

The Gordian Knot Revisited: Thoughts on Sustainability and the Search for an Epistemological Sword

Robert M. Abbott

President

ABBOTT STRATEGIES

Vancouver, CANADA V6T 2H2

“We stand now where two roads diverge. But unlike the roads in Robert Frost’s familiar poem, they are not equally fair. The road we have long been travelling is deceptively easy, a smooth superhighway on which we progress with great speed, but at its end lies disaster. The other fork of the road – the one “less traveled by” – offers our last, our only chance to reach a destination that assures the preservation of our earth.”

Rachel Carson

Setting the Stage

Can it really be nearly three decades since the inaugural Earth Day? As one who has grown up in the modern environmental movement, I still hear echoes of Rachel Carson’s voice directing us to protect the world around us, to move society onto a different road, a different trajectory. But these echoes are of a time that is a distant memory, part of our history. The intervening years have seen much to celebrate, but perhaps even more to fear. The Union of Concerned Scientists, a group of 1,600 that includes 100 Nobel Laureates, sounded a stern warning in 1993 that society has “no more than one or a few decades left to avert global ecological and social collapse.” The Royal Society (UK), the National Academy of Scientists (US), and many others have voiced similar warnings. Against this grim backdrop it seems timely to comment on the arguments put forth by latter day Rachel Carsons who suggest that sustainability¹ is the “road less traveled by”. While these advocates are, for the moment at least, united by their belief in sustainability, the emphasis in their arguments is strikingly different. Economists argue that an enlightened sense of price, of the value of the ecological world, is all that is needed to reverse the trend of ecological degradation. Technocrats are not impressed and believe that human ingenuity is the answer. Still others, spiritual descendents of Thoreau perhaps, believe that a fundamental shift in society’s ethics will do more for sustainability than anything else. Let us consider each of these perspectives in turn.

Wait a Minute, Technology Can Fix That!

To suggest that technology can lead society onto a sustainable path is to invite scorn. After all, hasn’t the industrial economy, and the technology that drives it, caused so much of the environmental degradation around us? Paul Gray, the former president

¹ There is a fertile debate in both the academic and lay press concerning the meaning of sustainability. This paper will not resolve this debate. For the purpose of the argument presented here, sustainability means managing human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations.

of the Massachusetts Institute of Technology, calls this the paradox of technological development; technology causes environmental damage, but it can also repair that damage (1989). The reparation includes the creation of substitutes for scarce natural resources, the development of more efficient products that allow existing resources to be stretched further, and perhaps most important, the institution of new ways of thinking about the world. C.S. Holling, in a provocative new essay (1998), cites the reconstruction of the composition of the Earth's atmosