the world in the Autumn of 2008.

Crashes constantly take economists by surprise, as if crashes, however often repeated, lie outside the natural order of things. As has been remarked by Nobel economist Paul Samuelson, "Economists have predicted nine of the last five recessions." Despite economists' disclaimers, however, regular crashes are surely inevitable. Stock market euphoria is almost invariably followed by dysphoria, a.k.a. boom followed by bust. The positive feedback that creates the bubble in the first place converts into a negative feedback that works in reverse—and the trigger that converts one situation into the other can be almost anything (Ayres, 2000). And yet we persist in claiming that such surprises still catch us unaware.

Finally, note a couple of economic surprises that have crept up on us unremarked, and are still little recognised outside their own sectors. In 2006 China purchased 15 million tonnes of wheat in the global marketplace. This marked a switch from China's role as a leading grain exporter over many decades, to a leading grain importer. The amount imported will surely grow year by year as carnivorous Chinese demand more steaks and hamburgers via grain-fed livestock (Myers and Kent, 2004). The knock-on effects will be profound for global grain supplies as China's demand drives up grain prices worldwide. But how many shoppers at U.S. supermarkets have noticed the steadily climbing prices for bread and pasta? One-worlders, hello.

China is affecting the entire world community in an even more significant sense. The country sits on one eighth of the world's coal, and it wants to use that coal to fuel its runaway development. The country already burns far more coal than the United States, the European Union and Japan combined. Coal-fired power already accounts for nearly one third of CO_2 emissions from fossil fuels worldwide, yet during the past five years the world has been on a coal-fired binge. It has been conventionally estimated that we have been bringing new power stations online at a rate of two per week, each of a size to serve all households in a city the size of Dallas (Clayton, 2007). Yet an estimate of mid-2007 vintage postulates that China alone is now accounting for at least one per week, and aims for more still (Orchison, 2007).

Further outsize socioeconomic discontinuities could arise if China were to break up into half a dozen "Chinas", a not impossible prospect insofar as the Chinese government has long found it all but impossible to run a country the size of the United States and with four and a half times as many people. Or consider Saudi Arabia, only semi-stable at best with its lavish, untaxed and oil-subsidized lifestyles becoming unaffordable. What if its autocratic regime were to be undermined by educated princes returning from Harvard and Oxford Universities, plus equally educated princesses told they must wear the veil, not drive a car and submit to numerous other highly personal

restrictions? Were the Saudi regime to collapse or be dispatched by a coup, there would be a swift and sharp rise in oil prices, possibly leaping as high as $200 per barrel.

Predictions and forecasts

Prediction methods have evolved enormously since the ancient use of oracles, and in recent times they have been much accelerated by the study of unpredictability in scientific advances such as Heisenberg's uncertainty principle. The demand for foreknowledge has escalated to an all-time high, and not just with people wanting to know next week's weather this week, or with investors wanting indicators of the best way to play the stock market. Despite all the advances already made and those in prospect, we are still stuck with the fact that we shall always be beset with uncertainty (Cornish, 2001; Halpern, 2000; Sarewitz et al., 2000). How far ahead should we peer? Strategy planners now select time horizons that range from the next business quarter to the next five years. Other futurists limit their purview to 30 years, often as little as 10 or even a mere five years (Cornish, 2001; Coates et al., 2001; Godet, 2001; Sarewitz et al., 2000). Those academics who ponder our responsibility to future generations usually consider the needs of people only 100 years ahead at most (Rawls, 1971; Weiss, 1989), yet we are now able to modify the biosphere and the planet, and hence the world and its works, to an extent that will shape our futures for millennia ahead, even millions of years in the case of mass extinction of species and gross degradation of the evolutionary biosphere (Myers and Knoll, 2001). So should we not expand our predictive institutions, especially our forecasting capacities, to match the real world? The number of professional analysts who are probing the future of many millennia—from standpoints ecological, biological, ethical, philosophical—is minimal.

At the same time, there is a great abundance of failed predictions. We should expect a reasonably correct assessment of the future from a front-rank body such as the United Nations and on a thoroughly researched issue such as population. Yet within the brief period 1999-2006 the predictions first “lost” 19 million and then “found” 10 million Russians (United Nations Population Division, 1999, 2003 and 2005; see also Schwartz, 2003; Smil, 2005). We should also note the supposed predictions of specialists such as Lord Kelvin in 1885, “Heavier-than-air flying machines are impossible”; Yale Professor Irving Fisher in 1929, “Stocks have reached a permanently high plateau”; Charles Duell, U.S. Commissioner of Patents in 1899, “Everything that can be invented has been invented”; Albert Einstein in 1932, “There is not the slightest indication that nuclear energy will ever be obtainable”; and the Decca Recording Company in 1962, “We don’t like their [the Beatles’] sound, and guitar music is on the way out.”

We can surely do a better job of anticipating certain “inevitable” surprises (Coates et al., 2001; Cornish, 2001; Godet, 2001; Rubenstein, 2000; Schwartz, 2003).

Fifty years ago we could readily have foreseen the emergence of OPEC (the organization had been warning us for years), followed after a few years by another foreseeable surprise in the form of tumbling oil prices. Similarly we could surely have predicted the end of the Cold War, the revolutionary advances in communications, the U.S. Savings and Loan crisis, the boom-and-bust economy in Japan, the growth of the Asian "tiger economies", and the rise of radical militant Islam. With the benefit of hindsight (that exact science), we could have held our ears closer to the ground and picked up those preliminary soundings that portend crucial deviations from the norm. Had we made better use of all information available, in fact, we could have gone far to anticipate and hence prevent 9/11. To cite an expert analyst, Peter Schwartz (2003), "The terrorist attack that day was perhaps the most forecast event in history. A half dozen reputable commissions over the previous 20 years had suggested that an attack very much like this might occur. Many predictions had singled out the World Trade Center as a target, mentioned the use of airplanes as weapons, and specifically referred to Osama bin Laden." We could also have made better use of our imaginations, along the lines of what the 9/11 terrorists did.

Will our forewarning institutions do better in the future, even as the array of targets multiplies? Tomorrow's terrorist attacks could range from launching cyber assaults on electronic infrastructures and poisoning urban water or food supplies, to the decapitation of national leadership, to the explosion of a dirty bomb, and to releases of old or new pathogens (Smil, 2005). The reader could no doubt consider a good number of other candidates for this list.

We should develop our predictive faculties with all urgency in that, as proposed above, we face a "surprise rich" future, indeed a world where surprises become the norm (Coates et al., 2001; Cornish, 2001; Rubenstein, 2000; Schwartz, 2003). Will we learn from experience and find ways to live more securely in what will surely be a world with surprises many times more frequent than today? Specifically, will we build the analytic institutions that will enable us to forestall the more disruptive surprises (Coates et al., 2001; Godet, 2001; Sarewitz et al., 2000; Watkins and Bazerman, 2003)? Thus far we are losing the game, and with costly consequences, because for the most part we are starved of adaptive institutions.

An onrush of surprises ahead?

We shall encounter ever-more numerous surprises arriving at once, many of them making for super surprises. "There could well be one surprise series after another, or rather side by side with each other, overtaking us at accelerating pace, and producing fundamental shifts in global systems of every sort from grandscale ecosystems to nation states, in fact the entire human enterprise" (MacNeill, 2000; see also Martin, 2006; Smil, 2005; Steffen et al., 2004). Several harmful changes might reinforce one another. For

example, coastal flooding resulting partly from sea level rise and partly from increased storms, could lead to a simultaneous loss of cropland, especially in Southern, Southeast and East Asia with their huge populations and fertile alluvial plains. What if these were combined with broadscale disruptions of urban settlements in those same sectors of Asia with almost four billion people. The overall outcome could be food scarcities, large-scale migrations and socio-political upheavals of many a kind (Dyson, 2005). Other climate impacts would hit advanced nations too, and all the harder because of their highly specialized and interdependent communities that would leave them unduly vulnerable.

To cite the editor of Future Survey magazine, Michael Marien (2006), "The world is facing a global emergency. The changes in greenhouse gas levels now being induced by human activity are greater than the changes associated with the onset and termination of ice ages. In some of the great regions that we rely on most for our grains and foodstuffs, agriculture will become unsustainable, [and] whole regional economic systems will be jeopardized." This warning has been reinforced by another expert, the President of Britain's Royal Society, Lord Martin Rees (2004): "Humanity is more at risk than at any earlier phase in its history."

Whether all this will precipitate a shift in our understanding is questionable. Thus far we have scant idea of what surprises lie ahead, nor are we likely to know until they start to happen (if then) (MacNeill, 2000; see also Gardner, 2006; Reading, 2004). Will be able to cope with the changed perceptions of our long familiar world, from a "gradually improving" world to a "suddenly deteriorating" world, indeed a wholly unimaginable world? This precipitous switch might prove the most difficult of all for us to accept (Drake et al., 2005)—whereupon the expert in greatest demand could well be the specialist in surprises.

Reader, why not take a moment to try your hand at becoming an expert in the surprises field, by looking beyond the headlines to seek out the true news. Attempt, in other words, a surprise change in your own manner of thinking.

5. ECONOMICS: A PARTIAL RECKONING?

"There's more to life than money, and it's time to shift our focus from Gross National Product to General Well-Being. The pursuit of wealth is no longer, if indeed it ever was, enough to meet people's deepest hopes and aspirations. We have to remember what makes people happy as well as what makes stock markets rise."

Lord Keynes, 1930, originator of the GNP concept

"Socialism collapsed because it did not allow the market to tell the economic truth. Capitalism may collapse because it does not allow the market to tell the ecological truth."

Oystein Dahle, former Vice-President of Exxon

"The stone age did not end because the world ran out of stones, and the oil age will not end because the world will run out of oil."

Amory B. Lovins, Rocky Mountain Institute

The institution known as economics features a good number of roadblocks that prevent policy from being as common-sensical as it could be. True, the academic field of economics offers many fine insights into the workings of the economy, with all their positive implications for policy frameworks (as for humankind's ultimate wellbeing). Moreover many economists are well aware of the limitations of their discipline, and they seek constantly to make it more coherent and productive—a qualifier to highlight to the skies though without asserting it in every paragraph. In this chapter we examine the shortcomings of economics as an institution, being shortcomings that rank as sure-fire roadblocks. One could suppose that these shortcomings are due to economic mechanisms rather than the field of economics itself; they are nonetheless failings in the way that economics is practiced. It is both the way the field is conceived in principle and the way it operates in the everyday world that is sometimes deficient.

Let's start with a selection of instances that demonstrate how (a) economics can sometimes be quirky, and (b) it is often over-ruled by politics anyway.

- Desertification affects two fifths of the Earth's land surface and imposes losses on agriculture totalling at least $65 billion per year. Anti-desertification measures (proposed more than two decades ago) would cost only $20-40 billion (2005 $s) (Adeel et al., 2007; United Nations Environment Programme, 2005).
- That staple of many an American breakfast table, bananas, offers a canonical case of the difference between price and cost. Bananas used to carry a sizeable price tag to reflect their apparent scarcity. How different today when the average

American consumes almost 30 pounds of bananas a year, far more than any other fruit whether foreign or domestic. Many bananas are grown cheaply in Central America through over-exploited labor and chemically polluting agriculture; as a result the last two decades have seen banana prices steadily decline (Schor, 2005), even though prices are ever-less capable of reflecting the full costs of production. Cheapness has its price.

- In 2002 the United States contributed a meagre $4 million to Ethiopia to boost its agricultural output, and then gave $500 million in emergency food aid when famine predictably hit the country (Sachs, 2005).
- In Britain the government's tax revenue of £8 billion a year from alcohol contrasts with alcohol-related problems such as public drunkenness, road accidents, crime, absenteeism, general rowdiness, and a host of other "social costs" totalling at least $30 billion (Tuxworth, 2006).
- To avoid one death on British roads costs a small fraction of what it costs to avoid one death on the railroads. Since the arrival of the railroads in the 1840s, over 3,000 passengers have been killed in rail accidents, whereas 3,400 people are killed every year on the roads.
- Subsidies are a central theme of economics and are much beloved by political leaders, yet agricultural subsidies cost the average family of four in OECD countries an extra $1,000 in higher food prices and taxes (OECD, 2007).
- If Britain is to have any chance of saving its North Sea cod, it must close the fishery for several years. But fishermen, enjoying munificent subsidies, have exerted political muscle to get the catch cut by no more than 15%, meaning they are effectively destroying their industry.
- A peak in oil production is just around the corner, yet most countries are reckoning on much higher oil consumption during the next several decades. At the same time, many countries are building more auto assembly plants than ever, and the same for roads, freeways and parking lots, all these being activities undertaken as though cheap oil will last indefinitely. Yet markets are supposed to be super sensitive to shifts in those two iron determinants, supply and demand, implying that these can solve all our economic problems. A rise in oil prices will supposedly trigger a shift to other energy sources, even though the real world questions whether high prices truly cut demand. During 1991-2004 oil prices rose by 350%, yet at the end of that period demand was growing faster than in all the previous 25 years. Plainly the energy companies will not respond to market pressures inducing them to pursue alternative energy sources until oil reaches considerably higher prices—and by then it could be too late to make the switch (Stein, 2005).

These eight instances illustrate the limitations of economics as an institution when applied in isolation from political factors outside the realm of economics. To cite the economist guru John Kenneth Galbraith (2001), "The greatest problem with economics lies with its wilful denial of the presence of power and political interests." In other words, economics is partway to being a branch of political science.

Now for four examples of how economics can get things semi-right, especially in big-picture instances.

- ✓ The United States uses only half as much energy per dollar of economic output as it did in 1973, thus reducing costs by $1 billion a day. But much additional saving could lie ahead, as witness the path-breaking achievements of Japan. Worldwide energy waste costs more than $1 trillion a year (Lovins, 2005), so why don't we do more to cut back on waste? Is it simply old-time institutional thinking?
- ✓ In 1990 the U.S. Clean Air Act set up a market for "pollution permits" that power plants must purchase in order to emit sulphur dioxide (SO_2), this pollutant being a major culprit in acid rain. Pollution permits are sold in annual auctions, and a "market referee", in the form of the government, periodically cuts the amount of SO_2 emissions for which permits can be sold. Thus the permits price reflects the economics imperative of supply and demand. The worst polluters take steps to lower their emissions, whereupon they sell their excess permits to those plants for which further upgrades would be too costly. In addition, environmentalists can purchase permits simply to keep them off the market. During the 1990s the cost of SO2-removing scrubbers fell by 40%; and as the cap on SO_2 permits has steadily declined, so too has acid rain. By 2010 the program is expected to cost 30%-50% less than if the government had simply required plants to meet a specific emissions standard. Other pollutants are being reduced by similar "cap and trade" measures. But again: why don't we do still more when the scope is so huge?
- ✓ Tackling air pollution can generate big economic savings of other sorts. For instance, through lower health-care costs and by prolonging productive life; through fewer losses to agriculture and forests; and through reduced damage to buildings and infrastructure from corrosive pollutants. These economic benefits in the United States have often been six times higher than the costs of pollution controls. So why don't we do more to slash pollution? Is it lack of creative thinking on the part of bureaucrats? Or is it outright inertia?
- ✓ New York City has been investing $1.5 billion over 10 years in watershed safeguards, mainly forest protection, to avoid having to build a water filtration plant costing $6 billion to construct and $300 million a year to run. Half a dozen other American cities have followed suit, while Bogota in Colombia has delayed

the need for new water supply facilities by at least 20 years (Postel, 2005). Fine, fine—but why don't many more cities do as much?

None of these four items is new, indeed they have been around for years. Yet in many instances the economics field has been slow to push the corrective buttons, or even to recognise shortcomings—which are, after all, missed opportunities. Fortunately there has been some welcome advance in this regard on the part of leading economists such as Kenneth Arrow, Partha Dasgupta, Robert Costanza, Richard Norgaard, Paul Hawken, Todd Sandler, Andrew Simms, Geoffrey Heal and Larry Goulder. Still, there has been a dearth of innovation in relation to what is urgently needed for a science that is central to all our futures. To again cite that leading economist, John Kenneth Galbraith (2001), "Economists are economical of new ideas."

Gross national product: too gross a measure?

"It's the economy, stupid." Yes, the source of much of our progress (some observers would include a good many of our problems too) lies with that pivotal phenomenon, the economy. Long measured by the formula of Gross National Product (GNP); or by its parallel, Gross Domestic Product (GDP), pretty much the same as GNP (more recently too by Gross National Income, GNI) (World Bank, 2007), it is a device for calculating the economic value of all goods and services produced in a country and traded through the marketplace. It is not only proclaimed by many traditional economists to be a form of ultimate truth, but it is regarded by politicians, stock markets, the media and other leaders of public opinion as the holy grail of economic activities. Thus GNP is central to our understanding of the world. But while the concept has long served as a convenient shorthand for how society is progressing, it is now subject to severe shortcomings.

The established mode of calculating GNP does not differentiate between constructive and adverse economic activities. It does not reflect the many negative externalities, both environmental and social, that reduce the value of the economy in increasingly significant senses. Yet according to GNP, these externalities are to be viewed as contributing just as much to human wellbeing as growing a field of wheat or educating a child. In the United States, waste alone accounts for a huge share of the economy. In their 1999 book "Natural Capitalism", economist Paul Hawken and energy experts Amory and Hunter Lovins engaged in some intricate arithmetic showing that of the economy's $9 trillion total in 1998, at least $2 trillion was spent on activities when the buyer got no value, e.g., by sitting in a traffic jam on a congested road—such congestion was costing American society $100 billion in lost productivity alone. Two million traffic accidents cost society over $150 billion, including property damage,

health care, lost work output and tax revenues, and police, judicial and social services costs. The nation spent $50 billion a year to guard sea lanes bringing oil from sources that would not be needed if the White House had not gutted light-vehicle efficiency standards since 1986. These and other "hidden" costs of driving, i.e., not paid by the motorist, totalled almost $1 trillion or $7 per gallon. A further $200 billion in wasted energy was due to Americans' disinclination to employ the same efficiency practises as Japan in businesses and homes.

Plus: in the health care sector, $65 billion was spent on non-essential or even fraudulent tests and procedures (including more than 400,000 unnecessary caesareans). The insurance system levied $250 billion through inflated and needless medical overheads. Then there was $100 billion in the costs of air pollution. On top of all that, Americans spent $275 billion on avoidable heart disease and strokes, and $50 billion on substance/drug abuse. Further, we can include the accounting, auditing and bookkeeping expenditures to reflect the complex tax code: these cost citizens at least $250 billion. Crime cost $450 billion, plus another $300 billion on lawsuits. These and other forms of waste could well swallow a huge chunk of the entire U.S. economy (Hawken et al., 1999).

There are other gross inaccuracies in GNP as a measure of economic advance. In certain instances the externalities of U.S. business enterprises can be greater than businesses' profits; for instance, the health costs of the fast food industry may cause the industry to act as a net drain on the economy (Hawken et al., 1999). Even worse, an ultra-cynic might assert that the Kobe earthquake in Japan has generated so much rebuilding activity that it could be seen to have been a boost for the economy.

Nor does GNP reflect many economic activities and values that are not registered in the marketplace. It ignores non-marketed items such as housework, child care, voluntary work and DIY. It says much about quantity of livelihood, but little about quality of life such as leisure, security, relationships, environment and general amenity. Nor does GNP reflect the many negative activities that lie outside the official economy, notably tax evasion, government corruption, secret gambling, money laundering, fraud, prostitution and a host of similar activities. In many advanced countries they amount to at least 10% of GNP, while in India the underground economy is 30% as large and in Russia as much as one half as large (making Russia a poor country full of rich people?). In the United States, the underground economy of narcotics, prostitution, tax evasion, fraud and other highly downside activities could be as much as $3 trillion per year (Reuter and Truman, 2004; Schneider and Enste, 2002; Talberth et al, 2006). All in all, the U.S. GNP could over-estimate the true economy by $7 trillion (Venetoulis and Cobb, 2004; see also Costanza et al., 2006; Krugman and Wells, 2007).

In these extravagant respects, the GNP measure sends out inaccurate and misleading messages about how the economy is faring—and, by extension, the same for

the fortunes of society. As psychologist Tim Kasser points out (2003), people who focus on material consumption for its own sake rather than for all-round wellbeing are less happy; in fact they suffer more illness, both physical and mental, than those not addicted to "junk consumption" (Costanza, 2006; see also Kahneman et al., 2006; Layard, 2005).

All in all, GNP ranks as an institutional roadblock of exceptionally broad-scale impact. We should replace it by a more realistic indicator such as Net National Product, or an Index of Sustainable Economic Welfare, or Genuine Progress Indicator (Costanza et al., 2008; Dasgupta, 2005; Jackson, 2004; Venetoulis and Cobb, 2004). There are lots of candidates, and a few are gaining recognition (albeit marginal as yet) in countries as diverse as the United Kingdom, Germany, Italy, Sweden, Netherlands, Australia, Cuba, Canada and the United States. At least 30 countries are likely to adopt the Ecological Footprint mode of progress towards Sustainable Development (at present our global ecological footprint so far exceeds the planet's carrying capacity that if the rich nations' footprint was extended to the entire world, we would need three additional planets (see Chapter 10 on Solutions) (Global Footprint Network 2006; Wackernagel et al., 2002; WWF et al., 2006). In the world at large, however, we are hardly on the start line since the best efforts have produced only crude results.

The above has been well summarized by the former U.S. Senator Robert F. Kennedy: "GNP does not include the beauty of our poetry or the strength of our relationships, the intelligence of our public debate or the integrity of our public officials. It allows neither for the justice in our courts, nor for the justness of our dealings with each other. It counts air pollution, cigarette advertising and medical costs, yet it does not allow for the health of our children, the quality of their education, or the joy of their play."

In short, we should recognize that economic growth does not necessarily promote human wellbeing. True, for much of the past, as for the present in the case of developing countries, advances in the economy generally lead to advances in human wellbeing. But in the so-called developed countries—better termed, in some respects, mis- or over-developed countries—this is increasingly questionable. Indeed leading economists such as those listed above go so far as to postulate that an advance in the economy may sometimes be purchased at a cost in human wellbeing, due to overwork, lack of leisure, decline in community values, impoverished relationships, and general stress of the rush-rush society, in addition to grandscale pollution, waste, and over-use of raw materials and scarce natural resources. To cite Al Gore, we should check that we are advancing toward a lifestyle that is not so much better off as simply better.

For instance, we are deluged with far more consumerist choice than we need or desire. True, this flies in the face of standard economics, which asserts that consumers enjoy sovereign choice, meaning they know precisely what they are doing in the marketplace because they make informed choices: more choices must make for better

choices. Today's consumers enjoy far wider choices than our predecessors could have dreamed of, but increasingly this does not deliver what consumers truly want. To cite a perceptive observer (Schwartz, 2004), "As the number of available choices increases, choice no longer liberates, it debilitates; it might even be said to tyrannize. ... [Consider] the overload of choices Americans face in almost all areas of life: education, career, friendship, sex, romance, parenting, religious observance. .... We would be better off seeking what is good enough instead of seeking the best." In this instance, then, more can be worse. Who needs dozens of different breakfast cereals or 50 sorts of jam (plus 20 different sorts of toilet paper) (Barber, 2007)?

Public opinion surveys suggest that despite an 80% increase in per-capita income in the past 25 years, Britain's lifestyle satisfaction has increased by a mere 1.4% (Easterlin, 2003; Gilbert, 2006; Marks et al., 2006; Offer, 2006). Conversely, both Colombia and Uruguay are almost 10% happier despite their relative poverty, widespread crime and stark economic inequalities; perhaps they seem to be happier because they enjoy strongly supportive traditions at both family and community levels. It seems too that the more advanced the governance institutions in a country, the more satisfied citizens are with their lives. Especially important are those institutions that facilitate individual involvement in politics, thus allowing people to feel they exercise a modicum of control over important aspects of their lives (Dasgupta, 2005; Frey and Stutzer, 2001; Layard, 2005).

All this implies that we can get to grips with what makes people tick at the most basic levels, and how we can help them tick better. Should our present understanding of human wellbeing extend beyond lifestyle fulfillment to "happiness"? This is not mere speculation about a big word, it is now being analyzed by what has become known in the trade as hedonistic psychology (dreadful phrase). Sceptics, tune in: a growing number of economists, including several Nobel Prize winners, are actually talking about—believe it or not—the economics of happiness; see, for instance, Costanza, 2006; Daly, 2000; Kahneman et al., 2006; Layard, 2005; Offer, 2006; Schor, 2005. Shall we one day look forward to a Ministry of Happiness? The "forgotten kingdom" of Bhutan in the eastern Himalayas has determined that happiness shall be the prime purpose of not only its economy but of all its national activities. It is actually seeking to establish Gross National Happiness as measured by nine "domains", being living standards, health, education, ecosystem resilience, cultural vigor, use of time, good governance, community vitality and psychological wellbeing (Ura and Galay, 2004; see also Marks et al., 2006).

To see how it might work out in practice, note the Life Satisfaction Index devised by Professor Rutt Veenhoven of Erasmus University in Rotterdam, Netherlands (Veenhoven, 2005). He believes that "The relationship between money and happiness is subject to a law of diminishing returns. Once you earn more than $10,000 per head, the relationship levels off." His analysis indicates that Malta is the happiest place in the

world with an Index of 74%, followed by Denmark, Switzerland and Colombia with 73%, Iceland with 72%, and Ireland and Netherlands with 71%. Then come Sweden, Finland and Canada, together with a "poor" country, Ghana, all with 69%. The United States is only thirteenth equal on 67%. Britain and Germany are tied on 64%, though they do not make the top 20, in fact they are exceeded by far less well off countries such as Mexico, Colombia and Uruguay. All this contrasts with per-capita GNP, when Malta ranks 53rd with $13,600, Colombia 123rd with $2290, Britain 12th with $37,600, and the United States 7th with $43,740 (2005 figures) (World Bank, 2007).

Conclusion to this lengthy critique: if the great god of GNP is proving to be partway to a false idol, we urgently need to devise an improvement that is institutionally embedded in society's genes.

"Perverse" subsidies

Now for a look at how conventional economics is subject to sizeable lacunae that are not as prominent as the GNP problem but are highly significant nonetheless. Consider the propensity of governments to misuse fiscal instruments. Such instruments, whatever their form, should be designed to promote good policies and discourage bad ones. Instead, almost every government has created, almost without realizing it, a complex structure of subsidies which, once established, prove almost irremovable (inertia again). Traditional thinking has proposed that subsidies are devised to support our economies, and if they cause environmental injury along the way, that's too bad—but we must keep a sharp eye on our one true priority, and that's the economy. Such a view is okay until we find that certain subsides are harmful to our economies as well as our environments—a choice instance of a double whammy. Well might we term them "perverse." Such subsidies bedevil all our economies, whereupon the public interest, which was their original justification, becomes lost (Myers and Kent, 2001).

Take a few examples. German coal mines have been so heavily subsidized that the economy would come out ahead if the government were to close down all the mines and send the workers home on full pay. That would also reduce coal pollution in the form of acid rain, urban smog and global warming, plus other environmental ills. Clearly both the economy and the environment are the losers (German Federal Environment Ministry, 2003). So too with marine fisheries. The annual global catch, well above sustainable yield, is worth around $100 billion at dockside, where it is sold for only $80 billion, the shortfall, plus $15 billion for profits, being made up with munificent government subsidies. The result is that more and more fishermen chase after fewer and fewer fish until stocks collapse and fishing businesses fail outright with massive unemployment. Within all U.S. territorial waters, today's fish catch is only 60% as valuable as it could be if fish stocks were allowed to recover (Myers and Kent, 2001).

Worldwide perverse subsidies are prominent in six sectors: agriculture, fossil fuels, road transport, water, forestry and fisheries (Myers and Kent, 2001). In all cases they serve to severely undermine both economies and environments. Subsidies for agriculture foster over-loading of croplands, leading to erosion of topsoil, pollution from synthetic fertilizers and pesticides, and release of greenhouse gases. Subsidies for fossil fuels are a prime source of pollution. Subsidies for road transport also promote pollution, plus such other ills as road congestion. Subsidies for water encourage misuse and over-use of supplies. Subsidies for forestry encourage over-logging and other forms of deforestation. Subsidies for fisheries foster over-exploitation of fish stocks.

Let's put the issue in biggest-picture terms. Of the world's GNP of some $53 trillion (2007 value), roughly two fifths passes through the hands of governments in the form of taxes. At least $2 trillion goes in some way or other to serve as subsidies, whether direct or indirect (almost half are traditional subsidies, the rest being externalities, mainly environmental, see below). There is scarcely a sector of government that is in greater need of root-and-branch reform than subsidies—and it is precisely the long-run impact of subsidies on political processes that makes them so hard to change. Perhaps the largest roadblock is the inclination of political leaders, policy makers, the corporate community and the general public to view subsidies as long-term pay-outs that are part of the natural order of things and hence untouchable. Moreover government bureaucracies feature exceptionally obstructive obstacles to reform; for extreme instance (however hard it may be to believe this), governments do not always know how large their subsidies are. This attitude is further reinforced by the self-reinforcing cycle of election campaign funding and political pay-offs (Steenblik, 2005). The German coal mines, for instance, are mainly located in areas that are pivotal come election time, hence no political party has the guts to urge their demise.

Despite all, we can be heartened by a lengthening list of success stories in phasing out perverse subsidies, even though they account for a very small proportion of all those subsidies: New Zealand in agriculture; Russia, China, India, Japan, Britain and Belgium in fossil fuels; Spain, South Africa, Australia, Mexico and China in water; Singapore in road transportation; and Iceland in fisheries. Message: all things are possible, provided the political process can be cleared of institutional roadblocks (Myers and Kent, 2001; Pomeroy, 2002).

Meantime perverse subsidies defer the time when we can achieve the holy grail of Sustainable Development. The $2 trillion total is three and a half times larger than the Rio Earth Summit's proposed budget for Sustainable Development, $600 billion per year—a sum that governments dismissed as simply not available. Moreover, if governments were to phase out all their perverse subsidies, many of them would find themselves with enough spare funds to cancel their budget deficits at a stroke, to offer huge tax cuts, to reorient their fiscal priorities by supplying large increases to front-rank

sectors such as education and health—and to have enough money left over to throw a week-long party for the country. Yet the subsidies persist virtually untouched because they tend to create powerful interest groups and political lobbies, which spend as much as $235 million each month in the US—making for a super-size institutional roadblock (Center for Responsive Politics, 2008; see also Beloe and Thorpe, 2005).

A final thought, this one on subsidies to support children. The authors of this book are totally persuaded that every couple has an intrinsic right to have two children. But if a couple want to have a third child, that should be up to them entirely and they should cover all costs involved, including those met by government handouts averaging at least £600 per year per additional child in the U.K. ($1100 at 9/2008 exchange rate)—and the same of course for all subsequent children. This factor is all the more significant at a time when we should be carefully planning the size of our populations and asking all couples to stick to just two offspring.

Externalities

Next, let's take a closer look at externalities since they reflect the basic fallibility of pricing systems. As has been well stated, "Markets are superb at setting prices but incapable of recognizing costs", a situation that serves as a prime institutional roadblock.

The economies of all nations are fundamentally undermined by what are known technically as externalities, or, less formally, spillover effects. These distortive effects may account for a whopping one third of the global economy (Hawken et al., 1999). Governments should internalize these externalities through taxes, but they are often frustrated in their efforts by powerful corporate lobbying. In 2007, $2.8 billion was spent on lobbying in the U.S., up from $1.5 billion in 1998 (Center for Responsive Politics, 2008; see also Beloe and Thorpe, 2005).

The problem can be illustrated by cars' pollutants. Cars cause much injury in the form of urban smog, acid rain and global warming, plus lesser known items such as suspended particulates (which actually kill more people than do road accidents). The developed nations have tried to clean up their car exhausts, with moderate success, though they still emit huge amounts of the number one climate change gas, carbon dioxide (CO_2). In the developing world with much dirtier air in cities, the main pollutants are sulphur dioxide, nitrogen oxides and suspended particulates.

In China as much as 60% of air pollution stems from motor vehicles, mainly from cars. As long ago as the late 1990s, it was causing at least 175,000 deaths per year, possibly several times more, plus nearly two million documented cases of chronic bronchitis (non-documented cases much higher) (United Nations Development Programme, 1998; Warford, 2004); the situation is a good deal worse today. All forms of pollution damage top $200 billion per year. In 2005 China invested $30 billion in clean-

up measures ahead of the 2008 Olympic Games. In Mexico City with its 20 million inhabitants and two fifths of the country's cars, the mortality and morbidity impacts of air pollution have been levying annual costs of over $1 billion (Holgate et al., 1999). When we count in all forms of air pollution from all sources worldwide, we find that the death toll is at least 800,000 (Cohen et al., 2003). If traffic pollution was a disease, huge funds and other resources would be mobilized to tackle it.

Message thus far: governments should internalize their externalities, i.e., ensure that all spillover costs of driving a car, managing a factory, growing food, etc., are reflected in prices. Easily said, usually disregarded—or vehemently resisted by the special interest bodies with their munificent lobbying.

A graphic instance of externalities and pricing failure lies with the carnivore culture of the United States. With its "supersize" and "value" meals, the country has become a haven of fast fat and junk-food junkies. It features more people on diets than ever before, more obese people too. Obesity-related illnesses—ranging from heart disease and strokes to diabetes and cancer, and often brought on in part by gorging on grain-fed meats—cost around $120 billion annually (two and a half times more than smoking-related costs), plus another $33 billion spent on weight-loss schemes and dietary drugs. The combined total is far more than the country's fast food industry's annual revenues of just over $100 billion. Every year these obesity-related illnesses kill 300,000 Americans, compared with 400,000 killed by cigarettes, the latter total being on the decline. Moreover if all Americans were to cut their meat consumption by just 5% (roughly the same as eating one less meat dish a week), that would save enough grain to feed 30 million people (Gardner and Halweil, 2000). The economic benefits from ensuring that all people in the developing countries are healthier and hence more productive would be 20 times higher than the costs (World Health Organization, 2008).

Wanted: institutional fixes, such as taxes on fatty foods, to take care of the many externality costs of a hamburger a day. In Britain, a fat tax could prevent 3200 deaths from heart disease and stroke every year (Mytton, 2007).

Discounting the future

Now let us look at how economics views the future—or rather how it fails to view the future much at all beyond just a few years. This is all the more pertinent in that we live at a time when we are degrading the planet and its environments to a degree that will lead to much biotic impoverishment for several million years, no less (Myers and Knoll, 2001).

Whatever our situation and whatever our time horizon, we all discount the future. For each and every one of us, a dollar today is worth more than a dollar tomorrow. A sum of $100 in 50 years discounted at an annual rate of 10% (a frequent rate as dictated by capital markets) is worth less than $1 today. The clincher factor is

that a discount rate of 10% implies there is no future worth bothering about beyond seven years. Thus the iron rule of the investment market (Ayres and Martinas, 2005; Ermolieva et al., 2003; Goulder and Stavins, 2002; Groom et al., 2005; Hepburn, 2005).

Now consider how this discounting dogma of classical economics applies to the world outside the window—a world that is surely starting to experience the problems of climate change. Suppose we decide that climate change is a prospect we don't want to experience: how much would we have to invest to avoid it? Figure the arithmetic and discover some surprising results. Suppose we undertake the single most productive way of stalling climate change, viz. shifting out of fossil fuels and into non-polluting energy; and suppose that were to require a single payment of $3 trillion today. Suppose too that the world economy would thereby avoid perpetual annual costs of $500 billion 100 years hence. Then, and with a 10% discount rate, the net present value of taking action costing $3 trillion today would be almost a negative $3 trillion. Because the benefits of taking expensive action today are so distant in time, the present value of those benefits appears minuscule when compared to the costs paid. We therefore find that the "economically logical" course is to do sweet nothing (Ayres and Martinas, 2005; Ermolieva et al., 2003; Goulder and Stavins, 2002; Groom et al., 2005; Hepburn, 2005; see also Nordhaus, 2007; Stern and Taylor, 2007).

Equally to the point, if the most valuable forest on Earth cannot make its "investment in the future" in less than seven years (most trees in the forest won't produce new adult trees in less than 10 years, more likely 20 years or more), it makes commercial sense for a logger to chop the whole lot down forthwith and put the earnings into the stock market with its greater because quicker profit. It is financially rational too for a corporation to pursue all manner of activities with revenues of $1 million this year even though it is fully aware that in 50 years' time these activities will entrain environmental costs (e.g., the write-off of a potentially renewable resource) of $100 million.

Thus arises the "myopia" of investors, i.e., their apparent short-sightedness if not their outright indifference to the future. It is not that they are truly short sighted, rather they play by the rules of the marketplace as set down by society. If society does not like the outcome, it is up to society to change the rules rather than shout foul at the investor (as is the inclination of certain environmentalists).

Within this framework, consider one particular environmental problem, the mass extinction that is overtaking the planet's species. As we have seen in Chapter 6 on Science, this biotic crisis threatens not only to eliminate large numbers of species (effectively tens of thousands per year already) but to reduce evolution's capacity to generate replacement species. This "end to birth" phase looks likely to endure for at least five million years ahead. Just five million years would make it entirely impossible for us to postulate any realistic discount rate at all. Moreover the number of people

affected could be as many as 500 trillion within five million years, or 10,000 times more people than have ever existed thus far. The "decision" being taken by the present generation will be far and away the largest decision ever taken on the unconsulted behalf of future generations. In certain respects it will surely surpass all such past decisions combined. Discount rates, anyone?

Upshot: at a time when the world is threatened in wholly unprecedented fashion and for a wholly unprecedentedly long time ahead, we need to adopt an unprecedentedly innovative form of economics response. To accomplish that we need to move beyond the institutional roadblock of conventional economics—or at least, those aspects that are way past their "best by" date.

Intergenerational equity

The crucially limited capacity of economics to figure the future throws perspective on what is known as "intergenerational equity", or justice to future generations. The best books on the issue (Broome, 2004; Jamieson, 2006; Rawls, 1971; Weiss, 1989) speak of no more than a dozen generations (300 years) ahead, beyond which the future is ostensibly unknowable and of scant practical interest anyway. This bears strongly on the mass extinction problem. While there is much uncertainty about what species are "good for", we are effectively saying we are completely certain that 200,000 future generations during the next five million years will not be unduly disadvantaged through the mass extinction we are precipitating today. Yet our scientific understanding indicates the opposite is absolutely the case.

Anyhow, can we really envisage so many generations ahead? That is, can we identify with them, can we sense how they will cope with their future world, can we imagine what will be their hopes and experiences? I must confess that I myself, for all my professional understanding of the future, cannot personally reach out in my mind beyond just a few generations. I speculate on my grandchildren and what sort of children they will eventually produce in turn. But five generations ahead is the best I can manage, try as I might to peer further. At the same time, I have to admit that my affluent lifestyle is surely imposing injury, however unintentionally, on the future world way beyond five generations and their 125 years. Climate change, for instance, will degrade the planet for many hundreds of years at least, probably for many thousands of years; and it will grossly degrade certain basic processes of evolution for several million years.

Bottom line: we need an institutional device in addition to discount rates to reflect our evaluations of the future (Ayres and Martinas, 2005; Ermolieva et al., 2003; Goulder and Stavins, 2002; Hepburn, 2005; Newell and Pizer, 2002; Posner, 2004). In fact, to reflect those evaluations that truly count. Relying on the supposed preferences of the marketplace means we would not bother to safeguard the planet's forests, its oceans,

its atmosphere or its ozone layer, let alone its climate. But because we do not have a sufficient economic alternative to conventional discounting, the case for forests, etc., tends to fail by default. Hey, it would not be "economically efficient" for us to bring up children. Herein lies a major institutional roadblock.

Further limitations

There are many other deficiencies in the way we practice our economics. For instance, the mis-targeted tax system (unsystematic as it is, systemically too), which primarily penalizes people for their hard work (a "good") instead of hitting them for their over-use of scarce natural resources and their pollution among other forms of waste ("bads"). Consider too that many democracies are being converted into oligarchies by virtue of the over-weening financial leverage of the corporate community via its lobbyists and special interest groups. Then there is the fact that economic policy is no longer set by governments alone but by the globalized marketplace, little though certain governments are prepared to acknowledge this. Of the 100 biggest economic entities in the world, fewer than 50 are governments, the rest being mega-corporations (World Bank, 2007).

Next, an astonishing lacuna. Several countries simply refrain from publishing information about their economic policies and performance on key sectors such as foreign aid, international debt, trade, and agricultural subsidies in a form that enables ready comparisons across countries. Indeed much essential information is not published at all. These omissions are akin to those encountered by the authors when they were researching their Perverse Subsidies book (Myers and Kent, 2001). Several leading governments declined to disclose basic statistics on their subsidies, even though, as it subsequently turned out, these statistics were available through the public domain. Other governments denied they had any statistics, or protested it would take far too long to collect and analyze them. In the case of the United States, we received four different sets of energy statistics from four different colleagues, none of whom seemed surprised that his was not the only "official" set.

Then there is the question of inexplicable delays in economics research—the inertia problem again. Consider, for instance, the phenomenon of "perverse" subsidies, described above. Given the monumental importance of the issue, one might ask why professional economists didn't pick up on it a couple of decades earlier. The basic data had been there all along, albeit sometimes difficult to track down, and the task would have amounted to merely collecting and collating them, then analysing them. One might think that many a leading economist—or any economist looking for a breakthrough into leading economist—would have done the arithmetic long ago.

Much as certain economists display their field's many intellectual insights, economics features further basic shortcomings. For instance, one of its central tenets is that things change in slow, gradual and hence predictable fashion. This is because—so it is asserted—economic systems, like political, social, environmental and most other systems, have in-built capacity for adjustment and self regulation. Jumps and jerks are no-no's, as are threshold effects and other non-linearities; and so too are crashes among other disasters. If some economic sector finds itself heading toward the edge of the cliff, the cliff will send out messages to warn of impending but eminently avoidable catastrophe. As we have seen in Chapter 4 on Surprises, however, the world often switches from one state to another in emphatic fashion and without warning. Indeed the past several decades have been shaped at least as much by system shocks (e.g., OPEC, the Berlin Wall, Japan's bubble economy, the steep rise of China) as by business-as-usual trends. Still more to the point, the next several decades might well be marked by what is known in the trade as a surprise-rich future.

Note too that economics is heavily dependent on "marginal" analysis. That is to say, what counts is what happens at the margin rather than in the totality. If you have one apple, then a second one may greatly increase, though hardly double, your pleasure; and if you have 10 apples an eleventh one will make next to no worthwhile difference. In effect, marginal analysis denies the operational value of totality, let alone absolutes. For most of human history, this understanding has been valid enough, whereas today we face the prospect of absolute changes: for instance, an end to all tropical forests, a mass extinction of species, and a fundamental dislocation of climate—all of which would grossly alter the workings of the planet, and for thousands if not millions of years ahead. Truly we live in a new era.

There are other shortcomings to economics as a dependable discipline. As pointed out by one of the greatest gurus of the past half century, Paul Samuelson (2001), the early 2001 economic recession in the United States was predicted by few if any economists. Economists routinely miss the turning points of business cycles, and they have missed most of the major economic transformations of the past half century. The great boom of the 1990s was barely anticipated, and the same for other upheavals such as sporadic "energy crises", the sharp rise of inflation in the 1970s followed by its dramatic fall in the 1980s, and various shifts in productivity growth. Conclusion: "Most economic forecasts are bravado and bluff" (Samuelson, 2001).

To cite Samuelson (2001) still further: Not only are economic statistics, being the backing for predictions, incomplete and imperfect, but citizens' behavior often changes in erratic ways. Forecasting models exclude many of the most interesting and disruptive phenomena in contemporary life: politics, technological change, weather, fear, ignorance and stupidity—to name but a few omissions. Plus outright blunders. "Shocks"—whether of oil and energy prices, or food prices, whatever—contradict the premise of

conventional models which is that economic change is always gradual and comprehensible. Most of the time it is, but economists overlooked the onsets of the 1981-82 and 1990-91 recessions. Hence the paradox that economic forecasts are least reliable when they are most needed.

The bottom line is that we shall never attain the imperative of Sustainable Development without radical reform of our economies. The insights of much economics can go far to fine-tune the system, but we need to go further and redesign whole sections of the economic engine. No matter how hard we work to establish Sustainable Development, let alone human wellbeing, our present economic systems often mean, effectively, that we are trying to push an ever-bigger rock up an ever-steeper hill.

Conclusion

Finally, let us remind ourselves that we live in a world where more than one billion people are short of water for their most basic needs such as washing and cooking; where cash incomes for 1.4 billion people do not exceed $1.25 per day, and another 1.7 billion people subsist off no more than $2.50 per day (these two categories account for almost half of the world's population); where 925 million people enjoy only rare occasions when they don't feel hungry; where 115 million children receive no schooling at all; where 800 million people can't read or write, yet have a vague and compelling sense of how the rich world lives thanks to their social halls with communal television sets, also thanks to glitzy advertising pictures in magazines; where a sum of only $190 billion could probably turn these profound problems into superb opportunities; and where 800 billionaires possess wealth totalling $2.6 trillion (Brown, 2008; Chen and Ravallion, 2008; Myers and Kent, 2005).

Bottom line here: the problems are greater than at any time in human history, and the potential solutions are likewise greater than at any time. Yet again: what's going on?

Many economic analyses stack up moderately okay, and many economists do an exceptional job in setting out the strategic arithmetic. But economics does its job best when it is perceived within the larger context of the world's politicum. However much the economics field supplies a multitude of useful insights into how to run our world, the overall answer often lies beyond economics.

6. SCIENCE: NOT ALWAYS SO SCIENTIFIC?

"Traditional scientists have terribly fixed ideas, and it takes an awfully long time to un-idea them. A new idea is the most quickly acting antigen known to science. If we watch ourselves honestly, we shall often find that we have begun to argue against a new idea even before it has been completely stated."

Wilford Trotter (1941)

Scientists are popularly viewed as smart people who are forever probing new ideas on how the world works. They roam around the frontiers of knowledge, constantly pushing back those frontiers. They owe most of the progress in their field to their innate curiosity, their insatiable inclination to ask "How?" and "Why?" Hence one would suppose that the vital attribute of any scientist would be an adventurous spirit that knows no bounds.

If only. More often than might be supposed, certain scientists tend to be conservative, reluctant to stick their heads above the parapet with new ideas. However revealing and path breaking these ideas might be, their originators might be perceived as boat rockers: the scientific community can be "establishment" indeed. Not surprisingly, then, the institution known as science is often beset with caution and lacking the exploratory spirit that should be the very stuff of science (Hoyle, 1982; Kuhn, 1979; Perkins, 2000; Giles, 2002).

This is not to say—and the point is so important that it should be surrounded with neon flashing lights—that there aren't many scientists who depart vigorously from the above. They remain true to the spirit of their profession, and they demonstrate it with regular evidence, stacks of it. The critique that follows in this chapter reflects those other scientists who do not always practice science with the creative daring that it warrants, especially at a time of unprecedentedly large and urgent challenges. How different are those who are ever-ready to push out their intellectual boats (e.g., Martin, 2006; May, 2005; Rees, 2005; Tickell, 2005). In recent decades the "hold backers" seem to have become more numerous and influential, and much of the scientific enterprise has grown ever-more conservative—which means, in a proper broad sense, it has grown less adventurous and hence less scientific.

Scientists and caution

Why, then, are certain scientists resistant to change, especially in the form of new insights? When Charles Darwin first published his theory of evolution, he caused such controversy that he felt his discovery was being rejected almost on principle (Darwin, 1859; Darwin, 2001). In more recent times, plate tectonics and ozone layer depletion have been severely doubted long after they were first proposed. So strident

and widespread can be the rejections by one's professional peers, that it can sometimes seem as good to be wrong with the crowd as right on your own.

This has long been the case. As far back as 1663, Spinoza asserted "Be not astonished at new ideas, for it is well known that a thing does not cease to be true because it is not accepted by many." More recently Lord Keynes (1936) opined "The difficulty lies not in new ideas, but in escaping from old ones." Also William Beveridge (1950): "Many discoveries must have been stillborn or smothered at birth. We know only those which have survived." Finally, Arthur Clarke (1963): "It is really quite amazing how competent but conservative scientists can miss the mark, when they start with the preconceived idea that what they are investigating is impossible. When this happens, the most well-informed men become blinded by their prejudices and are unable to see what lies directly ahead of them."

To reiterate the theme of this chapter: scientists are supposed to be inventive people, forever probing the outer realms of what is possible. In reality they often tend to be the opposite. Note a few further rejectionist sentiments from some of the most prominent scientists; for instance, Lord Kelvin in 1900, "X-rays are a hoax"; Thomas Edison in 1922, "The radio craze will die out"; Thomas Watson, Chairman of IBM, in 1943, "There is a world market for maybe five computers"; Sir Harold Spencer Jones, British Astronomer Royal, in 1957, "Space travel is bunk" (shortly before Sputnik); and Bill Gates, CEO of Microsoft, in 1981, "640k of memory is enough for anybody." For additional comments of scientists on science, see Box 6.1; and for more instances of spectacular denial, see Box 6.2.

Box 6.1: Denial: Not Just a River in Egypt?

"What use could any company make of this electrical toy?" (William Orton, Western Union President, on the telephone, 1876)
"Radio has no future." (Lord Kelvin, 1897)
"All great truths begin as blasphemies." (George Bernard Shaw, 1919)
"Who wants to hear actors talk?" (H. M. Warner of Warner Brothers, on sound movies, 1927)
"The end of our exploring will be to arrive at where we started, and to know the place for the first time." (T.S. Elliot, 1944)
"Television won't hold up after the first 6 months." (Darryl Zanuck, Head, 20th Century Fox, 1946)
"Computers in the future may weigh only 1.5 tons." (Popular Mechanics magazine, 1949)
"A man receives only what he is ready to receive. The phenomenon or fact that cannot in any wise be linked with the rest of what he has observed, he does not observe." (Henry Thoreau)
"The obscure takes a while to see, the obvious, longer." (Cited by Stephen Viederman, 1996)

"It is difficult to say what is impossible, for the dream of yesterday is the hope of today and the reality of tomorrow." (Robert Goddard)
"If you haven't found something strange during the day, it hasn't been much of a day." (John A. Wheeler, American theoretical physicist)
"Only those who attempt the absurd will achieve the impossible." (Marc Escher)
"New and stirring things are belittled because if they are not belittled, the humiliating question arises, "Why then are you not taking part in them?" (H. G. Wells)
"You can recognize a pioneer by the arrows in his back." (Beverly Rubik)

Box 6.2: Scientists on Science

"It's like religion. Heresy in science is thought of as a bad thing, whereas it should be just the opposite." (Thomas Gold)
"There is no source of deception in science which can compare with a fixed belief that certain kinds of phenomena are impossible." (William James)
"Almost all really new ideas have a certain aspect of foolishness when they are first produced." (Alfred North Whitehead)
"New opinions are always suspected, and usually opposed, without any other reason but because they are not already common." (John Locke)
"Research is to see what everybody else has seen, and to think what nobody else has thought." (Albert Szent-Gyoergi)
"If we knew what it was we were doing, it would not be called research." Albert Einstein
"We are probably nearing the limit of all we can know about astronomy." (Simon Newcomb, astronomer, 1888)
"Perhaps the only thing that saves science from invalid conventional wisdom that becomes effectively permanent is the presence of mavericks in every generation—people who keep challenging convention and thinking up new ideas for the sheer hell of it." (David Raup, University of Chicago, 2001)
"The most exciting phrase to hear in science, the one that heralds new discoveries, it is not 'Eureka!, I've found it!', but 'That's funny.'" (Isaac Asimov)
"Such startling announcements as these should be deprecated as being unworthy of science and mischievous to its true progress." (Sir William Siemens, on the first successful light bulb 1880)

A different form of myopia, this time of a more collective nature, arose at the Stockholm Conference on the Human Environment in 1972. The gathering attracted several hundred of the best environmental scientists from around the world, and during their two weeks of discussions they mentioned items such as the Ohio river that caught fire through oil pollution and the mercury deaths in Japan's Minamata Bay. But their

consultations focused largely on such localized problems, severe as many of them were. There was hardly any mention of problems that were international if not supranational in scope, and hence worthy of keen attention: mass extinction of species, desertification, soil erosion, ozone layer depletion and tropical deforestation, all of them on a grand scale. Most surprising of all was the silence on climate change and global warming, even though the first warning of the linkage to fossil fuels had been raised by the Swedish scientist Svante Arrhenius and the American P.C. Chamberlain almost a century before.

Why were reputable scientists so clouded in their views of newly emergent problems on unprecedented scale? Was it precisely that they were such established figures that they had become establishment figures—and a prime purpose of any establishment is to ensure its survival and hence its own ways of thinking (Porritt, 2000; Rees, 2004; Tesh, 2000; Tickell, 2005)? All this is the more puzzling in that certain fields of science are advancing at a rate altogether headlong as compared with past experience. Over the long haul we have made remarkable progress with Information and Communications Technology (ICT). In 3000 BC, clay tablets could feature one written character per 1 cubic inch (cc1), an amount that rose by 1450 AD, with the advent of the printed page, to 500 cc1, and by the 1990s, via the optical disk, to 125 billion cc1. So too with the field of computation: in 5000 BC the abacus managed 2-4 instructions per second (ips), rising by 1945 AD and the computer to 110 ips, and by the 1990s by super-computer to 1 billion ips. So too again with the transmission of information: in 4000 BC and by human messenger, the rate was 0.01 words per minute (wpm), rising by 1844 AD via the telegraph to 50-60 wpm, and by the 1990s via fibres to 100 billion wpm.

Consider too the Internet, which can store at least 500 billion documents, available to hundreds of millions of searches a day on the part of surfers. In 1988 we could send 3,000 messages together on a single fiber-optic cable, a total that by 1996 had surged to 1.5 million messages. We can send more information on a single fiber-optic cable than was sent over the entire Internet in a whole month 10 years ago (Dryden, 2004).

This brief historic review reflects advances in scientific information. Shall we dare to ask if this translates into human wisdom? To cite the Harvard guru, Professor Edward Wilson (1998), “We are drowning in information while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information at the right time, think critically about it, and make important choices wisely.” Meantime we could reflect on our supposed wisdom and ask why we still allow 925 million people in the world to suffer hunger, even though we possess power unequalled to end the problem.

Paradigm shifts

Perhaps as a result of the ingrained caution and conservatism of science, we find that advances sometimes arrive in jerky fashion, a.k.a. paradigm shifts. The phrase was first deployed by the philosopher Thomas Kuhn (1979) to describe how the history of science is not gradual and cumulative, but rather punctuated by a series of more or less radical shifts, after which nothing is the same again (Casti, 2001; Conant and Haugeland, 2002; Fuller, 2000; Popper, 1992). To cite Kuhn specifically, a paradigm is "a universally recognized scientific achievement that for a time provides model problems and solutions to a community of practitioners." Further, Kuhn distinguishes between the paradigm of "normal science", i.e., the day-to-day solving of puzzles within the established rules of the existing vision (paradigm), and "revolutionary science" or the overthrow of the old paradigm by a new one.

To illustrate: Copernicus and Kepler showed that the Earth is not the center of the universe. Adam Smith postulated that the selfish actions of individual players in free markets can accumulate to the common good. Thus a paradigm can totally transform a system or a society. Sometimes a paradigm amounts to a new way of seeing, and hence individuals, like societies, resist challenges to their paradigms more strenuously than they resist any other kind of change. (Meadows, 1997). Indeed "Paradigms constitute unfamiliar ways of looking at the familiar, or any rearrangement of the intellectual furniture. They tend to arouse emotional opposition beyond rational argument; thus opposition to the idea of evolution by natural selection, of continental drift and tectonic plate movement, and more recently of commentary or asteroid impacts from space. ... Especially is this so as regards reductionism, and the tendency of some to put subjects into boxes, shut the lid, and ignore what is going on in other boxes. Most of us are better at looking at the constituent elements of problems than in seeing the connections between them and understanding how the resulting system works" (Tickell, 2007).

There have been several examples of prominent paradigm shifts in science, notably Newton's view that time and space are absolutes whereas Einstein subsequently showed they were relatives (Einstein, 1920). But, and as Kuhn emphasizes (1979), a new paradigm cannot establish itself unless it overcomes "the stubborn adherence to intellectual vested interests." The same applies in fields other than science; in economics, for instance, there has been a shift from perceiving the economy as the whole system to seeing it as only a part of the relevant whole, viz. the planetary ecosystem.

Not just individuals but certain societies have proved adept at the creativity needed for breakthrough inventions. Consider the saga of the wheel, which was first devised somewhere in present-day Iraq or Iran around 3500 BC, i.e., a long time after the first civilizations emerged 6500 years previously (Lienhard, 2005; Piggott, 1983). The wheel then stayed within Asia and Europe for many millennia. Egyptians of the

Pyramid Age 2700-220O BC didn't have it, though it reached India and Pakistan with the Indus Valley civilization in the third millennium BC and appeared in China's chariots around 1200 BC (Barbieri-Low, 2000; Williams, 1987). It was hardly seen in the American hemisphere until the arrival of large numbers of European settlers in the 17th Century. The 11th Century Mexicans possessed the idea of the wheel, but did not put it to general use. All in all, only five of the nine ancient civilizations invented the wheel, and they did so independently of what societies over the horizon were doing (Lienhard, 2005; Littauer and Crouwel, 1979). What was it about the other four that prevented them from achieving the breakthrough until many millennia later? Was there something in their societies that discouraged creativity? Something that fostered conformity, that disapproved of fresh thinking, and that frowned on any inclination to step out of line whether intellectually, socially or culturally? Or was it simply a case of "Better to quack with the flock"?

Whatever the reason, it seems to have generated a sense of general myopia. And if such restrictive spirit did indeed infect their societies, was it somehow encoded in their institutions? Equally to the point, does today's science feature enough of an institutional "push" in the form of incentives for research that treads where none has trod before? Does it offer rewards for work that may threaten career advancement? What "wheels" are we failing to invent right now—and when we finally get around to inventing them, will we wonder why the inspiration did not strike us sooner?

Myopia and "risky" research

Similar problems of myopia arise when research is actually stifled by undue scientific caution. Note the comment of the prominent mathematician Lancelot Hogben: "There is nothing particularly scientific about excessive caution. Science thrives on daring generalizations"; and the comment of the Nobel Prize physicist Richard Feynman (1988), "If we will only allow that, as we progress, we remain unsure, we will leave opportunities for alternatives. We will not become enthusiastic for the absolute truth of the day, but remain always uncertain. In order to make progress, one must leave the door to the unknown ajar." Also by Feynman: "Anybody who thinks they understand quantum theory, probably doesn't." In other words, we exemplify our capacity for hubris by remaining blissfully ignorant of our ignorance. (For more such comments, see Tables 6.1 and 6.2.)

These warnings notwithstanding, there is a fear among certain scientific circles that if one pursues truly path-breaking research, one runs the risk of being proved wrong. Better, then, to stick with "safe" areas. During the three decades since it was first mooted, the mass extinction of species underway has been only moderately investigated, whereas there have been tens of thousands of reports and dissertations on the white-tailed deer in North America, a single species that is not at all threatened,

indeed it flourishes in such huge numbers that its excess have to be regularly culled. Meantime thousands of endangered species do not receive even basic conservation support because scientists know next to nothing about them.

The world is not standing still and we cannot afford to wait until every new theory has been re-re-confirmed. Why is it that at certain famous universities, Masters students undertaking a two-year Business course receive only a few hours of classes on environment and sustainable development? Similarly, many zoology students receive only a few hours on mass extinction, even though it surely ranks as the number one phenomenon of our planetary ecosystem? Lacunae like these show that we fail to recognise that changes in the world can be not only incremental, but can take place in large jumps on our way to crossing thresholds. Yet much of the science enterprise continues to move at its traditional steady-to-slow speed. It has long been supposed that until a scientist has 90% proof supporting a new idea, he should keep quiet, certainly speak no word to policy makers, still less to the public. However valuable the new idea may be (so goes the traditionalist view), it cannot be so valuable as the scientist's reputation for never being wrong. Suppose he were to "go public" with only a 75% case and was then shown to be mistaken, that would spell disaster for his public image (and, by association, that of his colleagues too). The ultra-cautious approach has served us well for the past 3,000 years, but today we have a basically different world. In the case of the foremost scientific challenge, climate change, we do not yet possess a 90% case in every major respect. Were we to wait until we have a traditional level of certainty, it would be too late to do anything worthwhile about the problem.

Getting out the word

Even when a scientist has assembled all the evidence and analysis he needs to make his case and he wants to share his insights with his colleagues across his professional field, there can be an inordinate delay in bringing his message into the light of published day. First of all his paper has to be screened by fellow (and anonymous) scientists, designated "referees", who may delay for months before evaluating the article and giving it a thumbs up or down. Myers' first article on biodiversity hotspots (1988; see below) eventually proved to be such a trail blazer that the conservation strategy it proposed has eventually attracted funding to the tune of $850 million, the largest sum ever assigned to a single conservation strategy. Yet the original referee delayed for all of five months before starting to check the article. A senior person in the science hierarchy, he had been unable to find the time to do the job because he had been "too busy." Years later he was still insisting that he had been right. Moreover he had nothing to offer when one of his fellow referees asserted that such-and-such a paragraph was such rubbish that it should be eliminated entirely, whereas another opined that the point was so

important that it should be expanded to at least a full page. When I (NM) asked the chief referee to decide whether I should go along with the first or the second, he instructed me to follow both sets of imperatives forthwith—and to be as suitably disciplined and professional about the article as he was.

When and if an article has been cleared by an anonymous referee, the editor of the intended journal sends it back to the author for sundry revisions ("Not even Darwin's or Einstein's draft articles would have been regarded as perfect"). After amendments, the editor then sends it off for copy editing and other editorial practices, and then back to the author again for proof reading, before the article finally joins the queue of articles awaiting a slot in the proposed journal. The whole process can easily take a whole year, sometimes longer (Harnad, 2001)—as if the world outside the window has been standing still. True, on-line publishing and the Internet have markedly reduced the delays in certain instances. All the same, and as in politics and business, just a week in science has become a long time; after all, the sum total of scientific knowledge doubles every three years (and by 2020 it is predicted to double every two and a half months) (Appiah, 2007; Brown, 2006). Meanwhile the scientific enterprise can go its stately way in isolation from the busy world.

Consider a further pressure that fosters scientific caution. There is often an urge among scientists to produce as many peer-reviewed publications as possible (which, because they tend to say more and more about less and less, do little to give a hefty shove toward the boundaries of knowledge). This pressure has arisen in order to satisfy the requirements of governments' periodic assessments of research bodies. In Britain a minor shift in the ranking can lead to a huge increase or decrease in annual funding for as long as five years. Hence the scientific imperative "publish or perish."

Hence too the passion for "balance." Whatever new viewpoint is proposed, it must, as a matter of unwritten principle, be challenged by arguments attacking it. The more ferocious these arguments, the (supposedly) better, since that demonstrates the key quality of "academic rigor", meaning the strength of the process comprising analysis and counter analysis. As has been well said, a basic rule of science is that for every expert there is an equal and opposite expert (oh! for a one-handed scientist to counter those who assert "On the one hand, on the other hand ..."). Then again there is the problem of referees simply being wrong. The authors' "Biodiversity Hotspots for Conservation Priorities" article (Myers et al., 2000) was first submitted to "Science", being one of the two leading scientific journals worldwide. It was roundly rejected by three out of the four referees, some of the critiques being not only professionally off target but personally abusive. The article was then submitted to the other major outlet, Nature, and it was instantly selected for the accolade of "cover story", whereafter it was cited in the writings of other scientists more than 2,000 times during its first seven years, a record for an article in the ecology field.

There are other absurdities. Articles have been rejected on the grounds that while the science content has been fine, it was "too controversial"—as if controversy is not the very stuff of science. Certain referees admit that if their comments could not be concealed behind a curtain of anonymity, they would certainly write them differently. Journal editors need to find referees with expertise in an article's scientific area, so they tend to seek out scientists who are likely to be professional competitors of an article's author—a factor which, as some of them concede, can color their judgements ("Well, why shouldn't scientists be fallible humans too?"). Hence the scope for personal vitriol to creep in by the bucket full. The refereeing system is far from fail proof, yet all scientists are subject to its built-in deficiencies (Campanario, 1998; Frey, 2003; Gillies, 2008). Even articles written for Nobel Prize acceptance speeches have been rejected by referees of leading journals.

Other scientists have experienced refereeing of curious kind. In 1997 Robert Costanza, then a University of Maryland professor, and 12 co-authors, attempted to calculate the approximate non-market value of the planet's environmental goods and services, e.g., forests, grasslands and oceans. They came up with a total that indicated that global Gross National Product is matched if not surpassed by Global Gross Natural Product. They submitted the paper first to Science journal, where it was rejected by one of the two reviewers. The editor at the time recognized its importance, however, and said that while he couldn't accept it because of one reviewer's negative recommendation, he would like to publish a news piece on the paper when it was eventually published elsewhere. Costanza then sent the paper to Nature, whose reviewers strongly approved it to the extent that the journal's editor published it immediately—and as a cover story. Science then also ran their news piece about it when it was published. Both Myers et al. (2000) and Costanza et al (1997) are among the most extensively cited papers in environmental sciences in the last 25 years.

The overall upshot, however, is that there is endless intellectual pirouetting around a particular point, rather than moving ahead on to new ground. It is this scientific inertia that fosters overly conventional thinking, often masquerading as mainstream thinking (Barber, 1961; Best, 2001; Ehrlich, 2002). As has been stated by one of the most prominent British scientists of the past half century, Sir Fred Hoyle (1982), "Science today is locked into paradigms. Every avenue is blocked by beliefs that are wrong, and if you try to get anything pioneering published by a journal today, you will run up against a paradigm and the editors will turn it down." In this situation there is a premium on leadership of all kinds (Angel, 2004; Ehrlich and Ehrlich, 2004)—leadership that for the most part is sadly lacking. Too often in science, if you want to get along you have to go along.

At this stage of the chapter, there is need to reiterate the vital point in the third paragraph of page one. The above strictures do not apply to all scientists, not by a long

way. (Nor do they apply to all science; indeed in some respects, recent research has been producing incremental advances at a rate to rival science fiction (Krebs, 2006).) There are quite a number of trail blazers, being individuals who prefer to think their individualist thoughts rather than treading the well worn paths of much contemporary science. We urgently need many more adventurists at a time when the Earth, hence the world too (no less!), are threatened like never before (Lawton, 2007). After all, we are conducting a planet-wide experiment with scant idea of how it will turn out except that it will almost certainly prove irreversible and thoroughly bad news for humankind. If a gang of rogue scientists were to propose a plan for such an experiment, they would surely be viewed as criminally inspired. Fortunately we still have time to contain some of the worst dangers ahead, provided we mobilize the best science possible to map the road. There is a massive premium on science of the most innovative sort; regrettably that is a resource in critically short supply. Moreover, even if certain of the scientists needed were indifferent to the downside outcome of our planetary experiment, they should surely be leaping at the chance to engage in cutting-edge science of a creative sort and on a scale never before dreamed of. After all, they face the challenge of probing the planet's deepest secrets: what makes it tick and what will keep it ticking at a time when we threaten to overwhelm its innermost mechanisms.

Scientists should count themselves fortunate beyond dreams to be alive at this momentous era.

Research delays

Here's a tale to further illustrate the source of scientific caution. In 1971 a mature student at the University of California, Berkeley, became intrigued by the idea that within the foreseeable future there could occur a mass extinction of species. He checked on the "official" extinction rate with various scientific bodies and expert agencies, and was told the rate was around one species per year. This did not seem to him to be a worrisome rate, given that the prehistoric background rate, i.e., before humans began to make their impact, was not much more than one species per year. He checked the details of the official estimate for current extinctions, and lo, he found the evidence was a distinctly limited affair, based largely on three categories of organisms, viz. plants, mammals and birds, which make up less than 5% of all species worldwide (if we agree there are 10 million species altogether). It took next to no account of the three other categories of vertebrates, nor—vastly more significant—of invertebrates that make up some 95% of all species. If the three other vertebrate categories could be supposed to be losing species at the same rate as mammals and birds, that would not make much difference to the overall extinction rate since all vertebrates comprise only around 50,000 species. Conversely, invertebrates probably total at least 9.7 million species. So the student took a deep breath and extrapolated the extinction rate for

plants, mammals and birds to the other vertebrates and to all invertebrates, coming up with an extinction estimate of at least one species per day.

He had reason to draw several more deep breaths. The evidence for his calculation was thin to say the least: after all, we know next to nothing about invertebrates. A colleague with tongue firmly in cheek described it as a "heroic" extrapolation. Yet the student considered it justified insofar as an extinction rate of one species per day would certainly signal the onset of a mass extinction. Such a phenomenon would rank as one of the biggest issues, if not the biggest issue of all, in modern biology. Nonetheless the student was warned by a couple of professors that he should be content to learn his trade as a student and leave such momentous matters to those who were equipped with the skills to do the job. Despite all, and with the backing of several enlightened professors, he went ahead and got his findings published in the front-rank journal Science (Myers, 1976), followed by a book "The Sinking Ark" (Myers, 1979)). As things turned out, he started what might be termed a mass extinction industry. Within seven years three hotshot scientists published books confirming that there was certainly a mass extinction underway, and within 10 years there was a regular torrent of books and articles.

Note the "research procedures" involved. The basic question—"What is the "true" extinction rate today?"—occurred to the student while he was lying on the grass of the Berkeley campus, enjoying a sunny day. His musings on the basic question occupied roughly one hour. He spent another few hours making phone calls and in libraries to check on estimates of the "official"/ current and prehistoric extinction rates. Finally he did some arithmetic with a pocket calculator and a pencil. Total time for the "research", five hours. He then spent the rest of the day writing up his findings in professional-journal format. Start-to-finish effort, 11 hours. Sole research tool: curiosity. Thus the birth of the whole mass extinction story, figured by a student lying out on the grass (making like a "lay about" scientist?).

The episode gives rise to a critical question. Given the momentous scale of the issue, why wasn't it picked up earlier by professional biologists? The data had been there for years, and the task amounted to merely collecting and collating the data, then analyzing them. One would think that many a leading biologist—or any biologist looking for a breakthrough into front-line biology—would have done the analysis a decade before that Berkeley student did. Meantime that student has gone on to other fields—such as writing this book.

Biodiversity hotspots

Much the same applies to the issue of biodiversity hotspots. Ever since the start-up of conservation efforts half a century ago, it has been plain there has not been nearly

enough money, scientific expertise, government support and citizen interest to do a complete job of saving threatened species, or even a modicum of a job. In fact, the problem has been expanding at an accelerating rate decade by decade. Worse again, the nature of the problem has been shifting. Whenever we assign conservation support (funds, etc.) to one species, we automatically deny those same funds to other species. However much we recoil from the prospect, we are saying that one particular species should enjoy our support and certain others should not—meaning, all too often, that the latter could well be consigned to eventual extinction. We have tried playing Noah, and our ark has proved far too small. Now we are playing God, deciding (unwittingly but effectively and increasingly) which species should live and which will likely not. Faced with this appalling prospect, it has become plain that conservationists should develop a way to establish priorities: What is the best strategy to ensure that scarce conservation funds will save a maximum number of species?

Way back in the late 1980s the first author Myers (1988) figured that the most "efficient" way would be to identify areas that satisfied two criteria. First, they should contain exceptional concentrations of endemic species (species found nowhere else and generally with very limited ranges); and secondly, they should feature exceptional threats of habitat destruction. By focusing on such areas, we could surely save more species than through any other method. There were lots of other criteria for key localities, e.g., exceptional totals of species whether endemic or not, or areas with species and ecological workings vital to future evolution. Deciding to zero in on 18 areas that met the two criteria above, they were designated "biodiversity hotspots." In two professional papers (1988 and 1990), Myers revealed that just 0.5% of Earth's land surface contains the last remaining habitats of some 20% of all terrestrial species (except fish) these habitats having already lost the bulk of their natural vegetation and hence of their species' living space. If these 18 areas could be safeguarded, it could knock a huge dent in the entire mass extinction problem.

All this has raised a further question about how science works. The hotspots thesis was not developed through months or years of field research in Amazonia or Borneo. It was all done while sitting in an Oxford office, mobilizing data that had been available for at least a decade. Question: why hadn't some other conservation biologist latched on to the same idea as far back as the 1970s if not before? Was it further evidence that institutional barriers inhibit scientific innovation? Were professional biologists, pioneering spirits as they surely are by vocation, limited by "tradition"? In fact the hotspots strategy was ignored by virtually all who might be expected to be immediately interested, with the exception of the MacArthur Foundation in Chicago, which began pouring some $15 million a year into on-the-ground efforts in countries as diverse as Philippines, Indonesia, Madagascar, Tanzania, Costa Rica and Colombia. But it took the scientific community a further eight years to react in substantive fashion. Myers

was invited to head a team organized by Conservation International in Washington DC, to produce an expanded version of the hotspots concept. When the new findings were published in 2000 (Myers et al., 2000) Myers was roundly criticized by a group of scientists from Britain, South Africa, Australia and elsewhere, for being "precipitate"—even though the scientist critics had had all of 12 years to conduct their own in-depth research on the theme since its origin in 1988.

Today 34 hotspots have been identified covering 2.3% of Earth's land surface and containing the last hold-outs of half of Earth's plant species and two fifths of all animal species on land. The hotspots thesis has been described by that doyen of biodiversity, Professor Ed Wilson of Harvard University, as "The most important contribution to conservation biology of the last century."

Depleting future evolution

A similar story arose in 1985 when Myers published a short article asking whether the biodiversity crisis might degrade and otherwise deplete certain basic processes of evolution. Specifically, the current biotic crisis will not only eliminate large numbers of species but it will grossly reduce the capacity of evolution to generate replacement species within a "normal" length of time, viz. several million years. This extended hiatus will arise because our current battering of the planetary ecosystem looks set to virtually eliminate tropical forests and wetlands, both being zones that in the recovery period following mass extinctions in the prehistoric past have served as pre-eminent sources of new species. With these two "cradle" areas gone, we could indeed declare with Professor Michael Soule (Soule, 1980) that "Death is one thing, an end to birth is something else."

Myers figured that this depletion of evolution would be regarded as a matter of major moment, and he expected a torrent of comment from the scientific community. Instead there was total silence for 15 years until the U.S. National Academy of Sciences invited him to convene an international conference to assess the issue and his earlier findings. The conference attracted 30 leading scientists from around the world, though a number of invitees declined to attend on the grounds that the issue was to do with the future, therefore it was speculation, therefore it was not science. Fortunately the scientists at the conference produced a consensus statement upholding the basic thesis and agreeing that it was indeed a front-rank issue of contemporary biology (Myers and Knoll, 2001).

Once again Myers expected an outburst of reactions to this latest pronouncement, but again there has been hardly a word in seven years. Yet we should surely ask whether there could be any issue of greater import for modern biology than the prospect of gross degradation of evolution for several million years ahead. Caution, it

seems, rules the day. Myers has even postulated that within a few decades the present inhabitants of planet Earth could depauperize the biosphere and thus impoverish the human cause for at least 20 times as long as humans have been a distinct species. How many people would actually be affected by today's actions or inaction? Well, a human generation is generally reckoned to be 25 years, and we're talking about, say, five million years into the future. A bit of back-of-the-envelope arithmetic reveals the total will be some 500 trillion people, or 10,000 times more than have ever existed to date. Even one trillion is a big number. To wrap your head around it, calculate the length of time made up of one trillion seconds. When I was asked that question, I guess-timated what I thought would be a number large enough to be on the safe side, 18 years. I was, one could say, way off.

Conservatism revisited

Professor Jim Lovelock is a British scientist who devised the Gaia hypothesis, postulating that the Earth ecosystem—land, oceans, atmosphere, organisms—comprises an integrally interlinked system that possesses the exceptional property of ensuring it maintains optimum conditions for supporting life (Lovelock, 2006). This is a highly contentious viewpoint that has won Lovelock much approval and much criticism. He is an extremely controversial figure. Still, he has managed to pursue a career as an independent scientist for 40 years. "I knew if I worked for a university, they would have said, "Look here, Lovelock, you have to drop this Gaia research, it is giving us a bad name."

Myers has followed a similar track as a stand-alone and unsalaried scientist, even though for much of the last 40 years he has rarely known where his income would come from six months down the road. Conversely he has been free to follow his own research inclinations, with the result that he has generated "research firsts" by identifying issues such as mass extinction of species, tropical deforestation, the "hamburger connection", the economic value of species, environmental security, biodiversity hotspots, degradation of future evolution, environmental refugees, "perverse" subsidies, and the emergence of sizeable middle classes in developing countries led by China and India. He believes that if he had chosen to become a permanent professor in academia, a guru in a research center, a full-time scientific adviser, or any sort of expert in a full-blooded research institution, he would, like Lovelock, have found himself under pressure to be the complete team player, to tread the same track as others, and thus to end up thinking other people's thoughts. Alas that there is all too little of an institutionalized niche to foster those scientists who admire Rudyard Kipling's cat that walked by itself.

The problem is widespread. The culture of universities makes it sometimes difficult for fundamentally different views to prevail or even be fully addressed. According to Derek Bok (1990), former President of Harvard University: "Armed with security of tenure and time to study the world with care, professors appear to have a unique opportunity to act as society's scouts to signal impending problems long before they are visible to others. Yet rarely have members of academia succeeded in discovering emerging issues and bringing them vividly to the public's attention. What Rachel Carson did for risks to the environment, Ralph Nader for consumer protection, Michael Harrington for problems of poverty, and Betty Friedan for women's rights, they did as independent critics, not as members of a faculty."

A final angle on this point. Professor (Lord) Robert May—a man who certainly knows what he's talking about since he was once the U.K. government's Chief Scientific Adviser and then President of the Royal Society, Britain's foremost scientific body—has commented (May, 2005; see also McKie, 2005) that scientific research in Britain is being stifled by "an appalling, obsessive bureaucracy." The country's scientific eminence is threatened by "a bunch of academic apparatchiks, [and] today the DNA work of Crick and Watson, both Nobel Prize winners, would have been blocked before they had got started."

More knowledge or better knowledge?

Many scientists are content to raise fresh answers to established questions. There is likewise a need for scientists who ask if we are raising all the right questions in the first place—all the greater is this need when the trail-blazing scientists are heavily outnumbered by the "follow your leader" group. Hence, and as indicated in Chapter 4 on Surprises, there is a dearth of research and publications on what are recognized as some of the most important phenomena in the natural world, yet whose nature remains virtually un-addressed. The same applies to one of the main sources of surprises, synergisms, or literally "a joining of energies." Check most leading textbooks on ecology or environment and if you find any mention at all of synergisms, it is when the author underlines their significance—yet check the book's index and you will likely find next to no elucidatory mention.

This brings up the vital question of "unknown unknowns." It was highlighted in 2005 by Donald Rumsfeld, former U.S. Secretary of Defence, and bruited as if it were Rumsfeld's own original idea; in fact he was way behind this book's first author who publicised the issue in a leading journal a decade earlier (Myers, 1995). In essence, the concept asserts that among the problems ahead, the most important ones could be those that are still unknown to us. Many problems are known to us in principle, i.e., we know they exist but we know little else about them. They rank as "unknown knowns." Other problems are presumably building up out there but as yet we have not even become

aware of their existence: they are "unknown unknowns." In 1970, acid rain was still not recognized, though we now acknowledge that if scientists had thought to ask where all those fossil fuel pollutants were going on the wind and what their impact would be when they finally came back to earth, they could have anticipated the problem. What unknown unknowns are waiting to jump out on us and become all too known? Recall the aphorism of that renowned scientist Francis Bacon: "They are ill discoverers that think there is no land when they see nothing but sea"; and by that other renowned scientist, Anon., "Wisest is he who knows he does not know."

So important is this factor that it deserves a research agenda with scope and scale to address the phenomenon of unknown unknowns. What frontiers of environmental science should we probe with a greater sense of exploratory foresight? The effort will require a shift away from developing more knowledge about what we already know in essence, and toward attempting to learn something about what is virtually a black hole of information and analysis. We are generally good at analysing problems when we recognize their existence, but we are less skilled at reaching out to new problems before they reach out to us.

This research challenge is so wide ranging that it could even entail a reorientation of certain aspects of our science culture. Many scientists prefer to grapple with problems about which they already know something; it is a strategy that often leads to research success, published papers and career advancement. So part of our response to the research challenge could concern questions of reward structures in science. Among other institutional interventions, we need incentives that promote rather than discourage research into unknown unknowns (Lawton, 2007).

Scientific uncertainty and public policy

Much scientific activity is stymied because scientific problems are difficult to evaluate when—as is often the case—they are beset with uncertainty (Kendall, 2000; Ravetz, 2006; Rowland, 1993). To cite a prominent British scientist who has spent 10 years in the public policy sphere, Professor (Lord) John Krebs, "Translating science into policy is frequently messy. Factors other than science come into play, such as cost effectiveness, ethics and politics. These problems, compounded with other factors such as perceptions of risk, mean that science policy is not just about science" (Krebs, 2006; see also Lawton, 2007; Pollack, 2003; Taleb, 2007). Even the science of weather forecasting, which has advanced during the past 50 years as if from the Stone Age to the 21st Century, still leaves us unable to come up with a precise forecast for next week's weather, or even tomorrow's.

Within this book's context of institutional roadblocks and within this chapter's partial focus on environmental questions, there is an obvious example of uncertainty

and policy: mass extinction of species. How many species are we losing per year, how many might we well lose within the next 50 years, how many species can we "afford" to lose, etc.? Then there is the question of the long-run impacts of covert pollutants such as endocrine disrupters which may not reveal their ultimate and drastic injury for at least a whole human generation (Coburn et al., 1996). Given that there are around 100,000 synthetic chemicals “out there”, the time-bomb effect could be exceptional indeed, yet remain entirely uncertain for ages. Then too there is the biggest problem of all, and one that is somewhat subject to the most scientific uncertainty of all, climate change.

In all these areas, scientific uncertainty bedevils the question of costs (Owens, 2005; Rayner, 2004; Sutherland et al., 2006). We are generally aware of the costs of problem-tackling action, but we know far less about the costs of inaction. Although grey areas abound, this should not be seen as a restraint on policy responses. After all, we confront uncertainty every day in the policy sphere. What, for instance, are to be the ultimate and overall economic returns on today's investments in health, education and defence, these being the three biggest outlays in most governments' budgets?

Key question: What is “legitimate scientific caution” in the face of uncertainty—especially when uncertainty can cut both ways? Some observers may consider that in the absence of conclusive evidence and assessment, it is better to stick with low estimates of environmental impacts on the grounds that such estimates are more “responsible.” But beware the asymmetry of evaluation at work. A low estimate, ostensibly “safe” because it takes a conservative view of such limited evidence as is to hand in documented detail, may fail to reflect the real situation just as much as does an “unduly” high estimate that is more of a best-judgement affair based on all available evidence with varying degrees of demonstrable validity. A minimalist calculation with apparently greater precision may in fact amount to spurious accuracy. In a situation of uncertainty where not all factors can be quantified to conventional satisfaction, let us not become preoccupied with what can be precisely counted if that is to the detriment of what truly counts.

This applies especially to issues with policy implications of exceptional import, as in the case of climate change. Suppose a policy maker hears scientists stating they cannot legitimately offer final guidance about a problem because they have not yet completed their research with conventionally conclusive analysis in all respects. Or suppose the scientists simply refrain from going public about the problem because they feel, in accord with certain traditional canons of science, they cannot validly say anything much before they can say all. In these circumstances, the policy maker may well assume there is little to worry about for the time being: absence of evidence about a problem implies evidence of absence of a problem. By consequence, the policy maker may decide to do nothing—and to do nothing in a world of unprecedentedly rapid change can be to do a great deal. In these circumstances, undue caution from scientists

can become undue recklessness in terms of the policy fallout: their silence can send a resounding message, however unintended. As in other situations beset with uncertainty, it will be better for us to find we have been roughly right than precisely wrong.

In face of this dilemma, what is a scientist to do? One response is to describe the situation to the policy maker with a maximum of "precise imprecision." Another response is to decide to do more to communicate with the outside world, and to do it with an advocacy stance, even at the supposed risk of losing professional credibility as a scientist (Lawton, 2007; Myers, 1999).

This latter point is surely one of the great imperatives of the future for both science and society. Fortunately—and to reiterate the point made in the opening page of this chapter—there are many scientists who recognise their newly expansive role in society at a time of altogether unprecedented challenge: a time of problems and opportunities alike. After all, there is a whole world out there to be saved, and there is a pivotal part to be played by scientists. Perhaps scientists should feel privileged to practice their profession at a time when it is needed as never before. Which biologist could dream that within the next five decades he could help to reduce the grandscale impoverishment about to overtake the planetary ecosystem for the next several million years?

7. ANCIENT MONUMENTS

"Throughout the great Gothic epoch and when technology remained rudimentary for the most part, virtually every city knew famine and disease, and their communities knew social instability and constant violence. Yet these communities mobilized the spiritual and civic commitment to sustain building projects that sometimes spanned centuries."

Robert Scott, 2003

This chapter departs from the analytic pattern of all the other chapters by looking at episodes from the distant past. It does this in an attempt to identify civilizations that have managed to commit the energies and the economies of many of their people toward a single goal over a period of decades if not centuries—as witness the accomplishments of building immense monuments such as the Pyramids, Stonehenge, the Great Wall of China and the Gothic cathedrals. These achievements stand in strong contrast to today when we seem unable to focus even a relatively small part of our energies and economies on tackling a worldwide threat, climate change, that has the potential to surpass any of the disasters of the past millennium if not longer. How could ancient civilizations accomplish what appears beyond us? Specifically, what was the institutional chemistry that enabled them to undertake projects of exceptional concept and scale? How come there were no institutional roadblocks to obstruct the mounting of such exceptional efforts? What can we learn from these endeavours as we confront our own institutional challenges?

The Great Pyramids of Egypt

The Pyramids serve as an eminent example of how a society can undertake a project of a magnitude that entrains sizeable chunks of its political economy. How did that far-back society organize its activities in a manner that led to the pyramids—and what, if any, insights can it offer to us today when we need, but thus far have failed, to put together a society-wide effort to save the global environment?

The three Great Pyramids, also known as the Giza Pyramids, were constructed during the period 2550-2470 BC, i.e., much further before the time of Jesus Christ than we are after that time. The building project consumed a period of 80 years or roughly three generations of Egyptians. The next of the Seven Wonders of the Ancient World, the Hanging Gardens of Babylon, was not constructed until the late 500s BC; and of the Seven Wonders, only the Great Pyramids are still standing. Their construction amounts to one of the most astonishing achievements in history, For 4,500 years the biggest Pyramid (sometimes known as the Khufu Pyramid after the Pharaoh for whom it was built) was the tallest and most expansive structure in the world. It has a perimeter of

roughly 1,000 meters, and its base area almost matches a small football field. If it were hollow, it would easily encompass both the Pentagon and the Capitol in Washington DC.

We have only limited knowledge of how the Ancient Egyptians undertook their Pyramids project, especially from architectural and engineering standpoints. Indeed there is only partial agreement on basic statistics, though we have enough to show that pyramid building was a monumental (sic) challenge. Suppose that a pyramid's base ramp took 1.6 million cubic meters of stone and the pyramid itself took 4.2 million cubic meters, for a total of 5.8 million cubic meters. This implies 2.3 million blocks each weighing an average of 2.5 tons or twice as much as an average car of today. All that material had to be mined in distant quarries and transported to the construction site before being raised as high as 147 meters (Jackson and Stamp, 2003).

Moreover, it was constructed with exceptional accuracy and precision. For instance, the level of the entire pavement around the Pyramid varies by only two centimeters (three quarters of an inch), while the Pyramid's sides deviate from true North by an average of a mere three minutes of one degree. There were 41,000 casing stones around 100 inches thick and weighing an average of 40 tonnes. Each one was flattened to within 1/100th of an inch, and featured almost perfect right angles on all six sides. To quarry the stones, the workers chiselled holes in sandstone cliffs, then hammered wooden wedges into them and soaked the wedges with water until the wood swelled enough to split the stone (Kemp, 2006; Lehner, 1997; Mendelssohn, 1974).

All this would have been an extraordinary achievement even with modern technical means (Edwards, 1993; Verner, 2001). Moreover the whole affair demanded a high degree of planning and organisation. To cite just one aspect: to construct the Great Pyramid within its established time span, workers would have had to set a stone in place every two minutes (for further details, see Byers, 2004; Edwards, 1993; El Mahdy, 2003; Jackson and Stamp, 2003; Tyldesley, 2003; Verner, 2001; Wilkinson, 2001). All in all, the three Giza Pyramids comprise a series of monuments of unsurpassed grandeur. “They were the closest mankind has ever come in architecture to creating an illusion of transcending the human condition” (Lehner, 1997).

Among the most contentious questions is the number of workers involved. It is estimated that for the construction of the Great Pyramid, 100,000 men worked at one time or another during a period of 20 years, four months at a go and mainly during the River Nile's July/October flood season when the rural population could not tend their farm fields. Roughly 36,000 men would probably have been enough for the task at any one time; indeed this estimate could be on the high side given the problems of accommodating all the workers and supplying them with a steady flow of building materials and food. Other estimates suggest higher totals of workers, as many as 50,000 or even 70,000 on site, plus 60,000 elsewhere (e.g., in the distant quarries), though these higher figures are based on a national population of 5-10 million, by contrast with the

20,000-30,000 worker estimates reflecting a putative national population of fewer than two million people. There seems to be a research consensus (Edwards, 1993; El Mahdy, 2003; Fagan, 2001; Jackson and Stamp, 2003; Kemp, 2006; Lehner, 1997; MacNeill, 2000; Mendelssohn, 1974; Tyldesley, 2003; Verner, 2001; Wilkinson; 1999) that the work force building the Great Pyramid constituted hardly more than 30,000 men. On top of all this there would have been an immense army of bakers, brewers and others who supported the builders, perhaps as many workers again.

A combined total of 60,000 workers would have amounted to maybe 1% of the population (and much larger proportions of the communities living within daily-travel proximity to the building sites). The total can be compared with Britain's National Health Service comprising one of the largest work forces in the world, 1.3 million employees or 2% of the national population and roughly 4% of the work force. It can also be compared with the Chinese Army, five million individuals or 0.4% of the national population and 1% of the work force.

Another crucial point is that these workers were not forced labor, still less were they foreigners. Contrary to popular opinion, they were ordinary Egyptian citizens, most of them working as conscripts on a rotating basis, while a few others toiled as full-time employees. The Egyptian language at that time featured no word for “slave.”

Institutional organization

Most experts say next to nothing about a vital riddle of the pyramids project, viz. how was the whole thing organized? Who first hatched the pioneering idea, how did he carry such large sections of society along with him, how did he motivate the architects, engineers, etc., how did he recruit the work force, how did he inspire the tens of thousands of participants over so many decades? How did he assemble the remuneration for so many workers, whether in terms of money or bread? How did he persuade the community to set aside such a large share of its economy in order to fund such a costly enterprise? In short, how did he handle the politics, the socioeconomics, the cultural aspects of pyramid building? Above all, how did he overcome the doubters, the cynics, the “What a waste of money” sceptics, and how did he resist the many institutional obstacles that were no doubt strewn in his path? These factors must all have been inherent in the project from start to finish, yet they were surmounted. Indeed might we ask: How?

The vital element of leadership in Ancient Egypt resided in a single person, the pharaoh (roughly the same as king). As stated by a leading expert on the socioeconomics of pyramid building, Dr. Toby Wilkinson (2001), “As the earthly incarnation of the supreme deity, [the king was] the unifying force that held Egypt together, without whom chaos would ensue.” Crucial to the whole enterprise of pyramid building, then, was the

political and socioeconomic structure of Ancient Egypt. As far back as 3100 BC the kingdoms of both Upper and Lower Egypt were merged under a single king, whereupon the country's populace became accustomed to operating as one vast work force during the annual flooding of the Nile.

The institutional architecture of Ancient Egypt has been examined at length by Dr. Wilkinson (see also El Mahdy, 2003; Fagan, 2001; MacNeill, 2000; Manley, 2003; Trigger et al., 1983; Tyldesley, 2003). He asserts that "Ancient Egypt witnessed the world's first example of that enduring and now omnipresent political structure, the nation state.... The government succeeded in creating and promoting an elite culture which expressed itself on a grand scale, notably the Pyramids at Giza which are perhaps the quintessential symbol of the Ancient Egyptians' extraordinary creativity and craftsmanship ... Without central control of the economy, and without the ability to command the necessary manpower, the royal court would not have had the resources to engage in monumental building projects. Without the religious and ideological motivation, the construction of huge funerary monuments would, quite literally, never have got off the ground."

Without this pivotal leadership, it is difficult to see how the government elite could have concentrated tens of thousands of workers in one particular place for a widely acknowledged and largely accepted activity (see also El Mahdy, 2003; Fagan, 2001; MacNeill, 2001; Trigger et al., 1983; Tyldesley, 2003). The same pharaoh-centered ideology supplied a dual motivation to energize the individual workers (Byers, 2004). First there was simple self-interest in that the Pharaoh was believed to be a god who would put in a favourable report to the collective gods on the workers' behalf. Secondly, the workers were assured that they and their families would be fed since their labor was largely remunerated with surplus grain grown along the fertile alluvial soils of the Nile.

What lessons, if any, can we learn from a society 4,000 years ago? Not a great deal insofar as we do not understand enough about what made Egyptian society tick. We can discern, however, three factors at the heart of the system. One is that the Pharaohs did not attempt totalitarian control over the entire populace; in major measure they had to exercise leadership through social structures. Secondly, they presumably had to mould public opinion, depending in part at least on expert PR advisers. Thirdly, they managed to figure out the multitudes of planning and organizational details of building monuments that in those days must have seemed almost impossibly grandiose.

Key question: If these various tasks could be accomplished by people who were still learning how to run a substantial society and its support economy, why can't today's nation states do as much?

Other feats of construction

Let us briefly note some other exceptional feats of building on the part of ancient communities. Stonehenge was constructed during a period stretching from roughly 2950 BC to 1600 BC, with the main work confined to the relatively brief period 2550-2400 BC. The preliminary planning was astonishing for its unduly precise and sophisticated analyses. According to some modern-day analysts (Burgess, 2001; Scott, 2003; Hill, 2008; Christian, 2004), the Stonehenge leaders apparently tracked the course of the moon-rise for 112 years, five or six generations, before they ever started work on digging the monument. When the building work began, no fewer than 84 massive sarsen stones, averaging 40 tonnes each, plus 82 bluestones averaging 1.5 tonnes each, were hauled a distance of 135 crow-flying miles from southwest Wales. Then consider the sheer sweat involved in the work on site. Suppose a hypothetical crew of 20 people worked eight hours a day and seven days a week throughout the year. This typical work crew would have needed at least 21 years of continuous work to dig that major feature of Stonehenge, the Great Cursus, being a long processional way with a causeway 1.7 miles long and 164 yards wide, and marked by a boundary ditch on each side 10 feet wide and 40 inches deep, together with an inner bank on each side some 40 inches high. The work of digging the Great Cursus was not, of course, confined to 21 years; rather it was spread out over three centuries roughly 3500-3200 B.C. (Burgess, 2001; Castleden, 1993; Scott, 2003).

How many workers would have been needed to accomplish the extremely heavy labor? In principle, a team of fewer than 200 persons could have dragged the stones and lifted them into position, using sledges, ramps and counterweights (Burgess, 2001; Castelden, 1993; Fagan, 2001). In practice there would surely have been several teams working in rotation. Even if the work force had numbered several thousand, this would hardly have been any major factor in terms of population numbers. What would surely have been problematic would have been inducing anybody at all to engage in such a protracted effort at a stage in human history when the main preoccupation of every day would have been getting supper on the table (Burgess, 2001; Castelden, 1993; Fagan, 2001). All this argues for a strong central authority to organise the entire enterprise over a period of numerous generations.

A much larger accomplishment was the Great Wall of China. This extraordinary edifice stretches some 2700 kilometers (1500 miles) in a semi-straight line, but its actual length—including double trip, triple and even quadruple sections, plus loops at passes and other strategic points—is at least twice as much; and when earlier sections of the Wall are included, the total length is nearly 10,000 kilometers or more than one fifth of the Earth's circumference. In addition there are some 20,000 wall towers and 10,000 separate watch- or beacon-towers. With all the stones and bricks employed, we could build a wall one meter thick and five meters high 10 times around the globe. It was

long supposed to have been the only man-made structure visible from space (Fagan, 2001; Lovell, 2007).

The original Great Wall was built sometime after 220 BC, with over 300,000 men conscripted, including soldiers, peasants, prisoners and scholars. Working in mountainous or desert regions, in extreme cold or heat, without adequate food or lodging, one worker died for each meter built. The Han dynasty (206 BC to 220 AD) extended the Wall to its longest ever, while most of the Wall we see today was built by the Ming dynasty (AD 1368-1644) (Fagan, 2001; Paludan, 1998).

The Gothic cathedrals

Finally, note the Gothic Cathedrals of Western Europe, almost all built during the 400-year period 1150-1560. They feature one of the richest flowerings of human creativity, with eighty of them soaring from the ground in France alone. Some of them reflected an expansive vision in terms of sheer size. When completed, the cathedral at Amiens featured a floor expanse as large as one and a half football pitches, yet it could accommodate the city's entire population, equivalent in modern terms to a sports stadium for one million people. Beauvais cathedral is high enough to accommodate a 14-floor skyscraper, while Strasbourg's spire is only 100 feet short of the Washington Monument (Erlande-Brandenburg, 1995; Gimpel, 1984; Raguin et al., 1995; Scott, 2003).

Yet statistics convey only a limited insight into the sheer daring that inspired their creators. To cite a Canon at Seville in 1402, "We shall build so large a cathedral that those who see it in its finished state will think we were mad" (Erlande-Brandenburg, 1989). Indeed, so monumental in spirit as well as construction are these edifices that they "seem to create an isolated physical and spiritual focal point." Such elevated reactions apart, however, the cathedrals played a part in the everyday lives of the local community. They were "not at all a set of self-sufficient buildings, apart and sublime. Rather, each was a city within a city, a structure that was above all a practical, functioning concern" (Erlande-Brandenburg, 1989).

The building of any cathedral would have commanded the labor of a sizeable share of the local populace, of its overall economy too. We know that a major motivating factor was the Christian religion with its governance apparatus, together with the feudal system of social organization, but we have few clues as to how these were mobilized to support the remarkable feats of erecting buildings with an architectural subtlety and engineering finesse that far surpassed anything known until then (Erlande-Brandenburg, 1995; Gimpel, 1984; Raguin et al., 1995; Scott, 2003). Several centuries later, they are still magnificent monuments of faith in the indefinite future. Yet their building was accomplished at a time when, to quote Thomas Hobbes, life was nasty, brutish and short. Thus the superb paradox: Why and how were the cathedrals built at a

time when “Medieval societies were fragmented, disorganized, and chaotic? ... There seems to be a mismatch between the singular elegance, grandeur, uniformity and beauty of the buildings, and the messy, confusing and chaotic world that produced them” (Scott, 2003). Within this highly unstable social context, perhaps a cathedral was intended “to make a profound statement about the power of the community and the constituent institutions out of which it grew.” (Scott, 2003).

Thus the melding of stone with spirituality, of social structure with giant architecture, all coming together to form an exceptionally creative culture. “Because this culture made human existence possible and tolerable, because people's sole source of protection and security lay with shared beliefs, it became important to make this system appear larger than life. Making communities appear powerful and efficacious was a way of reassuring people that they did not stand alone against the terrifying forces of nature and the difficult conditions of human life. Planning and executing incredible feats of construction have become a tangible way of empowering the culture that protects us” (Scott, 2003).

Something of the same spirit presumably inspired still other monumental building efforts. There is the Borobadur Temple in Java, built between the late seventh and early eighth centuries by the Buddhist society of the time, and comprising 55,000 square meters of lava rock with over 550 Buddha statues and almost 9,000 relief scenes. In Cambodia there is Angkor Wat, built as a huge pyramid temple during the first half of the twelfth century and regarded as the ultimate masterpiece of Khmer architecture (Coe 2005; Higham, 2004; Ortner and Mabbett, 2002). Then there are the striking Mayan constructions in Mexico and Central America, some of which were built on a master plan spanning several centuries after 200 B.C. (Coe, 2005; Demarest, 2004; Evans, 2004; Fagan, 2001; Kemp, 2006; Trigger, 2003).

Today we are far less concerned with, let alone inspired by, the long-run future, i.e., by whatever future generations may think of us. Our time horizons tend to be bounded by the annual corporate report and the next election. We no longer give the future its due, even though we are degrading the face of the Earth beyond capacity to recover in less than centuries, millennia—or even millions of years in terms of mass extinction of species and gross disruption of restorative processes of evolution. Building the Gothic wonders must have taken more than just creativity. They put a premium on long-term planning as well. Architects and stone hewers alike must have often known they would never see the finished product since construction would take more than a lifetime. The endeavor must also have absorbed a good part of the local community's energy. In the vicinity of York in England, for instance, with one of the largest cathedrals, there could not have been more than 15,000 people within walking, i.e., daily commuting, distance and thus able to lend muscle to the task (Branner, 1961; Erlande-Brandenburg, 1995; Raguin et al., 1995; Scott, 2003). At a time when most people's daily

preoccupation must have been keeping body and soul together, also coping with community upheavals, people were ready to allocate a sizeable share of the local economy to what nowadays might be termed a "discretionary" activity. Indeed most community life must have centered on the building site.

How different seems our outlook today regarding great social undertakings with long-term impact. We are faced with an environmental debacle that many leading scientists believe would be damaging enough to surpass a nuclear exchange. Yet we seem paralysed by the prospect. As was remarked by the organizer of the Rio Earth Summit in 1992, Maurice Strong, the conference attracted 132 political leaders, the largest number ever assembled, yet it displayed next to no leadership, as witness the lack of concrete actions to accompany pious pronouncements.

Is leadership the only resource in such short supply that it is virtually non-existent? Prominent Washington DC analyst Lester Brown (2007 and 2008) has calculated that a budget to fund sustainable development (via basic social and earth restoration goals) would lie in the region of $190 billion per year. Suppose the rich nations were to pay their usual one third share, they would have to come up with around $60 billion, or 0.1% of global GNP. The response thus far has often been along the lines of "We rich nations have never been poorer." Yet in 1947 the United States assigned 3% of its GNP to the Marshall Plan, at a time when Americans were only one quarter as affluent as today. The cathedral builders must have mobilized a far larger portion of the local economy, at least 10% and possibly several times more.

So is the root problem that we lack a George Marshall and a Harry Truman? Or does it lie with the intensifying hurly-burly of events—"a year is becoming a longer time"? Are we experiencing a sort of compression of contemporary history that distracts us from longer-term goals? As the University of Minnesota governance expert, Harlan Cleveland, has put it, "We tackle twenty-five year problems with five-year plans run by two-year personnel funded by one-year budgets."

So does the core challenge rather lie with our political systems and economic mechanisms that are failing to deliver what would surely be preferred by leaders and citizenry alike? Surely not. We know we can get to final grips with mega-problems when we mobilize the best in us. Within just a few years of the late 1980s and early 1990s we rid ourselves of the Berlin Wall, Communism, the Soviet Union and the Cold War. People in South Africa talked breakthrough turkey to each other. If we are to convert profound problems into splendid opportunities, perhaps the strategic approach is to first eliminate the Berlin Walls of indifference in people's minds.

In sum, we need to mobilize the individual leadership and the institutional chemistry that have occasionally enabled societies to rise above passing preoccupations and allowed their vision to soar in the manner of the cathedral builders. Their aspirations were articulated through Gothic spires, just as, in earlier times, they

enunciated their message through giant pyramids and other outsize monuments. What shall be our lofty expressions that astonish people several centuries hence (and likely to engage the spirit for many more centuries), if not the collective endeavor to save the planet at a time when entire sectors face terminal threat?

The four categories of monuments described above represent just a few of the exceptionally impressive building projects of humanity's early history and of its more recent formative stages. In terms of the sophisticated planning and advanced organizational skills required, and especially in terms of the political and socioeconomic contexts of their time, their achievements surely match if not surpass the most outstanding feats of our own time such as putting a man on the Moon. They succeeded, and we—thus far at least—are failing in mounting grandscale projects embracing the best efforts of contemporary society. In fact we baulk at supplying sufficient funds to support one of the finest manifestations of Gothic architecture in Britain if not Europe (some would say the world), King's College Chapel at Cambridge University. Yet the building faces a debt growing annually by $750,000. Simply to maintain it costs nearly $2,000 a day, on top of $3.8 million to undertake urgently needed repairs.

There are cogent lessons to be learned. How shall we achieve a global mind-set that is sufficiently expansive and unified for the climate changes ahead? Could it be that the principal roadblock of today lies with the gospel of extreme individualism which often militates against exceptional collective efforts?

8. THE ULTIMATE BREAKDOWN: WAR

"All dreaded [the Civil War], all sought to avert it ... and the war came."

Abraham Lincoln, 1865

Now for an institution that, let's hope, will soon have had its day and can be eliminated from our understanding of how the world works. It is war. Humans have practiced war as a means of sorting out their relationships since they came out of their caves 10,000 years ago, and, albeit in a lower key, for a good while before that. Viewed in strictly objective sense, war is a preposterous way to resolve our differences; to say, in effect, "I disagree with you, and if you won't change your mind I'll blow your head off to encourage you." Each soldiery adversary is likely to be as much of a decent, caring, family loving man (or, increasingly nowadays, woman) as the other; and each has no more cause to blow the other's head off than that he/she has been ordered to do so for reasons determined by some distant government or other agency. Each soldier is effectively reduced to an automaton, quite the opposite of an autonomous human person. The entire process amounts to a flat-out rejection of whatever makes us human. Hence the regular assertion of those who train military recruits: "We have to break you down as a human before we can build you up as a soldier."

The breaking down can be a dismal process, even while it illustrates the very nature of the military process. To cite a former Royal Marine Corps general in the British army, describing initiation ceremonies that have been celebrated rather than abhorred, "Through forms of violent and demeaning behaviour, recruits have to be pushed to the extreme because the Corps wants to stay the best, the elite, and you cannot do that with kid gloves. We have all dished it out and been on the receiving end of stuff which would make civilians cringe." Cringe? Sadistic violence is reportedly standard, and wounds can be life threatening. Individuals have been beaten unconscious, and electronic pads attached to heads and testicles. In light of this, should we be surprised when we read of our best soldiers practicing torture on enemies as a matter of course?

As has been stated by numerous analysts (e.g., Gatt, 2006; Shaw, 2005; Smith, 2005; Woollacott, 2005), war is a form of collective insanity. It is the "collective" bit that causes problems. A man who wouldn't harm a fly will gladly line up a rifle on a supposed enemy, and feel after pulling the trigger that he has done his bit for the country's flag, for civilization, or whatever other value he ostensibly holds dear above all else. Or does he? It may be more realistic to say that he kills the other guy simply to prevent the other guy from sending the same compliment first. Both have been manoeuvred into a situation where they are forced to perform an action they would surely never do if they had a worthwhile choice. Who does the manoeuvring? Why, society does, the society that decides on war in the first place and then tells the individual soldier to go and descend

into brutality. Society offers no alternative, no opportunity for the two soldiers in question to sit down and discuss their differences—if they have any real differences anyway.

Once again, we are caught without any institutional means to live together in more acceptable ways. We continue to practice an absurd mode of settling our problems—a way that splatters ketchup all over the carpet and leaves many of us eliminated. This behavior has been practised for thousands of years: we all deplore it vehemently and we all endorse it implicitly. But could the time be arriving, maybe within the next few decades, i.e., within the lifetimes of those who may be commanded to yield up their lives for some cause, when potential soldiers will say "Hell, no, we won't go" (Shaw, 2005; Smith, 2005; Woollacott, 2005)?

Certainly we need a wholly fresh approach to violent conflict in light of what could lie ahead. Gone is the time when the most heated confrontations could be settled with clubs and axes, or, still more efficiently in determining a winner, spears and arrows. Then for centuries, war was an activity for a bunch of knights on horseback with outsize swords. Today war has become an event to which all citizens are invited in their many millions, and with weapons to wipe out the other guy's many millions at the flick of a switch.

Consider what we could achieve during the present century if we put our minds to it. It is generally accepted (Shaw, 2005; Smith, 2005; Woollacott, 2005) that during the 20th century at least 120 million people were killed in wars, making it far and away the bloodiest century in human history. Of the 120 million, somewhere around 50 million were thought to be soldiers and 70 million (58%) were civilians (notably the elderly, women and children). The civilian share rose to 75% during the 1990s when war became both more common and more lethal. Then on top of the 120 million we must add in 20 million who died violently under both Stalin and Mao. This makes an overall total of 160 million people killed in conflicts of one sort and another, and something like 100 million of the 160 million killed were civilians—the famous "collateral damage." During the present century, and if we extrapolate from our 20th Century experience and also allow for population growth among other factors, we can expect that unless humankind performs far better, there could be at least 300 million dead from violent conflicts; and if civilian casualties remain constant at roughly 75%, then the present century could feature the war deaths of 225 million civilians, innocents all. This is a prospect to give us pause like no other generation has remotely had to face (Blight and McNamara, 2001; Blight and Lang, 2005). World War II, the largest slaughter thus far, managed to kill 40 million civilians.

The Cuban missile crisis and the Vietnam war

A prominent expert in the nature of modern war is Robert S. McNamara, the former U.S. Secretary of Defense who was a prime player in both the Cuban missile crisis and the Vietnam war. So central was his role and so marked has been the revision of his views, that it is worth citing him at length. He convened two after-the-event conferences to sort out what had actually happened during the Cuban crisis, including the three major parties involved, viz. the United States, the Soviet Union and Cuba. It transpired that each party supposed it had an exceptionally close idea of what the other two were thinking and planning (i.e., where they perceived the brink of war to be and hence how far they could pressurize the others). Yet all sides proved to have been basically mistaken. "It was luck that prevented nuclear war. We came that close to nuclear war at the end [gestures by bringing thumb and forefinger together until they almost touch]. Kennedy was rational; Khrushchev was rational; Castro was rational. Rational individuals came that close to the total destruction of their societies. And that danger exists today. We all make mistakes, we know we make mistakes. Reason has its limits" (McNamara, 2002). "The current nuclear weapons policy is immoral, illegal, militarily unnecessary, dreadfully dangerous and politically indefensible" (McNamara, 2005).

When clarifying what he meant by the startling assertion "Reason has its limits", McNamara went on "Rationality alone, including the quite reasonable abhorrence of nuclear war, may not save us in certain situations from nuclear holocaust. This dire assessment is based on two principal findings. The momentum of the [Cuban] crisis meant that being rational, and being unalterably opposed to initiation of nuclear war at the outset of the crisis, did not guarantee that such a war would or could be avoided after the crisis had begun to escalate—to spin out of control. ... As the crisis evolved, there seemed to the central participants to be fewer and fewer non-catastrophic options. A war that began in this fashion would be called an inadvertent war, in which the evolving crisis itself produces successive situations so shocking, with available options so dreadful, that the formerly unthinkable—initiating a war that could lead straight away to nuclear war—began to look almost unavoidable." (McNamara, 2005). As for the Vietnam war, McNamara continues "We were wrong, and we had a mindset that led to action that carried such heavy costs. At times we see only half of the story. ... [Throughout the war] each side was imprisoned in a powerfully held but deeply erroneous mindset. Each side, believing the other had already made an irrevocable decision for all-out war, took actions in defence that seemed, to the other, to confirm their worst-case hypotheses. The misunderstandings led to actions that guaranteed that each side's beliefs would become self-fulfilling prophecies" (McNamara, 2005).

Misguided mindsets such as these, affecting no less than outright decisions of peace and war, seem to be proliferating and with catastrophic consequences. For notable instance, the United States could not imagine that Iraq did not possess Weapons

of Mass Destruction; and it took months of massive evidence to the contrary to persuade the American leaders that they could conceivably have been wrong. Committed to the idea that it was totally wrong for anyone to suppose it could have been wrong in any respect regarding WMDs, the U.S. mindset seems to remain as misguided as ever (McNamara, 2005).

The fog of war

McNamara attributes many mistakes to what he terms the "fog of war." He means that war is so complex that "It is beyond the ability of the human mind to comprehend all the variables such as human error, bad weather, bureaucratic red tape, imperfect communication through the chain of command, loss of control over events, shortage of time, high stakes, and sheer fatigue. Our judgement, our understanding, are inadequate; and we kill people unnecessarily" (McNamara, 2005). This fog of war concept is central to our understanding of recent conflicts, and we need to embrace it with much more rigor than it has generally received thus far. The concept has a protracted pedigree, having been first bruited in the Iliad almost 3,000 years ago. In Tolstoy's "War and Peace" (1860), the battlefield reveals a confusion that obscures the whole scene; of order there is no apparent trace, and chaos reigns supreme. The reader may also recall the total havoc of the opening scenes in the film "Saving Private Ryan." The same can also apply on a much larger scale: "[I]n even the most brilliantly planned military campaign, the Allied invasion of Normandy, contingency was soon king" (Weigel, 2003). Moreover it's no use protesting that military leaders should make a better job of being in charge. The generals are often old-timers who fight with the methods of the last war, and that, as the British and the French learnt in 1940, leads to calamity compounded (Stevenson, 2004). In any case, and as Winston Churchill put it, it's generally not long after the start of a conflict that the combatants have scant regard for what was the source of hostilities in the first place (Churchill, 1948; Cowley, 2003; O'Connell, 1995).

Basic message: war rarely turns out the way we want it to. Modern war in particular is so complex that we can scarcely comprehend how complex it is. It has become far too complex to be used as a deliberate means of exercising policy. It defeats us.

Thus the fog of war thesis raises the question of whether the supposed victors ever gain what they want out of a modern war. Does the concept of "victory" still hold up amid built-in confusion of a dozen sorts? In the mid-1980s I (NM) joined a global team of ecologists and economists to assess the outcome of a nuclear war. Answer, both sides would suffer so much damage from even a "minimum war" that they could not recover in less than 50 years, i.e., twice as long as the recovery periods of the two world wars put

together. When we applied the findings to a specific target, London, we were assured by the British government, which based its assurance on military advisers, that the health services could readily handle most of the human damage. Conversely our analyses demonstrated that within the first few minutes of a nuclear exchange the health services would be overwhelmed and within half an hour they would be eliminated totally (Myers, 1986). In response to this "defeatism", the military advisers still insisted that with enough of the right spirit, London would survive.

Reader, consider again the key factor of empathy—a factor that should lie at the heart of modern warfare. According to McNamara, "We need to understand the history, culture, religion, motives and attitudes of our adversaries. Empathy does not imply sympathy or agreement, rather it implies curiosity leading to deeper understanding of an adversary's mindset, as a prerequisite to resolving differences and eliminating threats to peace and security. ... We must try to put ourselves inside their skin and look at us through their eyes, just to understand the thoughts that lie behind their decisions and their actions. ... In the case of Vietnam, we didn't know the other side well enough to empathise, and as a result there was total misunderstanding. They believed we were seeking to subject Vietnam to our colonial interests, which was absolutely absurd. And we saw Vietnam as an element of the Cold War, not what they saw it as: a civil war" (McNamara, 2005).

Applying the empathy thesis to the current Iraq war, we might wonder how many soldiers scheduled to go to Iraq could find the country on a map. How many of their leaders could pinpoint Baghdad on a map? Similarly, soldiers could be more firmly briefed on the nature of their mission. Recall the soldier who deserted, saying he had not signed up to kill children. So too the soldier fighting with his bayonet who said he was astonished at how much blood his tunic had to absorb.

Costs of the Iraq war

Let's now consider the economic costs of the Iraq war to date, which turn out to be way more than originally anticipated. In the early days they were reckoned to total no more than $60 billion, and by the third year of the war they were still thought to run out at no more than $260 billion. By September 2008 it had cost $550 billion. By the time the war is finally over, however, it could prove to have been the second most expensive military venture in U.S. history, as measured by conventional military criteria. Yet according to Nobel Prize winning economist Joseph Stiglitz and his Harvard colleague Linda Bilmes (Bilmes and Stiglitz, 2006), the war's true cost for the United States could eventually turn out to be more like $1 trillion; a subsequent estimate of theirs (Stiglitz and Bilmes, 2008) goes as high as $3 trillion. These two latest estimates go beyond the immediate costs of combat operations to consider all other costs, not only direct but

indirect. They include lifelong disability payments to injured veterans, the cost of replacing military equipment, and the war's effects on oil prices among other sizeable impacts (though they omit the numerous incommensurable "costs" in the form of blood, tears and miscellaneous suffering). To put the total of $1 trillion in context, it is roughly $10,000 for every American household (and as of Fall-2008, the war-costs meter was still running as fast as ever). Or it would be enough to provide health care for all 47 million uninsured Americans and quality pre-kindergarten for every American child; it would solve the housing crisis once and for all; it would make college affordable for every American student; and it would provide tax relief to tens of millions of middle class families (Stiglitz and Bilmes, 2008).

We might further consider that the original rationale for the war, regime change, could have been secured at a tiny fraction of the overall cost, simply by paying Saddam Hussein to quit Iraq. As little (sic) as $20 billion would likely have done it (Hartley, 2005).

Then there are the costs to Iraqi civilians. By late 2006 and before the outbreak of civil war, the death toll for civilians had topped 600,000, making for a slaughter larger than the Rwanda genocide (Burnham et al., 2007). The "liberators" of Iraq had lost well over 3,000 soldiers in battlefield action, but in the case of British soldiers the number killed in Iraq has been exceeded by the number who died by their own hands after returning home to Britain.

Many if not most of the additional costs are obvious enough when we think about them. So why weren't they thought about by the experts when the war started but estimates of final costs still remained way lower than proposed by a real world calculus? Why wasn't more attention given to the prospective scale of civilian deaths in a country that the American liberators were supposed to be assisting? There were also costs among the living: in late 2006 one third of Iraqi children were malnourished, and there had been a decline of one quarter in the number of people with clean water. Why indeed were such across-the-board questions not raised? Could the answers lie in the intellectual inertia that bedevils much military thinking—the tramlines thinking that derives from the view that military imperatives simply outweigh all other considerations with no discussion needed? Does war constitute a super-priority that ranks in a class of its own? Has this outlook become so institutionalized that it is effectively set in concrete (O'Connell, 1995)?

War costs worldwide

What of war-induced costs worldwide? Despite the euphoric talk of wall-to-wall peace following the fall of the Berlin Wall, the world still spends $1.2 trillion per year (2007) on direct military activities, a total that is 45% higher in real terms than 1998,

though little more than at the 1987-88 peak of the Cold War (SIPRI, 2008). It averages at least $200 per global citizen, and in the United States, which outlays almost half of the global total, it is almost $1800 per citizen. Moreover the world's spending on instruments of death levies "opportunity costs" that have been opening up new battlefields of extreme poverty and deprivation. During the second half of the last century, at least 50 million lives were lost in war and other forms of violent conflict, by contrast with today, when at least 9 million die every year through malnutrition, including 6 million children (Bread for the World, 2007; Food and Agriculture Organization, 2005; White, 2005). Nor is it that we haven't had plenty of chance to ponder these stark statistics. Fifty years ago President Eisenhower warned us that far more is spent on weapons to destroy life than on health measures to preserve life. As he put it, "Weapons effectively kill people without firing a single shot."

Or consider that $1.2 trillion another way. It would be enough to fix Sustainable Development budgets for everybody several times over. Just one day of military spending at $3 billion would avert 2 million malaria deaths per year (Sachs, 2005). Has the time come when we should figure whether the U.S. government should spend $50 million on still one more fighter-bomber, as if one more on top of the 600 already in place would add to U.S. security? Or would the nation not earn more security—all round security, long lasting security—by investing the same $50 million in soil conservation, reforestation, water supplies, family planning, literacy campaigns, recycling, energy efficiency and the lengthy like?

The arms trade

A prime support of the war culture lies with the arms trade. In 2004 developed countries sold around $51 billion worth of arms around the world, two thirds of them to developing countries (Campaign Against the Arms Trade, 2003). The sum of $51 billion would be half as much again as would be needed to achieve a principal Millennium Development Goal, viz. basic health care to foster long life by contrast with life shortened. Today there are hundreds of millions of weapons for street sale in developing countries. A revolver costs as little as $25, while even a machine gun can be had for no more than $350. For a further grotesque twist to this tale, consider that most developed-country governments supply generous subsidies to arms exporters; in the author's home country, the United Kingdom, these have amounted to the equivalent of £435 million and possibly twice as much per year (Ingram and Isbister, 2005). Also significant is the fact that these U.K. subsidies divert investment funds away from more productive job-creating activities. Contrary to the promotional sales talk of the exporters, "It is highly unlikely that arms exports make a positive contribution to Britain's overall economic wellbeing" (Ingram and Isbister, 2005; Kaldor, 2003). In any case, a rational (basically

civilized?) world would surely ensure that arms exports are heavily taxed if not banned outright.

War might warrant a still more stringent comment when the widespread slaughter of non-combatants, notably children, is routinely described as "collateral damage." But it would surely be a more damning commentary on us all if we supinely respond that "War has always been with us and always will be", and "You can't make an omelette without breaking eggs." Has the time not arrived when there should be a top-to-bottom appraisal of war as the only recognized means of finally settling disputes, coupled with an equally rigorous assessment of potential alternatives? Of course the main problem is that we have not yet devised the institutional wherewithal to construct crucial alternatives in a form that will prove so successful in the real world that war will be declared obsolete. We have the United Nations and all kinds of other fora for adjudicating disputes, but thus far none commands enough support to bring an end to genocidal outbursts in Rwanda, D.R. Congo, Chechenya, East Timor, Dafur and Georgia.

And yet, and yet. Modern war has become so comprehensively destructive that we shall soon have no option but to find other ways of settling our differences, otherwise we shall face a future where survivors may mutter "There's a rumour going around that we won." In face of this prospect, the time could be arriving when young people of the world, being the ones who will have to wear the soldiers' uniforms of the future, assert that war is such an absurd way of sorting out problems that they simply refuse to do the generals' bidding. One factor that helped end the Vietnam war arose when American soldiers, appalled at what they were being ordered to do, started to disable their officers.

To urge that we consign war to history might suggest that we now live in a world where it is increasingly the same thing to be idealistic and realistic. But where is this reflected in similarly far-seeing institutions? Or is it the institution of the military establishment that perpetuates the notion that war remains a fitting activity for humankind at the present peak of civilization? There is a potent culture of warfare, as witness the glamorization of the military through e.g. "gun salutes" to mark a head of state's arrival, a royal person's birthday, or any of a dozen other celebrations where the spirit of the occasion is to be manifested with gunsmoke. We have even witnessed Princess Diana's coffin conveyed on, of all things, a gun carriage, surely the last thing she would have wanted associated with her funeral.

One day the human race will witness an end to war, just as it has outgrown human sacrifice and slavery. But that blessed day will not arrive until we devise an institutionalized escape from our inclination to practice "collective insanity."

9. TIME OF BREAKDOWN—OR BREAKTHROUGH?

"We seem to have expressly evolved institutional structures that prevent us confronting the fundamentals of planetary survival."

David Nicholson-Lord, 2005

There are stacks of books that document institutional snafus here and trip-ups there, but none that lists so many across-the-board instances of institutional deficiencies. What roadblock has stood in the way of a roadblock book? One obvious answer is that institutional shortcomings, prominent and potent as they are, have not been recognized as a proliferant problem, nor has it been shown that taken in aggregate these roadblocks can prove unduly expensive to our economies, to our political processes, to our futures. In this chapter, then, we shall look at a selection of exceptionally "off the wall" problems, before going on to a final chapter where we shall broach some solutions.

a. "Perverse" subsidies

As we have seen in Chapter 5, many subsidies encourage us to engage in counter-productive activities such as over-consumption. Such "perverse" subsidies end up undercutting our economies as well as degrading our environments on every side. Of $2 trillion a year worldwide, one quarter of which occur in the United States (Myers and Kent, 2001). Activities in several sectors inadvertently deplete biodiversity habitats through subsidies totalling at least $200 billion per year—a sum that contrasts with worldwide spending on conservation of biodiversity, $20 billion at most (McNeely, 2006; Myers, 2007). This is all the more regrettable in that biodiversity benefits, also known as ecosystem services, have long been worth more than $300 billion per year in the United States alone, and almost $3 trillion worldwide (Daily, 1997; Flack et al., 1997; Pimentel, 1997); some estimate 11 times as much (Costanza et al., 1997).

b. Lobbying

One might suppose that perverse subsidies would be eliminated forthwith because they are so harmful. Why, then, do they remain in place? Answer: it's in large part due to their support from lobbyists, huge hordes of them. Lobbying is a universal practice on the part of businesses, and okay, some of it is legitimate as straightforward public relations. But much of it is crassly false, directly distortive or outright untrue. "The longer a society enjoys political stability, the more likely it is to develop powerful

special-interest lobbies that in turn make it less efficient economically" (Peters, 2004 citing Olsen, 1982). Thus lobbying makes for a particularly potent IR.

What can be done to surmount the problem? It certainly packs political clout. In the U.S. total lobbying spending reached $2.8 billion in 2007—and lobbyists 16,000 (there are "only" 535 members of Congress) (Center for Responsive Politics, 2008; see also Beloe and Thorpe, 2005; Birnbaum, 2005; Nace, 2004; Nestle 2002). While not all lobbying is detrimental, perhaps half of it is, as witness the intensive lobbying that keeps alive the perverse subsidies totaling some $550 billion a year in the United States. Supporters of the subsidies depend on the institutionalized impact of special interest groups, which usually enjoy single-focus purpose, are highly organized, and are backed by hefty finance.

Unfortunately the American public seems little aware of the scale of political leverage available to expert lobbyists, and even were it to become better informed its political power would remain diffused among 200 million voters. Politicians are unlikely to restrict excessive lobbying unless there is powerful pressure to induce them to do so, the principal pressure coming from the public and hence the voters. There is scant scope for the public to mobilize that pressure as long as there is little institutional mode to aid them.

A prominent instance of destructive lobbying occurred with respect to one of the most fecund fisheries ever known, being the cod stocks in the Atlantic off New England and Newfoundland. There were so many cod in the sea that you could almost walk across the water. Scientists warned that unless over-fishing were reduced forthwith, the fishery would collapse. The fishing companies ignored the warning and engaged in decade-long lobbying of the governments to permit subsidized over-exploitation of the resource. In 1992 the fishery collapsed and fishing had to be closed for sheer lack of fish. Result, scores of fishing businesses went bankrupt and 42,000 unemployed fishermen had to be paid $4 billion in support measures (Harris, 1998). There has been a still worse result: after 15 years of no fishing the cod stocks remain at only 1% of their historic levels (Arms, 2004). Alas for the parlous state of that institution known as fisheries management.

Now that there is virtually wall-to-wall agreement on the causes and the likely courses of climate change, it is surely time to list those people—notably politicians and leaders of the energy industries (especially oil), boosted by armies of lobbyists—who totally rejected the concept as a mere fabrication on the part of incompetent scientists. How about an exercise of "naming and shaming" those individuals, as a means to combat future vested-interest behavior? A whole decade ago the prize-winning journalist Ross Gelbspan (1997) demonstrated how the coal and oil industries were recruiting dubious scientists to damage the credibility of climate experts, creating false science: "Profit-driven falsification of science constitutes a clear crime against humanity."

A prime candidate has been ExxonMobil. On the day in early February 2007 when the Intergovernmental Panel on Climate Change (IPCC) pronounced a more than 90% scientific consensus that climate change is due to human activity, it was revealed that an ExxonMobil-funded ideological body, the Washington DC-based American Enterprise Institute, offered scientists and economists $10,000 each for articles that spread doubt about the IPCC report. ExxonMobil could readily afford this gesture after it recorded 2006 net earnings of almost $40 billion (the corporation has actually backed off a little since early 2007) (Renner, 2007). Also in early February 2007 the White House declared that the US's emissions performance since 2000 was among the best in the world (1990-2006, US CO_2 emissions grew by almost 20%). During the period 1998-2005, ExxonMobil supplied $16 million to organizations which described global warming science as "dark-ages thinking" (Gleick, 2007; Maassarani and Dyckman, 2007; see also Flannery, 2005; Michaels, 2005; Union of Concerned Scientists, 2007; US Department of Energy, 2008).

c. The gun culture in the United States

Now to consider an extreme instance of lobbying of a different sort. That widely hailed institution called democracy works well by and large in countries with almost half of the world's population, yet in one of the leading exponents of this political system, being the United States, there is a notable failing with respect to the "gun culture." Four Americans out of five have long proclaimed through public opinion surveys that they want more stringent controls of guns, yet the main lobbyists, the National Rifle Association (NRA) with only one in 100 of all Americans as members, vigorously resists any such change. Meantime more Americans are killed by gunshot every year than in all other advanced countries combined, even though the United States makes up only one quarter of their aggregate populations (Cook and Ludwig, 2006; Goss, 2006; Hemenway, 2004). An average of 5500 handguns are sold every day in the United States, through 81,000 federally licensed dealers, three times the number of Macdonald's franchises (Wilson, 2007).

The United States' gun culture is an expensive business. The annual costs associated with firearm injuries, together with deaths, run to at least $125 billion per year, or well over $400 per citizen. Beyond these direct costs, gun violence diverts health, policing and social resources from other problems (Cook and Ludwig, 2006; Cukier and Sidel, 2006). Indeed these "opportunity costs" are likely to be much greater than the direct costs, conceivably on the way toward $1,000 per American per year. In response to the gun-culture stand-off, one must proffer the mantra that applies to most IR problems. Is the problem a case of ignorance about the issue (surely not, given all the protestations by both sides); a lack of citizen leadership (quite likely); or legislative

paralysis because of a particularly powerful lobby and no countervailing institutions (seemingly certain)?

In 2004 when Americans owned more than one third of the world's 640 million small arms (or one for every American adult), there were over 30,000 gun deaths in the United States, for an average of more than 80 per day. There were also 65,000 gun injuries, for an average of almost 180 per day (Goss, 2006; see also Cook and Ludwig, 2006; Hoyert et al., 2001). Every two years more Americans die through firearms than the total of American soldiers killed during the eight-year Vietnam War. At least two thirds of all firearm-related deaths are due to handguns, even though they account for only one third of all firearms in the United States—hence the fact that handguns are at the heart of the gun problem (Bell, 2003; Goss, 2006; Sugarmann, 2001).

Part of the argument presented by the pro-gun lobby is that it claims the Second Amendment of the Constitution guarantees the unregulated right to bear arms—though the Amendment refers to public militias rather than private guns. More importantly, the lobby protests that citizens need a gun to defend themselves; like free speech, they assert, the right to self-defence is a cornerstone of freedom (though so is the freedom to not get shot). They view the government as hopelessly incompetent at defending the citizenry (Kellermann et al., 1992). Almost half of all households own well over 200 million firearms, with handguns accounting for self defence as a prime justification (Bellesiles, 2000; Goss, 2006). A home with a gun is four times more likely to be involved in an accidental shooting, seven times more likely to be used to commit a criminal assault or homicide, and 11 times more likely to be used to attempt or commit suicide than to be used in self defence (Goss, 2006; Kellerman et al., 1992). A gun in the home triples the risk of the homicide of a household member. Among 26 advanced countries, 86% of gun deaths among children under age 15 have occurred in the United States (Hoyert et al., 2001).

During the period 2001/2005, at least 50 countries introduced stronger gun laws, but the United States blocked such efforts for its own citizens due to its vociferous gun lobby (the country even relaxed its gun controls during that period). The NRA ranks as arguably the most powerful lobby of any kind in the world, with three million members and an annual budget of around $100 million (Cukier and Sidel, 2006; Open Society Institute, 2000). The NRA's muscle stems from the fact that if a gun control bill comes up for consideration on Capitol Hill, the NRA can mobilize one quarter of a million letters of protest to Congress within a week, that being enough to block legislation.

Its lobbying strength apart, the NRA might gain more society-wide respect if it were to stick, as its name implies, to rifles for hunters. But it proclaims its support for all kinds of firearms, including machine guns, bazookas and assault weapons galore. It even resists measures such as sharper security checks at airports.

Conclusion: this surely represents a breakdown in the governance of a country that has often been portrayed as a leader among the world's democracies, and it must rank among the most prominent deficiencies in the institution of democracy. It has persisted for many decades, and there has scarcely been a start on a resolution of the problem. Conversely the problem could teach us something positive. The NRA comprises only three million Americans, whereas 10 times as many Americans are signed-up members of environmental bodies. If the latter could get themselves organized with the commitment and discipline of the NRA—what an institutionalized effort!—they could work wonders on Capitol Hill and right across the nation.

d. Bridges to nowhere

Now for a further instance of lobbying carried to absurd lengths. For years a ten-minute ferry has worked well to link Alaska's Gravina Island (population fewer than 50 people and 350 sitka black-tailed deer) with the bustling community of Ketchikan (population less than 8,000). Enter U.S. Representative Don Young, Chairman of the House Committee on Transportation and Infrastructure and Alaska's lone Congressional representative who wanted to replace the ferry with a bridge nearly as long as the Golden Gate and 26 meters higher than the Brooklyn Bridge. To that end he managed to gain a commitment of a federal check for $223 million (Clarren, 2006). A second proposal of Young's, the 8200 meter Knik Arm Bridge, a.k.a. "Don Young's Way", was to stretch from Anchorage, the State's largest city, to rural Knik (22 residents), at a cost of $231 million and a further $370 million to be collected by tolls. All this was proposed at a time when more than 150,000 bridges in the U.S., plus 12,000 kilometers of interstate highway and almost 45,000 kilometers of other roads, needed immediate repair (Jans, 2005).

Alaska is the nation's third least populated state but the fourth biggest recipient of transportation funds. Young's Transportation Equity Bill proposed spending $86 per American and at least $1500 on every Alaskan. The projects have been ridiculed by the media, and resisted by the unlikely coalition of the arch-conservative Cato Institute and the ultra-green Sierra Club. They have been awarded the Golden Fleece Prize from the citizens body Taxpayers for Common Sense. Further result: both projects have been put on the back burner.

This story reads like a refined version of those institutions known as porkbarrel-ism and bringing home the bacon.

e. Corruption

If lobbying sometimes becomes a cancer eating away at the body politic, how much worse is across-the-board corruption. At least $1 trillion is paid out each year in bribes around the world, plus a sizeable sum embezzled from public funds (Baker, 2005; Christian Aid, 2007; Transparency International, 2006 and 2008). Consider for illustrative instance that when President Mobutu of Zaire was obliged to leave office, his personal wealth of $5 billion was greater than the official economy of his country. African elites altogether hold $700-800 billion outside the continent, and another $150 billion leaves Africa each year in illicit capital flight, an amount greater than all foreign aid and debt relief (Africa All Party Parliamentary Group, 2006; Baker, 2005). No wonder there are reputed to be 100,000 African millionaires worth around $600 billion (Taylor, 2005).

Another form of corruption lies with governments' "tainted procurement", also fraud in the private sector. Corruption cuts tax revenues by at least half, thus reducing funds for schools, health centers and the like. So pervasive and profound are its impacts that were it to be controlled, plus good governance installed, there could often be a three- to four-fold increase in per-capita income and major reductions in welfare factors such as child mortality. Note too that drug counterfeiting can kill en masse. All in all, corruption can be reckoned to be the single biggest obstacle to global development (Transparency International, 2006; World Bank, 2006). Remember too that corruption is not just a matter for developing countries: think Enron, Conrad Black and Robert Maxwell.

Given the huge dividends available, plus the morality case for stamping out corruption, why don't we do a better job of it? Answer: because our institutional constraints are not constraining enough; very far from it. We need to tighten up with all the tough measures we can devise. Clearly our ultra-lax attitude toward corruption is a major blooper. And which of us has never offered or accepted a quiet backhander, maybe in kind rather than in a brown envelope—or a simple case of paying a plumber with cash?

f. Poverty

If corruption is a major cause of poverty, there are many other factors mixed in with what former Prime Minister Tony Blair has described as "the worst stain in humankind's history." Every fifth person in the world lives a life of absolute poverty: hungry, grossly short of water, no toilet, scant housing, no electricity, no health facilities, and so wretchedly on. It is summed up by an occasion when the two authors were teaching at the University of Cape Town, South Africa, and encountered one of the local gardeners wearing a specially long face. "Yesterday when I returned to the shantytown

where I live, I found someone had stolen my house." The cardboard walls, the plastic-sheet windows, the packing case door, the corrugated iron roof, all had gone—materials so light and flimsy they could be carted away in moments. The same for his bed and chair, cooking stove, eating utensils, the lot had disappeared. He was left with a small patch of bare ground.

Fortunately there is a better side to the picture. China's total of impoverished (<$1 a day) fell from 635 million people in 1981 to 128 million in 2004 (Chen and Ravallion, 2007; World Bank, 2007). This has been the greatest cut in poverty ever achieved in human history, and thus an advance to be acclaimed to the skies. At the same time, we must bear in sad mind that Sub-Saharan Africa with 810 million people in 2008 is sliding ever-deeper into poverty, highlighted by growing illiteracy, disease and hunger, a veritable vortex of degradation and despair. In 1981 the region featured 11% (168 million) of the world's absolute poor (<$1 a day), in 1990, 19% (240 million), and in 2004, 31% (298 million), with no improvement expected by 2015 (Chen and Ravallion, 2004; World Bank 2008). In August 2008 the World Bank released revised figures of 1.4 billion people in poverty worldwide, based on a new poverty line of <$1.25 per day (their earlier estimate was of 985 million on <$1 per day in 2004). The Bank also revised upwards the numbers of poor in 1981, from 1.5 billion on <$1 per day to 1.9 billion on <$1.25 per day! (Chen and Ravallion, 2008).

We must bear in mind, however, that poverty is not just about strictly economic factors. Moreover people in poverty generally do not have enough money to participate in the marketplace, hence they cannot register their "dollar votes" to denote this or that need, and their plight does not receive the attention it deserves. So let's take a look at the Human Development Index (HDI), which "provides a composite measure of three dimensions of human development: living a long and healthy life (measured by life expectancy), being educated (measured by adult literacy and enrolment at the primary, secondary and tertiary level) and having a decent standard of living (measured by purchasing power parity, PPP, income)" (UNDP, 2007). During the period 1990-2005, 14 countries with a combined population of 400 million people registered falling scores on the HDI. This development reversal is itself eminently reversible if only we would get on with the job). On the whole we know what to do and we possess the technologies to do it. We also know it won't break the bank; on the contrary, an anti-poverty campaign would supply more markets for America's exports; one U.S. job in three is linked to developing countries. In any case, the outright payments need not be large. If the 800 million rich world taxpayers were to pick up their traditional one third of the tab, it would work out per taxpayer at the equivalent of a beer every three weeks. Or, to put further perspective on the arithmetic, the rich world spends $18 billion a year on facial cosmetics, $15 billion on perfumes, and $14 billion on ocean cruises. This is not to suggest that rich-world women should abandon cosmetics, etc.—perish the thought. The

comparison is presented merely to point out the distinction between fundamentals and luxuries.

Reminder: the world has never faced extreme destitution on such a scale, nor has it ever possessed such total means to turn an appalling problem into a glorious opportunity. We are the first generation in history to face such a choice—or to grapple with such an outsize institutional lacuna. Warning: when we cast around for institutions to go into action, we might keep an eye open for stodgy bureaucracies. The U.N.'s Anti-Poverty Programme lists 54 goals with 449 proposals enshrined in a 3800-page plan. It is all so complicated that it leaves nobody accountable for anything.

g. AIDS

Now for another global problem that could be tackled much more vigorously if only we could mobilize the institutional measures needed. AIDS is surpassing the Black Death as the most devastating plague ever to afflict the human race. Worldwide there are 33 million people living with HIV, of whom 2.7 million were infected just last year (UNAIDS, 2008). Fully 2 million people die of AIDS each year, of whom 1.5 million are in Sub-Saharan Africa, a region that harbors one eighth of the world's population but two thirds of the world's HIV/AIDS cases. Funding required in 2007 to confront the disease amounted to over $18 billion, whereas the amount available was no better than $10 billion. While 3 million people in low and middle income countries received anti-retroviral therapy in 2007 (a 10-fold increase in just six years) this is only a small proportion of those in need (Mason, 2008; WHO/UNAIDS/UNICEF, 2007). According to the Executive Director of UNAIDS, Peter Piot, "The end of AIDS is nowhere in sight ... Every day almost three times as many people become newly infected with HIV as those who start taking antiretroviral therapy...We must categorically reject any attempt to so-called 'normalize' AIDS ... there is not too much money going to AIDS but too little." (Mason, 2008). Throughout the three decades since we first detected AIDS, we have witnessed self-delusion, dithering and failure at many a level. President Reagan did not pronounce the word "AIDS" in public until 1987, then the self-proclaimed judge Reverend Jerry Falwell stated that "AIDS is the wrath of a just God against homosexuals." It was this indifference and hostility that enabled the epidemic to spread so widely. Mis-governance has been worst in Sub-Saharan Africa, where, notably, South Africa's former President Thabo Mbeki, refused for years to countenance AIDS. Fortunately a few countries of the region, notably Kenya and Zimbabwe may have turned the corner, while President Bush increased U.S. funding somewhat. The funding shortfall to support a full-scale assault on the pandemic is no more than $8-10 billion per year, and even if rich countries were to cover half of the cost it would work out at very little per taxpayer per year. In the main, however, AIDS has been a story of neglect and rejection on the part of

governments, international agencies, development organizations and even some charities. There has been a superb opportunity for institutions of many a stripe to reach out caring hands, but in the main they have been notable for their response of "Call back next week."

h. Sub-Saharan Africa

The worst manifestation of poverty and AIDS is Sub-Saharan Africa. In 2004 the Africa Commission declared that the region is "a scar on the conscience of mankind." The region's prospects are bleaker today than ever before. Already the world's poorest region, it is falling further and further behind: the number of people suffering absolute poverty (<$1 a day) has increased by more than 60 million since 1990 (Stiglitz, 2006; World Bank, 2008). The latest World Bank projections (Chen and Ravallion, 2008) indicate there were 390 million people living on <$1.25 per day in 2005. Sub-Saharan Africa's collective economies are $850 billion, or just 1.6% of global GDP and less than Mexico's (World Bank, 2008). The region's share of world trade has declined from, 3.7% in 1980 to 1.8% in 2007, while its share of global investment is less than 1% (UNCTAD, 2008). As we have seen above, AIDS has inflicted a terrible additional burden. In one of the hardest hit countries, South Africa, the disease is expected to slash the economy during 2000-2010 by $22 billion (Bureau for Economic Research, University of Stellenbosch, 2006; Meredith, 2005; UNAIDS, 2006).

This is far and away the most disadvantaged of the three main developing regions. The population has expanded until it far exceeds carrying capacity, but its growth rate of 2.5% remains the highest in the world. The region suffers more from pandemic diseases than any other region. As a result of these and other problems, and despite major food imports, more than one third of people are malnourished and a large proportion endure outright hunger, even semi-starvation (Food and Agriculture Organization, 2006; see also Myers and Kent, 2001).

Much of the problem stems from the institutional context, especially as concerns trade. In 2005 Ghana imported 50,000 tonnes of chicken, mostly from the European Union with its heavily subsidized farmers. The imported chicken was available in Ghana's wholesale markets for half the wholesale price of locally grown chicken (Atarah, 2005). Much the same applies elsewhere in West Africa. As much as 80% of poultry in Cameroon comes from Belgium and Spain, and 60% in Senegal—leaving 40% of Senegal's poultry farmers forced out of business (Global Call to Action Against Poverty, 2005).

Fortunately there are some bits of better news. The World Bank's "doing business" report (2006) shows that some African countries, notably Tanzania and Nigeria, are among the world's leaders in reforming their economies. And thanks to better governance (always a vital institution), economies have been booming in

countries as diverse as Botswana, Mozambique and Rwanda. Further result, the region is enjoying an overall economic growth rate of 5-6%, or twice that of the United States (International Monetary Fund, 2008; Kristof, 2006).

It seems, then, that we know what to do to save Sub-Saharan Africa from its travails. Thus a key question arises (yes, the same one again): why don't we get on and generate shifts in the institutional architecture, and do it with all due despatch given what is at stake? Not only patterns of distorted trade but of shrinking aid and inequitable investment flows serve to build barriers of institutional indifference around the region (Myers and Kent, 2001). Could it be that the root cause of the region's problems simply lies with "institutionalized despair", a process that feeds on itself? If that could be made to give way to a spiral of hope (by our working on the sources of problems rather than the symptoms), that too could prove to be a self-reinforcing process.

All depends on whether the governments and agencies concerned will actually be concerned. Will they supply the one resource that has been so frequently missing in the past: institutionalized commitment?

i. Environmental refugees

Within the coming few decades, Sub-Saharan Africa is likely to feature tens of millions of "environmental refugees." In the early 1980s and witnessing sizeable numbers of impoverished people engaged in involuntary migration for basically environmental reasons, and primarily in Sub-Saharan Africa, we began to collect research materials on what we regarded as an emergent phenomenon of global import, viz. environmental refugees. These were people who felt they had been driven from their homelands by factors such as desertification, fuelwood shortages, water deficits and widespread pollution, plus associated factors such as population pressures and extreme poverty. They headed for the horizon despite the hazards entailed, and with no prospect of return. In 1995 this book's authors published "Environmental Exodus: An Emergent Crisis in the Global Arena" (Myers and Kent, 1995), where we estimated their numbers at a minimum of 25 million worldwide. This total was not only unexpectedly large but it was growing rapidly given that there were hundreds of millions of marginal people in marginal environments and subsisting on the very brink of survival.

This was not just a new phenomenon but a pre-eminent one insofar as the total exceeded all traditional refugees (those fleeing religious persecution, political oppression or ethnic turmoil). We estimated that in a globally warmed world the environmental refugee total could swell by 200 million (Myers, 2001), proposing that sea-level rise, hurricanes, tidal waves and storm surges could displace huge numbers of people at risk in coastal zones. In the year 2000 low-elevation coastal zones (less than

10 meters above sea level) in China featured 144 million people, India and Bangladesh both 63 million, Vietnam 43 million, and Indonesia 42 million; the next five, being Japan, Egypt, USA, Thailand and Philippines, featured 108 million, for a total of the top 10 countries of 463 million (McGranahan et al, 2007). Others totalled 171 million, hence an overall total of 634 million, or almost one tenth of the world's population. We can also reckon that two thirds of the world's cities with more than five million people are located at least partially in these low-lying areas—and more people are increasingly moving into cities (Gore, 2006; McGranahan et al., 2007). In addition there could readily be another 50 million people, conceivably twice as many, in drought-ridden sectors of Sub-Saharan Africa.

A number of subsequent investigations by other scientists have come up with similar findings, and they have all urged the same response: such a huge number of these refugees should be accorded succor by the international community (e.g., Conisbee and Simms, 2003). Yet the relevant agencies such as the United Nations High Commissioner for Refugees are reluctant to recognize this new category of refugees, who, according to the UNHCR, should be named "displaced persons" or "destitute migrants", or loaded with some other bureaucratic label, even though they deserved the designation "refugees" since they are simply driven to seek refuge. The agencies insist they want to stick with their traditional definition, devised in the early years of the United Nations 60 years ago. We have pointed out that the world has moved on, and that the institutional definition should move on too. No good: the agencies plead that they have their hands full with traditional refugees and their budgets already stretched to the limits.

That remains the situation today. It's a clear case of institutional paralysis, even though in the face of growing multitudes enduring ultimate despair.

j. New consumers

Next, a phenomenon quite the opposite of impoverished refugees but equally in need of institutional intervention. It comprises the 1.4 billion "new consumers" in 20 developing and transition countries (Myers and Kent, 2004), being people who have lifted themselves out of the poverty that has blighted billions of people in the developing world for decades. Most of these new consumers have achieved their affluence in just the past quarter century, many since 1990—an astonishing advance that surely ranks as one of the great events in the world's economics since humans first began to operate economies. In the year 2000 their spending power (as measured in terms of Purchasing Power Parity) more than matched that of the United States, and it may double by 2010. Today these newly middle-class people amount to a large proportion of the 5.5 billion

people in the developing world—meaning that the term "developing world" has long become a highly misleading label.

However, their new found affluence entrains certain environmental and hence economic costs. The new consumers already possess 150 million cars, a total that may well increase markedly by the year 2020, when China alone will likely have 140 million cars—almost as many as the United States today. The most damaging pollutant from the world's cars in the long run is carbon dioxide (CO_2), a gas responsible for more than half of climate change. To this extent, the entire world community has an interest in the prospect of all those cars in new consumer countries—just as the new consumer countries have an interest in the far larger numbers of cars in the so-called developed countries.

A basic question arises. Plainly these new consumers have become a prominent phenomenon, with repercussions for both the global economy and the global environment—indeed they are causing a shift in the world's geopolitical center of gravity. What institutional roadblock has deterred economists from tackling what is surely one of the most salient issues of their field?

k. Over-consumption

The new consumers are displaying a strongly carnivorous appetite, enjoying meat once a day at least rather than the erstwhile once a week at most. Much of the meat is grown in feedlots and raised on grain, which has prompted a steep increase in their countries' imports of grain. In China with its 400 million new consumers, one quarter of all grain is fed to livestock, even though the country features well over 100 million malnourished people. Similar mismatches apply to many of the 20 new consumer countries with their half billion hungry people (Food and Agriculture Organization, 2006; Myers and Kent, 2004). In some countries there are early signs of an obesity epidemic, reflecting fatty fast foods. McDonald's already has 900 outlets in China and has been adding another 100 every year.

Worldwide at least 1.8 billion adults are overweight, and one fifth of them are clinically obese. Indeed the world now features twice as many overweight people as underweight people, the latter totalling "only" 925 million. Two thirds of American adults are overweight and nearly one third are outright obese. The health costs of Americans' obesity run to almost $150 billion per year, whereas the fast-food industry, based strongly on fatty foods, posts sales of $110 billion per year (Lobstein, 2003; see also Center for Disease Control and Prevention, 2003; Finkelstein et al., 2003; Nutrition Online Media Kit, 2006; Ulrich, 2005).

Thus the arrival of the over-consuming society. We should surely aim to move on from "More is better" to "Enough is best." Public opinion surveys confirm that many

people no longer feel that greater income must necessarily lead to greater wellbeing, let alone lifestyle satisfaction. If advanced economies grow at an average annual rate of 2.5%, then during this century a citizen could expect to be enjoying an annual income roughly 12 times greater than today. What would he or she spend it on—12 houses, cars, vacations? Yet governments, the media, advertising, the whole business sector urge us to keep consuming more as an answer to all our problems (President Bush after 9/11: "Go out and buy something"). Our most prominent institutions are all urging us to over-do things at every turn. Needed: a massive institutional effort to help us toward a sustainable future.

l. Cancer research

For another instance of grossly inadequate spending on behalf of the public good—i.e., an institutional lacuna of the first order—consider funding for cancer research. In the author's home country, Britain, the disease catches up with every third citizen. For the majority of sufferers, lives are shortened, a factor that is specially significant in economic terms for those whose working lives are thus curtailed. The costs of human suffering, bereavement and general distress may well be larger, indeed far larger, but it is not possible to measure them economically (American Cancer Society, 2006; Brown et al., 2001; U.S. National Institute of Health, 2004).

There are three sets of readily quantifiable costs: morbidity costs due to lowered worker productivity, mortality costs due to lost productivity following premature death, and medical treatments of the disease. These three factors levy annual costs on the U.S. economy of around $200 billion, a sum large enough to suggest that cancer is worthy of as much research as is needed to point the best medical way ahead and the most cost-effective way ahead (Lasker Charitable Trust, 2000; U.S. Department of Health and Human Services, 2007).

Research that would reduce cancer deaths by just one fifth would be worth almost $10 trillion to Americans in terms of increased longevity (cf. the national economy in 2007, almost $14 trillion), while a modest 1% reduction would be worth $500 billion (Murphy and Topel, 2005). Yet less than a nickel of every health care dollar is spent on medical and health research of all kinds, and cancer research attracts far short of what it will take to make a solid dent in the problem (Lasker Foundation, 2007; National Cancer Institute, 2007).

Just medical treatment costs around $60 billion per year, or 12 times the $5 billion research spending by the National Cancer Institute (National Cancer Institute, 2007). This raises a key question. Is $5 billion a sufficient sum to tackle research on a prominent factor in the U.S. economy (remember that morbidity and mortality costs would greatly add to the $60 billion)? In the United Kingdom around half of the $1 billion of research spending is supplied by charities. Should such a large share, and

slightly more than the government contributes, be left to charities? The government tends to argue that since charities pick up a large part of the bill, there is no need to spend more of taxpayers' money on government support. But then: the U.K. does not depend on charities to help tackle other national imperatives such as running the police or building freeways.

In sum, cancer research is a case of extreme institutional mis-match. Cancer sufferers grow in numbers, economic costs keep climbing, the medical profession does not protest enough to persuade the holders of government purse strings to relax their grip, and the public says next to nothing about the issue. The public probably isn't aware of the details, it merely senses that cancer remains one of the most widespread and feared of all diseases, and that everybody is supposedly doing everything they can to beat it. Harken to Mary Lasker of the Lasker Charitable Trust (2000): "If you think research is expensive, try disease."

m. Preventive versus curative medicine

More on the most cost-efficient way to support our health needs. Modern medicine is not just about curing patients of disease. It is about preventing them getting sick in the first place. Crucial as this sounds, it is not recognized nearly so widely as one might suppose. In the authors' own country Britain, the National Health Service behaves as if it is primarily a National Disease Service, i.e., it spends much more time and money on curing people of disease than on stopping them contracting problems. It reminds one of the authors, Myers, of the time when he visited the University of Kentucky at a stage when much of the state's economy relied on tobacco. He saw a campus department designated Tobacco and Health, whereas it would have been more apposite to be called Tobacco and Disease (Graham et al., 1998; Gingrich et al., 2003; Tengs et al., 1995).

There are many examples of how it is better to move beyond treating a disease to eliminating the disease in the first place, i.e., so that it cannot infect any more people. During the 20th century 300 million people died from smallpox, but in 1978 the disease was finally snuffed out. Since that time the savings have amounted to more than $1 billion per year, or three times as much as the cost of the entire campaign to eliminate the disease. Malaria killed one million people in 2006, mostly children and predominately in Africa (the disease costs African economies at least $12 billion a year). There is a grandscale campaign underway to halve malaria's death rate by 2010, partly through new and more effective drugs but also through the simple measure of a ten-fold increase in protective bed nets (Global Fund to Fight AIDS, Tuberculosis and Malaria, 2007; Sachs, 2005).

Measles, one of the world's most infectious diseases, could also be eliminated. In 1999 the United Nations launched a vaccination drive to cut the measles death rate by

90% by 2010; Africa has already achieved 75% (IMF and World Bank, 2007). In 2003 it looked as though polio would become the second disease to be finally knocked out after it had been cornered in just six countries. When the eradication program began in 1988, the disease was endemic in 125 countries and paralysing 350,000 people annually; by 2006 it was down to 2000 new cases. Regrettably eight countries have recently become re-infected (Global Polio Eradication Initiative, 2007).

There are many other instances of "non-medicalized" initiatives that would prove highly cost effective, notably vaccination and immunization programs, plus efforts to cut smoking, road accidents, obesity and gunshot wounding. In many of these areas the cost-benefit ratio can be at least 3:1, and even higher for e.g., cardiovascular disease and diabetes (Graham et al., 1998; Tengs et al., 1995; UNICEF, 2007). The overall figures are still more spectacular: with an annual investment of $66 billion we could save 8 million lives a year and generate economic benefits worth $360 billion a year (Sachs, 2005; World Health Organization, 2007).

By citing cost as a reason for not supplying funds to promote preventive measures, governments are effectively saying a human life is worth only a handful of dollars. The institution of medicine could well check its mode for determining priorities.

n. Population: deep denial

Now for another institutional perversity. Ask anyone about the world's foremost environmental problems, and they will probably cite climate change, tropical deforestation, widespread pollution, energy shortages, water deficits, and so on. They are little likely to utter a word about population. The issue seems to have slipped off everyone's radar screen, especially politicians': which election campaign has offered a word about it? Yet the U.S. population, for instance, is now rising faster than at any time since the baby-boom years of the mid-20th century. Each year the United States grows by just over 3 million people (including immigration). Meantime the country's land mass is getting no bigger. No wonder that three out of four Americans believe their country is already over-crowded.

Population has become the Great Unmentionable, even though population growth is implicated, whether directly or indirectly, in virtually all our problems. Recall the equation that Professors Paul Ehrlich and John Holdren devised more than 30 years ago, to demonstrate the factors associated with population: I = P x A x T. Translation: Impact is a function of Population multiplied by Affluence multiplied by Technology of harmful sort (Ehrlich and Holdren, 1971). Of the three right-hand factors, the A and T factors are much harder to change than population. We know virtually all we need to do, viz. promote family planning and foster women's roles. We know family planning costs trifling amounts compared with the outsize benefits. We have stacks of success stories to

hearten us on our way (e.g., Bangladesh, Egypt and Thailand, have found that the benefits of preventing one unwanted birth exceed the costs in social services 10-16 times over (Speidel et al., 2007)). In certain Latin American countries, every $1 spent on contraception saves up to $12 in health and education services alone (Guttmacher Institute, 2007). Regrettably we encounter a lengthy list of roadblocks: ignorance about the issue; sheer prejudice; resistance to anything to do with that inadmissible word, sex; and even subsidies for families beyond two children.

Perhaps worst of all, certain developed-world governments argue that we need more people, not fewer in order to generate more workers and to pay for our pensions. Yet all new additions to the population eventually grow old and become part of the dependency problem they were meant to solve—in fact they worsen it. Before they grow old, moreover, all additional persons impose society-wide burdens through their consumption activities (pollution, over-use of scarce resources, etc.). Yet in the authors' country, Britain—as in other so-called advanced countries—a third child is heavily subsidized through family allowances and the like (see Chapter 5), even though that third child with present-day consumption patterns will generate as many carbon emissions as if taking 600 return flights London/New York per year (Optimum Population Trust, 2007). Meanwhile we need to recognise that of 190 million conceptions worldwide each year, at least 50 million end in abortions.

Fortunately there is a potentially upbeat side to population. No fewer than 140 million couples in developing countries lack the contraceptive means to put their family-planning wishes into action (another 64 million lack modern methods of contraception). If we were to meet these "unmet needs", we would reduce the ultimate global total by well over one billion people (U.N. Population Fund, 2004). It costs an average of only $20 to meet these needs for one couple for one year, so we are talking about $2.8 billion in all. This sum is equivalent to well under one day's military spending worldwide, and we might well ask which outlay would purchase the greater security (Guttmacher Institute, 2007; Myers and Kent, 2005). Yet we are doing all too little to reduce these needs because governments tell us it would be too expensive, even though for a rich-world taxpayer it would work out to no more than $3.5 a year, or enough for one hamburger supper. Is this not another instance where public opinion is way ahead of what our political leaders supply us, hence our institutions lag behind what is both desirable and feasible? Truly has it been said (Cohen, 2005), "In the population arena we need to create a bigger pie, with fewer forks and better manners."

Finally, let us remember that lack of contraception is not confined to developing countries. Of the six million pregnancies of American women each year, almost three million are unintended; result, 1.4 million unplanned births and 1.3 million abortions (Guttmacher Institute, 2007; Speidel et al., 2007). How long until the United States can call itself a truly developed country?

o. Missing females

Finally, one of the worst institutional oversights of all. Three countries with outsize populations, China, India and Pakistan (joint populations in 2008, 2.6 billion), share a powerful preference for male children. There is a similar situation in a few other countries, notably Afghanistan, Nepal, Bangladesh and Taiwan, plus certain sectors of North Africa (Collins, 2002). In all these countries, female offspring are "losers." They are deemed unable to go out and earn a sizeable living and thus build up the financial means to support elderly parents. They do not have the physical strength to help on the farm. And their parents must hand over a large dowry when daughters get married. In earlier times a female baby would often not be fed enough to stay alive or to ward off diseases; or she would end up in the local stream. Today's parents have access to ultrasound machines, albeit illegal in certain respects but widely used nonetheless, that discern the gender of a foetus at a mere three months old, whereupon a female foetus is often aborted. Result, the last four decades or so have witnessed the "disappearance" of at least 100 million females in the three main countries cited, with still more in other countries of Eastern and Southern Asia and in North Africa (Hesketh and Xing, 2006; Hudson and Den Boer, 2004; Klasen and Wink, 2002; Sen, 2003). As a result, in China there are now only 86 girls born per 100 boys and in India, 93. These skewed sex ratios are "on a scale unprecedented in human history" (Collins, 2002). In Europe and North America the normal ratio is 95 girls born per 100 boys (Collins, 2002; Klasen and Wink 2002; Sen, 2003).

Within 15 years China will be short of 30 million women, meaning that every tenth man aged between 20 and 45 (equivalent to the population of, say, Canada) will be unable to find a wife. This gender imbalance will not only threaten the make-up of the workforce, but, more seriously, it will undermine social stability. Already there has been an outburst of kidnapping of baby girls as families seek future brides for their sons (Klasen and Wink 2002; Sen, 2003). The ruling Communist Party views these problems as some of the greatest threats to its authoritarian grip on power (Collins, 2002; Hudson and Den Boer, 2004; Klasen and Wink 2002; Sen, 2003).

China's surplus males are becoming known as "bare sticks" since they will never marry and bear fruit because no marriage partner will be found for them (Collins, 2002). These bare sticks often come from the lowest socioeconomic class, are un- or under-employed, live a nomadic lifestyle with few ties to the communities in which they are working, and generally living and socializing with other bare sticks. Their behavior causes the overwhelming proportion of violent crime. One survey shows that "an unmarried man between 24 and 35 is about three times as likely to murder another male as is a married man of the same age. He is also more likely to rob, rape, and, yes, join others in proving his manliness." They also appear to play a prime role in the spread of AIDS (Collins, 2002).

The world is outraged, and with utmost justification, at the Holocaust, likewise the mass slaughters (though hardly on the same scale) in the Russian gulags, Cambodia, Rwanda, Kosovo and Darfur among several other episodes that testify to humankind's proclivity for grandscale massacre of innocents. Yet all of them put together would not match—in terms of sheer numbers anyway—the elimination of females in a few countries of Asia. This has been known in dreadful detail since the Nobel Prize winner Amartya Sen published his first article on it way back in 1992. In the main, however, it remains a sleeper issue of the first order, as if subject to a conspiracy of silence by governments, international agencies, humanitarian bodies, charities and all the other institutions that should be mounting a global hue and cry until the practice is confronted head on in the most public of public arenas. What is amiss, that the world and its institutions look so intently the other way?

To round off this chapter with its 15 case studies in very diverse sectors: institutional roadblocks are proliferant in many walks of life, deeply affecting our lifestyles and severely restricting our aspirations. What can be done about it all? Why isn't it being done already? What can we reasonably expect for the future given that our societies don't yet work nearly so well as they might? In fact there is a widening gap between what is and what could be. In the next and final chapter, we shall look at some institutional options for closing the gap.

10. WHERE DO WE GO FROM HERE?

"Never doubt that a small group of thoughtful committed citizens can change the world. Indeed it is the only thing that ever has."

Margaret Mead

To reiterate this book's message: at the heart of many of our problems lies the question of institutional failure. It has caused us a lot of trouble in the past, and it looks set to cause us a good deal more trouble in the future. In a world that is changing faster than ever, our institutions show scant sign of keeping up, as witness the years-long delay in getting to grips with the ultimate problem of climate change. Worse, we seem little aware of the need for much speeding up on the part of our institutions, even though we are going to have to make them undergo accelerating change to unprecedented extent. We tend to take steps into our future at a leisurely pace (Freidman, 2005; see also Burke and Mabey, 2006; Ehrlich and Ehrlich, 2004). This is because the future will be far from a simple extension of the past. We shall need to change gear time and time again as we head into a world that will surely prove more divergent from past experience than virtually anything we can envisage. Trends are underway that will transform all the hallmarks of our world—our governments, our economies, our careers, our ambitions, our hopes, our ideals, our beliefs.

One-world living: so far, not so good

Thus far we aren't doing very well, especially as concerns that predominant phenomenon of our time, globalization and its many institutions. True, globalization has enabled China and India to use their hundreds of millions of educated people to take advantage of globalised markets, and they have thus managed to go far to closing the gap between themselves and the advanced nations. But in the opinion of Dr. Joseph Stiglitz, former Vice President of the World Bank (2006), "The rest of the world exhibits a growing gulf between the richest and the poorest countries, plus growing inequalities within most countries. Globalization has actually made poor countries poorer still, notably through adverse trade practices."

Like many other processes, globalization certainly needs more and better institutions. In the view of Dr. Klaus Schwab (2006), founder of the World Economic Forum and hence a globalization guru, our present institutions are "on the brink of marginalization" even as global challenges grow more numerous. We have not made much progress to eliminate economic imbalances North/South, to narrow the digital divide, to address the global health crisis, to eliminate water shortages, to end hunger, to create jobs, to combat terrorism, or—most of all—to tackle climate change. In these and

many other ways, our global governance systems "lack the capacity to develop strategic responses to the challenges of a fast-changing world. ... We have to create purpose-oriented global networks to address the manifold challenges in a pragmatic way" (Schwab, 2006).

This is not to ignore our many success stories. Without them we would be in far worse shape. But: is the remedy a simple case of "The same as before, only more so", or do we need to consider altogether new strategies as well? The authors propose that we should engage in an emphatic expansion of our policy purview. Could it be that most of our best efforts are merely reactive in nature, and hence we should do more to get ahead of the game—to tackle problems before they become problems? We have become competent at tackling certain problems when once they have arisen; how about gaining a stranglehold on problems while they are still in their cradle?

Similarly and as concerns our existing institutions: why do we allow so many of them to fall into such disarray? Why do we not take up arms to fix them? Why don't we even give much attention to their deficiencies? One answer is that the very concept of institutions is hardly one to set the pulse racing, whereupon the prospect of working on them is a huge turn-off. Institutions simply do not grab the headlines. Television features programs on energy, food, cars, housing, health, children, cookery, climate and dozens of other topics, but when did we last see a program on institutions, even though they are at the heart of the dozens of issues dealt with in this book? As we have seen, good institutions are the stuff of the good life, whereas bad institutions leave us with lives that are far less fulfilling than they readily could be. Truly, Institutional Roadblocks (IRs) can drive us over the edge with lemming-like abandon.

To give us an insight into what we need to do to phase out bad institutions and devise new ones, this final chapter presents several instances of solutions that point us in directions worth exploring. Necessarily selective though they are, they serve to illustrate the themes in question. They are grouped here under three headings, viz. the role of the individual, the role of public opinion and the role of governance.

I. ROLE OF THE INDIVIDUAL

As mentioned in the Introduction, institutions reflect the collective needs of individual persons. Institutions made up of just a few like-minded individuals can shape the behavior of far larger groups of citizens. To cite Edward Burke: "Nobody ever made a greater mistake than he who did nothing because he could only do a little." And reader, if

you are still sceptical about how much of a difference can be made by an individual, you've never been in bed with a mosquito.

Purchasing power

Ah, the individual gesture—like changing all your light bulbs from incandescents to compact fluorescents. The old-style bulbs are so wasteful that they lose 95% of their energy in the form of heat and Australia has decided that they are to be phased out by law by 2010; other countries are now following suit. The European Union has called for energy-efficient modes of office and street lighting to be adopted by 2008 and in private homes by 2009. Within eight years the switch to fluorescents could save European consumers as much as $8 billion (Spongenberg, 2007). If everybody in the world took this energy- and money-saving step ($50 per bulb's lifetime), the global slashing of electricity would allow the closing of 270 coal-fired power plants (in the U.S., possibly as many 80 plants closed, out of 627). During the first four months of 2007, Americans bought 37 million fluorescents, worth a cut in carbon emissions equivalent to taking 260,000 cars off the road (Brown, 2007).

There are many other ways for the individual to save energy. If every California household were to replace one average-flow showerhead with an energy-efficient showerhead, that would equate to closing 15 coal-burning power plants; and if every household installed a solar-power water heater, that could shut down another 67 plants. If the California State Government paid for the light bulbs, showerheads and solar water heaters, that would cost much less than building just one new power station (Lovins, 2005; Martin, 2006; Schaeffer, 2007).

Of course, major institutional problems usually arise at governmental level rather than citizen level. Among notable instances are the distortive metric of Gross National Product, mis-targeted tax systems, and perverse subsidies (see Chapter 5). Response: we, meaning multitudes of individual voters, need to elect better people to run our governments. But that's a big turn-off insofar as national elections come around only rarely. Take heart, however: we can use our "dollar votes" by purchasing products from the good guys and boycotting the bad guys—and voting that way a dozen times a day.

Consider, for example, the emergent idea of Fair Trade products, i.e., products made available in ways that offer reasonable prices with all externalities (whether environmental or social) accounted for. The Fair Trade logo also requires that companies agree to pay decent wages and to invest in local communities. The list of Fair Trade items has ballooned from 150 in 2003 to more than 1,500 today, and while they still comprise only a tiny part of the market overall, they make a genuine difference to farmers in the developing world. The range of products affected includes coffee, tea,

chocolate, cocoa, sugar, bananas, nuts, oils, herbs, spices, rice, beer, wine, cotton goods and sports equipment. It all makes for an admirable institutional advance.

Note too a consumer opinion shift in Britain, manifested by the clothing and food giant Marks and Spencer (300-plus stores in Britain, others in 30 countries worldwide, annual group turnover $16 billion). Surveys indicate that well over three quarters of customers are interested in ethical factors behind their purchases, such as conditions in textile factories and use of chemicals in manufacture. Over half of customers say they are much more concerned now by issues of ethical sourcing than they were five years ago, and nine out of 10 believe retailers have a responsibility to ensure that what they sell has been manufactured in an acceptable way. In response to this pressure by millions of individuals, Marks and Spencer now plans that by 2012 it will be making the bulk of its polyester clothing from recycled plastic bottles instead of oil, it will be making its plastic carrier bags from recycled plastic, it will be clearly labelling all its food imported by air, it will be sending no more garbage to landfills, it will be promoting sustainable sourcing throughout its operations, and all its operations will be carbon neutral (the last being equivalent to taking 100,000 cars off the road (Harrison, 2007).

In many instances where the individual wants to "do something", however, he finds himself thwarted by institutions such as the pricing mechanism. Pricing roadblocks occur with respect to "food miles", viz. the distance that certain products travel between initial producer and final consumer. In the frequent cases of international transportation (strawberries, yoghurts, cut flowers, etc.—see Chapter 3 on Linkages), these food miles can total many thousands, thanks to heavily subsidized aviation fuel with its carbon emissions. Total transportation of food for British markets costs more than $17 billion a year in economic, environmental and social terms (Pretty et al., 2005; Transport 2000, 2007). The better news is that Tesco, one of the world's largest supermarket chains, plans to introduce food miles labels on 70,000 of its products, showing the total "carbon footprint" caused by transportation and production (Pretty et al., 2005; Transport 2000, 2007).

Charity

For the individual there is also the role of charity. This covers not only tsunami-style efforts but the unprecedented success of Live8 and charity wristbands of many a colour, plus the popularity of gifts such as Goats for Africa. In the United States there are now more than one million charitable bodies, twice as many as in the year 2000; and they employ well over 10 million people or 7% of the country's workforce. Thanks to tax-deductible allowances, philanthropy among other forms of charity constitutes a powerful force in the U.S. economy. Americans donate over $300 billion each year, for an average of $1,000 per citizen (Brooks, 2007; Clinton, 2007). In 2006 they set a record for

largesse, giving away the equivalent of Greece's entire GNP in personal donations. They handed over 2.0% of their country's economy (Giving USA Foundation, 2007), whereas Britons managed only 0.73% (Charities Aid Foundation, 2007; Giving USA Foundation, 2007). British people give more to animal charities than to charities for the disabled; donkey sanctuaries having a higher income than all the main charities fighting abuse against women. In the United States animal charities are receiving from Leona Helmsley a bequest of up to $8 billion.

In 2006 America's 60 top philanthropists donated $51 billion out of their combined net worth of $630 billion, i.e., 8%, led by Warren Buffet who pledged $30 billion over 20 years. The latter compares with the generosity of the industrialist Andrew Carnegie, who in his day gave away 78% of his net worth, saying "The man who dies rich dies disgraced." Worldwide there are almost 10 million people who qualify as millionaires, and in 2006 their total worth was $37 trillion, but their charitable giving amounted to only $258 billion or 0.7% (Clinton, 2007; Easterbrook, 2007; Merrill Lynch and Capgemini, 2007).

There is much scope for institutional interventions to enable the charity sector to play a still more expansive role in society. We should bear in mind, of course, that, the tax deductible system in the United States (that splendidly creative institution) encourages more generous giving than is the case with the majority of rich nations which enjoy far less of a fiscal dispensation.

At the same time, while urging that charity can serve as a corrective on the overall economy, let us beware the problem of "charity fatigue." People may feel that after they have been giving enough to worthy causes, along comes another appeal for help with an earthquake or some other disaster. In addition people tend to be swayed by the prospect that their actions will have a positive effect. They are more likely to donate towards a relief project that will save 80% of 100 lives at risk, than to another project that would save 20% of 1,000 lives, even though the second would enable 120 more people to be saved. Then there is the question of unimaginable scale, e.g., feeding millions of starvelings in distant lands who will otherwise be doomed to die. Projected deaths of such sheer size induce an "empathy numbing" effect that can neutralise compassion and other forms of fellow feeling (Gardner, 2004; Slovic, 2007; Vaux, 2002). Yet why do we turn away from the opportunity to save lives in their millions at trifling cost? Shouldn't we be jumping at a superlative opportunity that has not been remotely available to any other human generation in the past? Could it be that we need an institutionalized mechanism to articulate our common impulse to reach out to the many unfortunates who share the one world with us?

II. ROLE OF PUBLIC OPINION

Many of the institutional changes urged in this book are unlikely to be achieved without the support of public opinion. Some people say that to mobilize public opinion is tremendously difficult, others say it can be simple when you know how. Thus much boils down to the question of how to bestir public opinion. Central to this issue, of course, is the institution of democracy. Many if not most of us used to take democracy for granted, and we would urge that public debate will surely save us from system breakdown; let free discourse by all citizens, so it is said, get to grips with whatever problem, and that problem won't stand a chance. Until very recently the country that has long been hailed as the most democratic of all, the United States, has seemed on its way to becoming a plutocracy (government by the ultra-rich), a corporate kleptocracy (government by business stealth), or a theocracy (government by divine sanction) (Gore, 2007; O'Leary, 2006). Fortunately, and following the elections of November 2008, that situation seems to have changed powerfully.

Leadership

In all of the above, a catalyzing factor often lies with individual leadership. This can be the most vital resource of all, as well as the resource in shortest supply (Levesque and McNeil, 2003; Maccoby, 2003; Rosenbach and Taylor, 2006), and certainly there is much need as well as much potential for leadership in the area of institutional initiative. Think of what has been achieved by Franklin Roosevelt, Winston Churchill, Martin Luther King, Bob Geldof, and (yes, why not?) Oprah Winfrey. Oprah's TV show has 8.4 million viewers daily, making it the highest-rated talk show ever, and her website has 2.3 million unique viewers per month. Her magazine attracts 2 million readers a month, and her newsletter enjoys 420,000 weekly subscribers.

For a striking instance of little known leadership, consider Muhammad Yunus, a Bangladeshi economist who in 1974 led his students at Chittagong University on a field trip to an impoverished village. They met a woman who made bamboo stools but whose profits were eaten up by the extortionate rates of local moneylenders. To meet the needs of multitudes of women in similar plight, Yunus started lending money himself in the form of "micro-loans", maximum $50. After two years of start-up activities, he founded the Grameen Bank in 1976. The Bank now covers nearly 70,000 villages and makes small loans to more than 6 million customers, almost all of them women, who have built a loan recovery rate of 98%—a level to turn commercial banks and even the World Bank green with envy. Such is the success of the Grameen strategy that Yunus has established a network of 52 partners in 22 countries assisting 11 million people. Above all, he has shown that the seeming destitute are not charity cases condemned to their lot, rather

they are thwarted entrepreneurs who simply lack the means to improve their family's lives. This means that Grameen is a profoundly optimistic venture, backed by its supportive view of human nature. In 2006 Yunus and his Bank received the Nobel Peace Prize.

So let's beat the drum for leadership at whatever level, and the more charismatic the better. But: could it be that this is a time when many people do not want charismatic leadership? Their status quo has delivered so many perquisites of lifestyle, of philosophic outlook too, that they do not want to be dislodged from their entrenched comfort zones. In 1961 President Kennedy issued a stirring call to his fellow citizens: "Ask not what your country can do for you, ask what you can do for your country." This injunction was inspiring in 1961, today it would go over like a lead balloon. Americans have become too dedicated to "I deserve it all", and they have lacked political leaders to supply inspiration for an alternative future (indeed some politicians seem disinclined to blow their noses without a public survey to see how it will be regarded by voters). At the same time, and in terms of sustainability (which is becoming a crucial keystone of most future-oriented policies), many politicians epitomize the dictum that first, no country can support an indefinite increase either in its number of people or in its consumption of environmental resources, let alone both; and second, that they can.

Shifting public opinion

Even the most formidable individuals can encounter trouble in shaping public opinion. In 1936 when Churchill was trying to rouse Britain to the threat of Hitler's Germany and he felt thwarted by wall-to-wall indifference, he warned that the country's leaders were "decided only to be undecided, resolved to be irresolute, adamant for drift, and all powerful to be impotent" (Churchill, 1936). If we could rewind the tape from 1945 with hindsight of what we witnessed during World War II, we would surely ask how the disaster could have been prevented by a 1930s intervention in the policy process. We would have to acknowledge that it would have been a tough task at a time when the government wanted peace at any price, as did the public, the media too, indeed the country overall, even though a change of direction should have been a total imperative. Who could have mounted the critical intervention, and at what stage and in what form? Shall we find ourselves asking much the same in 10 years' time when the ravages of climate change will be all too plain—and what shall we then make of the warnings extending as far back as 1990?

For certain individuals, there is no problem in shaping public opinion, and doing it virtually overnight. At the Nuremberg trials of the Nazi leaders in 1946, the principal man in the dock, Hermann Goering, was asked how he and a few accomplices could take a nation of highly cultured and sophisticated people and in just a few years convert them

into a thoroughly thuggish society. How did the totally repulsive become the totally acceptable (LeBor and Boyes, 2000; Wulf, 2007)? Goering responded "Leaders of a country determine policies, and then it is always a simple matter to drag the people along, whether it is a democracy, a fascist dictatorship, a parliament or a communist dictatorship. It is easy. When we consider upon what ludicrous evidence the most preposterous beliefs have been easily entertained by millions of people, we may well hesitate before pronouncing anything incredible" (Goering, 1946; see also Gardner, 2004; Zimbardo, 2007).

Of course Churchill and Goering had very different purposes in view, but they displayed keen individual insights into how individuals operate when part of the collectivity known as society.

Cultural contagion

Within an institutional context, there is growing attention to the question of how new ideas can be made to spread fastest (Ehrlich, 2000; Osberg, 2003; Putnam, 2000; Walt, 2000). This process, technically known as cultural contagion, is exemplified by human rights campaigns, the spread of labor cooperatives, the build-up of research networks, the political power of women's movements, and the impact of citizen protest bodies and other efforts at collective action (Cohen and Rai, 2000). All these can be mobilized as modes to foster public opinion about tackling IRs.

To reiterate the core message of this book: With our present approaches and their limited payoffs, we shall find it difficult to shift the outlooks, the thinking patterns, and above all the institutional inertia that infects many of our social and political systems (Ehrlich and Ehrlich, 2004). To cite an expert on the citadels of power, Sir Crispin Tickell (2002), formerly Britain's Ambassador to the United Nations, "It takes time to learn to think differently. If policy lags behind change of mind, and practice behind policy, little will change unless and until we think differently. The power of inertia is immensely strong, especially in the functioning engine rooms of society—the middle ranks—whether in government, business or elsewhere."

Fortunately there is promise of a breakthrough by virtue of cultural contagion, deployed as a means for spreading a particular message both widely and swiftly. It is often generated by the media and other explicit molders of public opinion. Mexico's national television network Televisa has screened a series of soap opera segments on illiteracy—a topic that is hardly a "natural" for large popular audiences. Within just a week after a character in one of the programs visited a literacy office wanting to learn to read and write, one quarter of a million people showed up at these offices in Mexico City alone. Building on this success, the project launched a two-year series of programs

promoting contraception; during the following decade, Mexico's birth rate fell by an astonishing one third (Brown, 2001).

There is a similar success story in Ethiopia. A soap opera sponsored by the US-based Population Media Center was broadcast over a period of 30 months, during which time the demand for contraceptives soared by 157% (Guillebaud, 2007).

To further assess the power of cultural contagion, consider a very inspiring form and a very disillusioning form of globalization. The 26 December 2004 tsunami was one of the greatest natural disasters ever recorded, followed by another great phenomenon, a tidal wave of generosity as millions of people sent money and other types of aid, making that one of the greatest such outpourings ever recorded. Curiously enough, however, the public has long seemed indifferent to a disaster far larger and far less apparent, being the "creeping" disaster of deep poverty. Every week developing-world poverty kills many more people than did the tsunami. What is needed is another tidal wave of bold action, but much bolder and more enduring than any such thus far. Enter the leverage offered by cultural contagion: is humankind ready to become human kind?

Curiously enough, an unlikely setting may provide something of a model for the workings of cultural contagion, also an insight into certain of our global dilemmas. It is golf, a game played by 70 million people worldwide and by at least 1 million in each of several dozen countries with their widely varying cultures. However divergent their social mores, virtually all play with a common sporting spirit and adhere to the same voluntary fair-play code. Now consider that the bane of planet-wide efforts at collaboration lies with the lack of any global agency with enough muscle to conclusively promote the community's will when vital values are at stake. Of course the best way ahead is through persuasion and whatever other means will serve short of policeman-like antics. The challenge of international politics is to get enough players to pull strongly enough on one rope in one direction, and the key to golf is that there are no referees (police) to enforce rules: players are their own referees and engage in self-regulation. Players can cheat if they wish by e.g., submitting false scores or quietly nudging a bunkered ball into a more playable position, and it's likely that nobody else will know—except the cheater, who must then live with the knowledge that he is implicitly standing apart from his co-players and not sharing in their companionship. The system works because everybody wants it to, and their payoff is a strong feeling of belonging to a universal pattern of behavior.

The churches

Each weekend the Christian faith can attract as many as one billion adherents into its churches, thus making up what would be a huge captive audience for any institution wanting to purvey a particular message. Yet there is one issue with a

particular message that leaves the churches almost entirely indifferent. It is the mass extinction of species underway, a crisis that is sufficiently widespread that, if allowed to proceed virtually untrammelled (as is largely the case to date), will leave the Earth and hence the world severely impoverished for several million years ahead, i.e. until evolution can generate replacement species to match today's in numbers and variety. Moreover each species is a unique manifestation of Creation (in both evolutionary and theological senses); and when once a species is gone, it is gone for good (or rather, for bad), by contrast with all our other environmental problems, which are intrinsically reversible.

Given the nature and scale of the crisis, shouldn't the churches be urging their flocks to spread the conservationist word until every citizen is fully plugged into the message and ready to get out there and do something about what deserves to be regarded, in certain senses at least, as the single biggest issue of our time? Yet the churches utter scarcely a squeak about it, notwithstanding the assertions of one or two enlightened leaders such as the Bishop of Liverpool.

Moreover, there is a profound gulf between the two institutions of Christianity and Christendom. Many churches argue endlessly about sexual orientation, abortion, evolution and other divisive issues that have little relevance to the "live and let live" spirit of the Gospels. Why don't the churches speak out more on poverty, hunger, and children dying needlessly in their many millions, as well as the mass extinction of species?

The churches enjoy a superb opportunity to exert a profound influence on the way society goes about its business if only by virtue of their huge flock of willing listeners. But as a measure of how far they carry authority to persuade society, note the naivety of certain Christians. In the Fall of 2005 while in the United States, I (NM) heard certain rightist Christians complaining with one breath about the supposed nonsense of evolution, and protesting with the next breath about the shortage of new flu jabs. They hadn't pondered why they needed new flu jabs with every passing year.

"Green" businesses

As one of the biggest institutions in the world, the business community can supply enormous leverage in moving both the global economy and the global environment onto sustainable tracks (Lyon and Maxwell, 2004; Najam et al., 2007; Northrop, 2007; Strong, 2001). Fortunately there is some good news here—so far as it goes as yet. Alcoa, for instance, plans to reduce its GHG emissions by 2010 to one quarter below 1990 levels; there are similar plans on the part of General Electric, Caterpillar, and dozens of other major corporations. Particularly prominent is DuPont, which in 2000 set itself the ambitious challenge of a two thirds reduction in the 1990 levels of

GHGs by 2010, only to achieve its target by 2005. It now uses one tenth less energy than in 1990 while producing one third more goods—an effort that has saved the company $2 billion (Climate Group, 2007; see also Esty and Winstone, 2006; Monbiot, 2006).

Standard economics proclaims that marketplace competition will always impose the imperative of trying to out-perform one's rivals, so why don't others at least aim to match DuPont? Is it something to do with rigid corporate cultures or sluggish organizational structures? Or outright inertia among bodies that, as a mega-institution, supposedly epitomize the very spirit of innovation?

U.S. mayors

Next, consider an American sector that is showing admirable capacity to mobilize public opinion. By 2008, 800 mayors from all states, with 78 million American citizens had signed on to a programme to meet or beat the Kyoto Protocol's original target for the U.S., viz. to cut GHG emissions to 7% below 1990 levels by 2012. Some cities got a head start, for instance Portland in Oregon which zeroed in on climate change as far back as 1993, and has already slashed its emissions, partly by building light rail networks and 1200 kilometers of regional bikeways. Seattle's Pledge to reduce greenhouse gas emissions translates into the equivalent of retiring 150,000 cars a year (Kristof, 2005; Office of the Mayor, Seattle, 2007; Underwood, 2007). Major cities are building new bus routes and bike tracks, planting trees for carbon sinks, supplying the police with hybrid vehicles, pressing local utilities to use more renewable energy, and providing energy-efficient light bulbs for street lamps and stoplights. There are similar efforts in Britain, where a typical household emits more CO_2 than an average car per year. British consumers spend the annual equivalent of $7 billion on goods and services with a low impact on climate change, for a year-on-year increase of 21%. The European Union is targeting television standby devices—and the same for computers and other electronic appliances—in a new legislative drive aimed at slicing 100 billion Euros a year from the European Union's energy bill. The goal is for a 20% energy saving and a 30% cut in GHG emissions by 2020. There are plenty of such efforts in the industrialized world, but little as yet from the fast-growing economies such as China, India, Brazil and Mexico, none of which was included in the Kyoto Protocol.

Note too what individual state governments are doing. California has committed to reducing its GHG emissions by fully 80% by the year 2050. New York State plans that within a decade it will gain one quarter of its electricity from carbon-free and renewable energy resources. New York City's government is investing heavily in hybrid-powered vehicles. Nine northeastern and Mid-Atlantic states have banded together to form the Regional Greenhouse Gas Initiative, requiring electric power generators to reduce CO_2

emissions through market-based trading systems. Colorado aims to require utilities to provide 10% of their electricity from renewables by 2010.

Tipping points

Let's conclude this section on Public Opinion by recognising that institutions can sometimes be pushed by the power of public opinion into changing direction—and do so in an abrupt manner that catches us by surprise. Such a shifting of the gears is a kind of "tipping point", so named because it reflects what happens when a change is no longer gradual and predictable but becomes sudden and unexpected. (For an earlier and shorter assessment, see Chapter 4 on Surprises.) The phenomenon has been defined by the originator of the concept, Malcolm Gladwell (2005), as "that magic moment when ideas, trends and social behaviors cross a threshold, tip and spread like wildfire", whereupon institutions undergo fundamental change as "a small group of influential people get behind an idea" (Gladwell, 2005; see also Costanza et al., 2007; Marten et al., 2005).

For illustration, consider the saga of smoking in the United States. In 1990, if you wanted to be socially accepted, you would be under pressure to light up. By 2000, if you wanted to be socially accepted, you would be under pressure to stub out. During that decade, 55 million smokers quit. What was the process of this seismic shift in social mores within just a decade—lightning speed for such a profound change? Did the non-smokers eventually (or soon) achieve enough of a critical mass to trigger an urge among the "still smokers" to join the new mainstream of public opinion? If so, did it overtake established practice with a sudden shift soon after the start—or did it operate for a while in semi-covert fashion, then burst unheralded upon the unsuspecting social scene? If we had had answers to these questions ahead of time, then governments, businesses, health officials, NGOs and other stakeholders could have devised institutional interventions at "high leverage" points early on in the process.

The classic example of a tipping point in the political arena lies with the fall of the Berlin Wall. Ostensibly the Wall came down in just a single night, but in truth it had been effectively coming down for at least half a dozen years. Since the early 1980s if not sooner, there had been a growing reservoir of citizen resentment at the many deficiencies of the East German regime, especially when citizens could increasingly learn from television that other peoples lived much better. By the time Gorbachev was in the ascendant in Moscow, the reservoir of resentment had attained such a volume that it finally cracked the dam wall of citizenry forbearance, and the resultant outburst breached the Berlin Wall. True, the month before might have given scant portent of what had become imminent—just as when a reservoir of water is nearing a stage when it is too much for its dam wall, it gives no sign of being about to break. The crash effectively

occurs through a protracted process of build up, until the ultimate discontinuity arrives: "sudden" and "surprising"?

Consider too the ending of apartheid in South Africa in 1992. After four decades of rigid rule by the white supremacists, the racist system seemed set in stone for all perpetuity. Then it finally broke apart within less than a year. So too with the civil rights campaign in the United States. In 1955 a black seamstress Rosa Parks refused to give up her seat to a white man on an Alabama bus, and when she was put on trial Martin Luther King organized a boycott of the buses, thus starting the civil rights movement. Even so, the movement totalled only a few million people for year after discouraging year, until finally their numbers reached critical mass and public opinion no longer viewed them as idealistic dreamers. There have been several other U.S. movements, notably the anti-Vietnam War campaign, that were long seen as lunatic fringes until they triggered a "tipping point" of social acceptability and political power (Gladwell, 2000).

As we have seen in Chapter 4, there have been numerous tipping points in the past few decades; in this chapter we ask what we can learn from past experience, and what it says about the scope for us to anticipate and thus to exploit fresh tipping points ahead. As Al Gore has pointed out in his recent film and book "An Inconvenient Truth", "The political system has one thing in common with the climate system: it's non-linear. It can seem to move at a glacier's pace, but then it can cross a tipping point and steadily shift into high gear, changing rapidly and dramatically. I think enough people are changing their minds about the climate crisis to make it likely that politicians in both American political parties will soon be competing actively to offer meaningful solutions to this crisis" (Gore, 2006). Institution experts, please note.

Given all these plus points, we might well ask "Why aren't there more tipping points to help us on our way?" How to figure out the mechanisms by which ground-breaking ideas and behaviors emerge and spread (Ehrlich and Feldman, 2003)? Unfortunately there are many blockages to radical changes in the way society works to conform to people's expectations. To cite Paul and Anne Ehrlich again (Ehrlich and Ehrlich, 2004), these blockages include "not only obvious items such as socio-cultural discontinuities, group (mis)behavior and special interests and lobbyists, but more covert blockages such as contagion of attitudes, 'stickiness' of thinking, and other forms of social rigidity and perversity." And to cite another perceptive observer (Tickell, 2004), "To bring about change we need three things: leadership from above; public pressure from below; and, usually, some instructive disaster to jerk us out of our inertia." Or, instead of the last item, how about "a benign catastrophe"?

To wrap up this discussion of tipping points and their relevance to institutional opportunities to foster more such breakthroughs: If I (NM) had one million dollars to put into research, I would want to investigate issues like "What, in detail, was the institutional chemistry that brought down the Berlin Wall or put an end to apartheid?

What induced the New Zealand government to cancel virtually all sheep farming subsidies at a stroke, and thus do what many observers claimed would wreck farming and was politically impossible anyway—yet the cancellation quickly made farming more profitable commercially and more sustainable environmentally? What other such tipping points have occurred, and what can we learn from them? How can we discern emergent tipping points ahead of time and then intervene with policy initiatives to accelerate the process if it seems propitious? What does it all say for institutional adaptability (Marten et al., 2005; Costanza et al., 2007)"?

III. ROLE OF GOVERNANCE

Finally let's take a look at an arena that by its very nature features a host of institutions: governance. This includes not only conventional forms of government at local and national levels but trail-blazing structures for international and even global governance.

Alternatives to GNP as an economic measure

As we have seen in Chapter 5, a government's prime measure of its economy's health is Gross National Product (GNP), being a measure that supposedly supplies us with a realistic assessment of our economies. It is also vital to the business world, the media, and public opinion generally. Yet our quirky modes of calculating GNP mean that many economic losses such as crime, pollution, etc. are actually viewed as pluses since they entail economic transactions in the marketplace and hence, willy-nilly, they are to be added on to GNP.

Let's figure out how many economic losses Americans have to endure without always being aware of it. According to recent calculations (Talberth et al., 2006; see also Talberth and Bohara, 2006), crime in 2004 levied costs amounting to $34 billion; road injuries and deaths $175 billion; pollution $199 billion; ozone layer depletion $479 billion; injury from carbon emissions $1.2 trillion; and depletion of non-renewable energy resources $1.8 trillion. There were further big-number items such as soil erosion, decline of wetlands and forests, loss of leisure time due to overwork, and a lengthy list of other such items, all with their sectoral costs. Their aggregate amounted in 2004 to $6.4 trillion, or equivalent to over half of the official GNP of $11 trillion.

Not included in the calculation is a host of "goods" that remain outside the GNP metric since they are not traded in the marketplace. These include housework, child care and volunteer work. When we add in all these "goods", i.e., list them on the positive side, we find that a "Genuine Progress Indicator" (GPI) for 2004 revealed a net total of $4.4 trillion, meaning there was a huge gap between GNP and GPI. In other words, Americans were not nearly so well off as they seemed to assume. Indeed, and if we view the arithmetic in per-capita terms, we find that during the period 1978-2004 the Genuine Progress Indicator did no better than remain constant at around $15,000 (Talberth et al., 2006). Clearly Americans would be much better off if they concentrated on a measure for their economy that would tell them which economic activities are good news and which ones aren't.

Other innovative modes of measuring economies include "Green" Accounting (Nordhaus et al., 1999; see also Darmstadter, 2000), Net National Product (NNP) (Dasgupta, 1999), and an Index of Sustainable Economic Welfare (ISEW) (FOE et al., 2000). The last has been formulated for such diverse countries as the U.K., Germany,

Austria, Netherlands, Sweden, Chile and Australia. These measures go far to recognizing that our economies are ultimately dependent on the environmental resource base that underpins all human activity. We can realistically anticipate that within a few years there could well be 30 front-rank countries managing their environmental wealth in the same way they currently manage their finances.

A further way to assess how a country is faring, and especially how far it is pursuing a path that is sustainable, is to invoke the Ecological Footprint. This mode of analysis examines humanity's use, or over-use, of environmental resources such as water, soil, land and vegetation, these resources being collectively known as "biocapacity" (Dietz et al., 2007; WWF et al., 2006). Earth's 14 billion global hectares (gha) of biocapacity equates to only 1.8 gha per person, yet our average per-person footprint now exceeds 2.2 gha (Americans' 9.6 gha). The analysis further shows that we have increased our loading of the planet from 70% to 125% in just four decades (our CO_2 footprints have increased nine-fold since 1960). Or: our footprints amount to 1.2 "planets", and by 2016 they could expand to 1.6 planets. To achieve sustainable development, we need to get our footprints back below 2 gha. A "slow shift" would leave us in overshoot until 2080, whereas a rapid shift could see an end to overshoot by 2050. Conversely a "business as usual" scenario would see our footprints reaching 2.6 gha by 2050 (Dietz et al., 2007; WWF et al., 2006). Already the Swiss Government has incorporated the Ecological Footprint concept into its National Sustainability Development Plan, while the Japanese Ministry of the Environment is conducting a scientific assessment of its National Footprint. China tried to make the 2008 Olympic Games in Beijing a case of the Footprint Neutral Olympic Games.

On top of GNP there are other major Institutional Roadblocks in the economics arena. For instance, and as we have seen in Chapter 5, perverse subsidies distort our economies and deplete our environments to the tune of $2 trillion (no less) worldwide each year. If we could sort out just the two supersize roadblocks of distortive GNP and perverse subsidies, our economies would leap ahead and in much more sustainable fashion. The reader will readily target other economic roadblocks that warrant radical reform. It's not a case of fine tuning the engine of the economy; we need to redesign whole chunks of the engine's workings. Or, to change the analogy, we are motoring along and making every effort to get more speed out of our car through sensitive use of the throttle, but we forget we are still far from top gear; indeed for the most part we do not realise there is a top gear, let alone how to engage it for full efficiency. Nor do we notice that we have sometimes omitted to take off the hand brake.

Shifting taxes

Still another IR of economic sort lies with the tax system (Costanza, 1998). Most taxes penalize us for the work we perform as individuals and for the profits or "value added" that businesses contribute. Yet both these sets of activities are constructive and should not be penalized at all. Rather, we—both individuals and businesses—should be taxed for the downside activities we commit, like pollution and over-use of critical and scarce raw materials. A front-rank instance lies with our consumption of gasoline, which should be taxed to the hilt. Fortunately an outsize increase in the gasoline tax in the United States need not result in any extra tax burden at all, thanks to a tactic known as "switching taxes." Whereas motorists in the United States pay a mere 40 cents tax per gallon of gasoline, UK drivers pay around $4.20. These additional taxes have resulted from a steady shift in recent years: raising those on energy while lowering those on income. Sweden is going further: it is in the middle of a ten-year shift of $1100 per household from income taxes to energy taxes, as part of a strategy to free the country of oil by 2020. Other European countries making efforts at tax reform are Spain, Italy, Norway, France (Brown, 2006). In the U.K. there is a daily $20 congestion charge on cars in Inner London, a tax that raised $220 million in 2006, to be reinvested in transport services across the whole capital. In the same year vehicles entering the Congestion Zone fell by an average of 80,000 per day, with a significant reduction in air pollution and road accidents, plus more cyclists than ever. Similar congestion systems are being considered or already operate in Singapore, Stockholm, Oslo and Melbourne. A Statement on Climate Change signed by 2500 economists (including eight Nobel Prize winners) endorses the concept of tax shifting. In Europe and the United States, at least 70% of voters support environmental tax reform (Brown, 2006), yet eco-taxes such as the U.K.'s Climate Levy on energy consumption generate less than 7% of total tax revenues in the European Union thus far (Economist Intelligence Unit, 2007).Water is a resource in short supply yet many of us can use it and abuse it because no-one is sitting on our shoulder telling us to turn off the tap. While five million people a year die through lack of clean water, there are 150 billion liters of bottled water consumed each year—often as a worthless luxury, being hardly any healthier than tap water. The global market has now topped $100 billion per year, and certain brands cost more than gasoline (Arnold, 2006; Cain and Gleick, 2005). One of the United Nations' Millennium Development Goals urges that the proportion of water-short people be halved during 1990-2015, though this would still leave 600 million people lacking access in 2015 (Myers and Kent, 2005). To meet the goal would require $15 billion of additional funding per year (Gleick, 2005, Postel, 2005). How about a 10 cent (or equivalent) tax on each of those 150 billion liters, raising $15 billion?

Non-governmental organizations

It is in the international arena that we are specially short of creative institutions. This is partly because many nations are still jealous of their sovereignty, meaning they want to feel free to go their own sweet way and to heck with other nations—even though this is a time when nation states have become too big for the small problems and too small for the big problems, and even though independence is coming to be superseded by interdependence, with international relations governed by many thousands of inter-state treaties. Hence this section deals with a newly powerful player at the international negotiating table, the Non-Governmental Organization; and it concludes with one of our best efforts at managing one planet with one accord, the United Nations.

We are witnessing a major new set of actors in arenas extending from the local to the national and the international, even the supranational: Non-Governmental Organizations (NGOs). At the Stockholm Conference on the Human Environment in 1972, all the environmental NGOs could have fitted into one room. At the Rio Earth Summit in 1992, they could have fitted into a few halls. At the World Summit on Sustainable Development in 2002, there were several thousand NGOs—and they enjoyed a place as of right at the negotiating table. In 1993 there were virtually no NGOs in Russia or China. Today Russia has more than 400,000, China 280,000 (plus perhaps twice as many unregistered in China) and India 500,000 (Clinton, 2007).

This means there has been a dramatic increase in the potential of individual citizens to be agents of advance, and for three reasons. First off, more than half the world's people now live in democracies. Secondly, the spread of information technology has empowered individuals to make common cause at a speed and on a scale previously unprecedented. Thirdly, and reflecting the first two, there has been an explosive growth of NGOs, bodies that have become prime agents of change. The response to the tsunami in Southeast Asia, for instance, followed by a tidal wave of charitable support, "enabled citizen power and the Internet to combine to provide a conduit through which enormous sums of money flowed from millions of people of modest means." Fully 30% of American households gave money, half of them through the Internet (Clinton et al., 2006). In this and many other ways, hundreds of commitments were made, totalling $14 billion worldwide (Center on Philanthropy, Indiana University, 2006).

The NGO movement covers activists of many a stripe, including civic clubs, trade unions, religious groups, charities, social and sports clubs, co-operatives, environmental bodies, professional associations and consumer groups. They tend to be flexible, adaptable and nimble, responding with a speed that is beyond many official bodies with their committee-ridden procedures. As grassrooters par excellence, NGOs have earned much credibility as honest brokers respected by governments. They have scored successes on global problems such as energy, water and health (Hawken, 2007; Lord

and Turekian, 2007). All in all, the former U.N. Secretary-General Kofi Annan has called them "the conscience of humanity."

The NGO phenomenon worldwide encompasses over 100 million people (Hawken, 2007). "Collectively it constitutes the single biggest movement in the world. It doesn't know it is a movement, it has no name, yet it acts in aggregate because at its core it is based on shared values that are universal. It is an extraordinary source of new thinking, ideas and initiatives. Because it is a bottom-up movement, it doesn't know how big and how meaningful it is. The healing and mending of the world is a massive challenge that can be undertaken only by ordinary citizens everywhere, not governments or oligarchies somewhere" (Hawken, 2007).

As an indication of NGOs' growing clout, in December 1997, 122 countries agreed to stop using and selling landmines. This remarkable breakthrough was attributed not so much to governments as to more than 1,000 NGOs which had lobbied officials on the issue for years. "This event marked a shift in the balance of power in international politics, unimaginable thirty years ago" (Bond, 2000).

National NGOs are being matched by International NGOs (INGOs), whose numbers soared from 6,000 in 1990 to 50,000 in 2001 (Ahmed and Potter, 2006; Kennedy et al., 2002; Petkova et al., 2002). Just a single INGO, the World Wildlife Fund, has five million members and an annual budget of $550 million. Friends of the Earth has one million members in 70 countries and Amnesty International has twice as many in 152 countries; the latter organization is better funded than the human rights arm of the United Nations (Amnesty International, 2007).

For an illustration of what a single NGO can achieve, consider Thailand and its family planning achievements. In 1979 the government planned to slash its population growth rate by half, i.e., from 2.5 in 1970 to 1.25, and to do it by the year 2000. Population experts responded with "Forget it, that will take 40 years at least." Thailand managed it in less than 20 years, and today's growth rate of 0.75 is one of the lowest in Asia (U.N. Population Division, 2007). Much of the credit goes to an NGO headed by Mechai Viravaidya. He originally promoted condoms as a contraceptive, and then expanded his purpose to urge condoms as a weapon against HIV/AIDS. Together with his grassroots Population and Community Development Association, he achieved an exceptional 87% decrease in new HIV infections during the 1990s. He used an array of innovative techniques to publicize his campaign; he even held condom-blowing contests in rural villages, and persuaded urban restaurants to offer condoms instead of after-dinner mints. By today the Association and its 12,000 volunteers have reached more than 10 million Thais in 18,000 villages. They have also trained nearly 3,000 people from 50 countries in HIV prevention, plus family planning and reproductive health. Mechai has done so much to avert an HIV disaster that many people don't use the word "condom", they speak of a "mechai" (Gates Foundation, 2007).

For further illustration of what a single NGO can achieve, consider the Mathare Valley shantytown in Nairobi, Kenya. This slum represents poverty at its utmost. Half a million inhabitants need to waken at 4.00 a.m. to go stand in line for their turn to receive a bucketful of water from a community standpipe, that being their daily ration. Then they join another line to visit one of the latrines they share with dozens of other persons. There are no regular roads, no electricity, no sewers. But 30 years ago, Canadian development worker Bob Munro hit upon a brainwave. He told the Mathare youngsters that he would find space for a football pitch and he would supply a ball (but no boots) for anyone who wanted to play. For every one hour of sport a youngster had to spend one hour on digging drainage ditches, clearing away garbage and other environmental clean-up activities. Youths now clear one tonne of garbage every day, doing it largely with tools no better than rakes and shovels. The scheme has been a huge "go" from the start in 1978, since when there have been 120,000 signed-up members of the Mathare Youth Sports Association (MYSA). Girls can play too, and football has expanded into hockey, netball and several other team sports. By mid-2007 there were over 1300 teams with 18,640 youngsters playing a dozen sports. Munro long ago handed over day-by-day running of MYSA to local African leaders, and the program has flourished to the extent that it is being replicated in other Kenya slums (plenty of them) and even exported to Uganda, Tanzania and Botswana.

Since 1978 Mathare's population has doubled and its environmental squalor has halved. The whole program has been grassroots-ism with a vengeance—except that there is no grass, only bare ground. Institutional support from officialdom in the shape of the Nairobi City Council is nil, rather the city fathers view the slum as a total blight: better to pretend it doesn't exist.

In sum, then, NGO-ers enjoy unprecedented capacity to make common cause with fellow participants throughout their countries and the world, and to do it instantly, all by courtesy of the Internet and e-mail, which serve to globalize public opinion via communications networks and transnational coordination (Emmerij et al., 2001; Gruber, 2000; Kennedy et al., 2002; Nua Publishing, 2002). There has been no other time, not remotely, when we could say that thanks to the communications revolution, everybody can be somebody and nobody need be nobody. Every last citizen can make their voice heard in a global village that becomes ever-more populous and ever-more connected. By 2008 there were 1.4 billion Internet users, a total expected to reach 1.8 billion by 2012. They enjoy mass communications, as intensive as extensive, by courtesy of 3.5 billion cell phones or one for every two persons on the planet. In 1993 there were only 50 sites on the World Wide Web, but by 2001 there were 9 million and by 2007 the total had soared to hundreds of millions (Clinton, 2007). In fact the Internet has become so powerful that it has spawned an altogether new institution in the form of "virtual nations." These are large-scale international communities of citizens with no limitations

of space and time, no political boundaries, no territorial frontiers, no economic divisions, no social differences, indeed none of the traditional divisions that separate old-style nations. "They amass sufficient power, wealth and shared purpose to acquire vast resources for those functions traditionally performed by nation states, viz. protecting their citizens' health and wellbeing. They are proving to be both the cause and effect of a monumental shift in economic, political and social structures right around the world" (Dillard and Hennard, 2002).

Note, for instance, the powerful impact of Google and other search engines. Google's strength is that within just a few years it has not only built itself up into a worldwide business, but, more significantly, it has begun the process of democratising the world's information. "By making more information available to more people, it is giving them more power—power to learn, power to get the best deal, and, above all, power to hold to account those persons who in the past might have held a monopoly of power, whether in government, business or the media" (Cameron, 2006).

United Nations

The preeminent agency for governance at the international level is the United Nations, plus associated agencies such as the World Bank Group. The U.N. system enshrines the hopes of many people and the disillusions of many others. It offers huge potential and it has often failed. Despite many success stories, the United Nations has fallen far short of meeting the needs of the community of nations that finds increasing difficulties with the multiplying demands of one-world living (Gruber, 2000; Kennedy, 2006; Mingst and Karms, 2007).

Indeed the United Nations and its failures point up the deficiencies that were built in from the start when Roosevelt and Churchill in 1943 began their Charter with "We the peoples of the United Nations determine that ...." What transpired in practice was "We the governments of the United Nations decide that ....." Therein lay the seeds of the U.N.'s enduring weaknesses as it became a forum for the half-century wranglings of the Cold War. Nor did the end of the Cold War do much to bolster the U.N.'s status. To quote a long-standing insider, Sir Crispin Tickell (2005), formerly Britain's Ambassador to the United Nations, "Like the end of an ice age, the end of the Cold War revealed international landscapes riven by pressures and faults which had long lain hidden beneath the ice." Outcome: whereas the U.N. should have been leading the charge to halt the genocides of Rwanda, Chechnya, Bosnia, Darfur and Georgia, it has been powerless to do anything much at all.

The shortcomings have become so pronounced that the institution has sometimes declined into paralysis and disdain. The former General Agreement on Tariffs and Trade, with the acronym GATT, has been described as a General Agreement to Talk

and Talk, while the erstwhile U.N. Conference on Trade and Development, UNCTAD, has been designated Under No Circumstances Take Any Decision.

There is need for urgent and far-reaching reform of the United Nations, also the World Bank and the International Monetary Fund (IMF) in order to make these dated agencies better able to cope with the seismic shifts of globalization (Kennedy, 2006; Mingst and Karms, 2007). "The post 1945 system of international institutions—built for a world of sheltered economies and just 50 states—is not yet broken, but for a world of 200 states and an open globalisation, is urgently in need of modernisation and reform. (Brown, 2007; see also Birdsall, 2006). Unfortunately there are many barriers to liberalization. The United States has long exerted excessive influence over the World Bank and the IMF, and they both need to be modernized. In particular "the IMF needs to ensure the stability of the whole world economy, with its primary role no longer to manage balance of payments crises but prevention of crises in the first place" (Brown, 2007).

In addition, the United Nations should be reformed to reflect the burgeoning power of developing Asia, with a permanent seat on the Security Council for India. Even so, the United Nations' authority has declined so much that many of its original functions are handled in other fora such as the G8 summits and the Organization for Economic Co-operation and Development, plus regional economic bodies, notably the European Union. In similar style, the G8 needs to be expanded to include such emergent powers as China, India, Brazil and Mexico.

The inherent deficiencies of the U.N. system apply especially to the environment (Hyvarinen and Brack, 2003; Speth and Haas, 2006). There are more than 500 multilateral agreements on the environment, but they are dispersed and poorly coordinated with different hierarchies of reference and accountability (Chambers and Green, 2006; see also Susskind, 2008). It would surely help to reform the U.N. Trusteeship Council with the aim of promoting environmental governance worldwide (Chambers and Green, 2005; Rechkemmer, 2005). To cite Gus Speth, former head of the United Nations Development Programme (2005): "Within the United Nations the intergovernmental institutions that have been created thus far to address environmental concerns are among the weakest of all U.N. arrangements. Individually and collectively, they are incapable of doing the job. Something new, exciting, vigorous is urgently needed." Indeed it has become strange to have specialized agencies dealing with World This for health, World That for climate, World The Other for trade, etc., but no World Organization for Environment.

To be more specific: the U.N. Framework Convention on Climate Change was drafted largely by the World Health Organization, the World Meteorological Organization and the United Nations Environment Programme. The Food and Agriculture Organization was not an equal-party participant, even though the world's

forests play a crucial flywheel role in climate systems. Indeed the entire U.N. system is constitutionally maladapted to manage linkages. The specialized agencies e.g., FAO and WHO (over 40 of them in all) have been set up to tackle single-sector issues for the most part (food, health, science). Plainly there should be collaboration on environment and development between the agencies designated, collaboration that is both systematic and systemic. Equally plainly, however, there is all too little collaboration. For further instance, the United Nations Population Division and the U.N. Fund for Population Activities do not always work in close accord, and both often overlook the U.N. Children's Fund even though there are many obvious linkages between population and children.

To this extent, the U.N. system hardly functions as a system. The Secretary-General has inadequate authority to ensure that the specialized agencies coordinate their activities. A cautionary tale lies with the origins of the Food and Agriculture Organization. When the FAO was set up in 1948, there was a dispute over whether it should be called the Food and Agriculture Organization of the United Nations or the United Nations Food and Agriculture Organization. The first, which won the argument, implied an independence that was not intended by the originators but was to be steadily exploited by the new agency's leaders. Similarly, the UN Conference on the Human Environment in 1972 wanted to term a new agency the Environment Programme of the United Nations, whereas it got the United Nations Environment Programme. The first was vigorously resisted by, of all agencies, FAO because it foresaw that an Environment Programme of the UN would abrogate to itself an authority to impose environmental policies on FAO. True, the basic aim was to foster collaboration and even integration between all the U.N. agencies—precisely the threats that FAO would fight tooth and nail to avoid. Labels mean lots.

In this complex international arena, it is difficult to grasp the scale of interactions. Desertification processes can spread from one country to another with disregard for national boundaries—and the same for many sorts of pollution. When the first astronauts looked back to Earth, they saw everything in place as they expected—the rivers and oceans, the mountains and plains; the only thing they couldn't discern was political boundaries. But we try to run the world on the basis of 200 management packages we call nations, with all the competitive spirit as opposed to collaborative spirit engendered thereby. A shame we can't generate the institutions to reflect that fact.

Author Myers has encountered these issues for fully four decades as he has travelled the world on all manner of activities with all manner of people. Whenever he turns up at an airport, he reflects that the bit of cardboard in his hand, known as a passport, is a hangover from another era. Although he has lived and worked in a world of numerous nations, it is increasingly becoming one indivisible world—a continuum of economies, environments, politics, cultures, and many other relationships. We are no

longer just Americans or Britons, we are also card-carrying citizens of a single global community. Yet we have only a limited idea of how to say "Hullo, fellow citizen", and we have only a limited institutional system to support that relationship.

In sum, this is a world where everybody is involved in everybody's affairs, whether they want to be or not and whether they know it or not (Capra, 2003). Most of us are not as aware as we should be of this profound fact of life. Similarly, what new problems do we not see because we do not expect to see them? How shall we find what we are looking for unless we know where to look for it? What, let us ask ourselves directly, is the full scope of globalization, and how far do we all contribute, albeit unwittingly for the most part? Answer: check our lamentable lack of competent institutions.

Finis

And so to an end. By now the reader has climbed his/her way through 10 chapters replete with problems—problems set out in all their regrettable glory. The reader is no doubt looking for a finale full of solutions. Well, as yet there aren't nearly so many solutions as problems. That's often because we understand all too little about institutions and their wayward ways. The list of references tells us a lot about what is wrong with our present institutions, little about why they fall so short of what we need, still less again about what we need to do to devise a better set. However unacknowledged in our efforts to manage the world and the earth, there could hardly be a greater challenge for those charged with the task of creating institutions to move us on from a Heaven Forbid scenario to a Golden Age future.

To hearten us on our way, let us bear in mind that where there is a problem there is surely an opportunity if only our institutions were better geared to reflect both. There are already many success stories recounted in this book and demonstrating the pivotal part played by institutions (or by the lack of them). Herewith:

- Water

  More than one billion of the world's poorest people consume no more than five liters of water a day—often dirty water at that. (An average rich-world person may well use more than 50 liters of water just to flush toilets.) We are losing five million people a year, mostly children, to sicknesses from dirty water (Gleick, 2002; Johannesburg Summit, 2002; United Nations Development Programme, 2006). For every $1 invested in water plus sanitation in developing countries, there is an average return of $8 in disease costs avoided and enhanced work productivity (Gleick, 2006; United Nations Development Programme, 2006; WHO and UNICEF, 2005). What institutional blockages prevent us getting on

with a splendid job of saving so many lives for so little cost? Note too that consumers rarely pay the actual cost of water. In fact, many governments practically (and sometimes literally) give water away for nothing (Brown, 2007). Yet water is becoming scarce in many lands, and the best way to educate consumers about water use efficiency is through the pocket book. In the United States, water prices have increased by an average of 27%, in Britain by 32%, in South Africa by 45%, and in Canada by 58%. In Tunisia and during just a single decade, the price of irrigation water has increased fourfold (Brown, 2007). And how about such an esoteric issue as toilet efficiency? Replacing all California's toilets with high-efficiency models could save enough water to meet the needs of 1.5 million Californians (Gleick, 2006).

- Hunger

  Twenty years ago fully 15 million people starved to death annually. Ten years ago we had beaten down the total to 13 million, and today to nine million (Food and Agriculture Organisation, 2005; White, 2005). Relieving hunger need cost no more than $24 billion a year (hardly more than a single week of military spending), and eventually generate $120 billion in enhanced human wellbeing (Food and Agriculture Organization, 2006). Why, then, are there still 925 million people who go to bed hungry every night?

- Recycling

  People consuming soft drinks or beer utilize 220 billion cans per year, almost all the cans being made of aluminum and hence eminently recyclable. Recycling just one can saves enough energy to power a television for three hours; recycling 40 cans has the energy-saving equivalent of a gallon of gasoline. The European Union's recovery rate of 52% in 2006 already exceeded the 36% target set for 2008; Finland and Switzerland have reached 88% and Norway 93%. In 2004 Americans recycled enough cans to conserve the energy equivalent of over 15 million barrels of oil; if Americans knew they were wasting $500 million a year in aluminum cans, they might do something about it. Institutional option, anyone?

- Energy efficiency

  This has been described by the American energy guru Amory Lovins (2005) as "The largest, least expensive, most benign, most quickly deployable, least visible, least understood, and most neglected way to provide energy services." That is to say, it is the most productive sector in the entire energy arena, yet the most unsung sector too: since 1973 we have done more to meet our energy needs

through energy efficiency than through all increases in solar energy, wind power, nuclear power, etc. The United States now saves more energy than it produces from any single source such as oil; even so, energy consumption could be halved through greater use of technologies already available. Clean and renewables will not take a lot more costly research; economic growth rates for solar energy and wind power, for instance, have long averaged 33-45% per year. California already gets 31% of its electricity from C and Rs (Worldwatch Institute, 2007). Dozens of Fortune 500 companies have been expanding production, reducing costs and slashing GHG emissions by courtesy of energy efficiency. BP's GHG emissions trading program saved $650 million in just three years, while IBM's energy conservation efforts reduced its energy use during 1990/2001 by almost one third, thus saving almost $800 million. Other major corporations such as Shell, 3M and Toyota are following suit (Lovins, 2005).

- Family planning

  Each birth averted in Egypt brings a twenty-fold economic benefit even before factoring in savings on health and housing (Guillebaud, 2007). To cite a former head of the United Nations Children's Fund (UNICEF) James Grant, "Family planning could bring more benefit to more people at less cost than any other single technology now available to the human race." Yet many governments have still to deliver on their funding commitments made at the World Conference on Population and Development in 1994.

- Primary education

  Since the year 2000, more than 34 million developing-world children have become enrolled in primary school, making for the biggest educational expansion ever (IMF and World Bank, 2007). But then: why are there still 115 million children not in school?

- Vaccination and immunization

  During the last two decades, vaccination and immunization programs have saved over 20 million developing-world lives, and today they save five million lives a year with potential to save millions more. But 30 million developing-world children are not safeguarded. A shot costs less than $10 while avoiding future medical costs averaging $150. During the brief period 1999/2005, deaths from measles were cut by 60%, and the vaccination campaign has saved at least 8 million lives. These health programs must rank among the truly "best buys" worldwide (UNICEF, 2007; Gates Foundation, 2005).

- Corruption

  This global blight totals at least $1 trillion a year. But there is an upbeat aspect insofar as we know from much experience that certain tough measures can turn the problem into a breakthrough. Corruption costs African countries $150 billion a year (Christian Aid, 2007). Were corruption in other regions to be controlled as well, plus other forms of good governance installed, there could often be a three- to four-fold increase in per-capita income—a leap forward that could be achieved by hardly any other single measure (Kaufmann et al., 2007; World Bank, 2006).

- Wildlife conservation

  This issue frequently offers a cost-benefit ratio of at least 1:100, with a still greater bonanza in many developing countries (Balmford et al., 2002). The Earth's 34 biodiversity hotspots harbor the last remaining habitats of 40-50% of the planet's species in just 2.3% of the planet's land surface. Most of the hotspots have lost 90% of their original vegetation, meaning they are severely threatened. If we could save these hotspots we would knock a huge dent in the mass extinction underway—a "great dying" which would not be repaired by evolution in less than several million years.

Finally, here's a miscellany of what is being done by nations large and small, rich and poor, democratic or not, capitalist or not, and North, South, West and East. Cuba has become the sole country to attain basic standards of sustainable development (and it has made itself largely immune to hurricane damage, in huge contrast to the U.S. Gulf Coast). Costa Rica plans to shift entirely to renewable sources of energy, and to become the first country to be carbon neutral. Israel has pioneered new technologies to increase water efficiency to a level several times greater than is usual around the world. Kenya, a country where mosquito-borne malaria used to kill almost 100 children per day, now enjoys free insecticide-treated mosquito nets that have halved the mortality rate. South Korea has covered its hills and mountains with trees. Finland has outlawed non-refillable drink containers, while Ireland imposed a tax on plastic shopping bags in supermarkets (cutting their use by more than 90%). Germany is exploring a major tax-shifting effort to increase energy taxes, offsetting this with reduced income taxes. Iceland is planning the world's first hydrogen-based economy. The Dutch have determined that the key to urban transportation lies with bicycles. Denmark has banned the construction of coal-fired power plants, as well it may being a country with more members of environmental groups than there are Danes.

So much for an insight into who's doing what. Note that in virtually every instance, there is room for us to be doing better: if one country or business or individual

is doing splendid this or excellent that, why aren't all countries, etc., doing the same? Surely this means there is huge scope for institutional intervention?

Finally, let us remind ourselves that today's world is changing faster than ever, is more complex than ever, and is more in need of creative institutions than ever (Ehrlich and Ehrlich, 2004). The ultimate crunch factor is that our institutional mode of exploiting the Earth and its environmental resources—wholly unsustainable exploitation for the most part—suggests that we view our planet as a business liquidating its capital, even though the "interest" available could increase indefinitely.

Bottom line: We should re-jig our institutional architecture so that we live on Earth as if we plan to stay rather than call by for a weekend. The citizens are willing: where are the institutional experts to set us on the right track?

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Government systems are often blighted by "institutional roadblocks" (IRs). These phenomena are profound and pervasive, and growing worse in many sectors. They apply especially to environmental problems, stemming as they often do from a lack of integration—whether economic, political or otherwise—among our principal institutions of governance. Plainly the environmental cause is failing. After decades of efforts by governments, businesses, media and others—and despite many success stories—we are losing ground faster than ever. Problems proliferate, leaving us trying to push ever-larger rocks up ever-steeper hills. How can we get ahead of the game and prevent problems from becoming problems in the first place? A key answer is to tackle the IRs.

This book looks at why institutional systems prove singularly unsystematic, and why they often fail in spectacular fashion as concerns the environment. Why should this be so? What can we do about it? What are some success stories to point the way ahead?

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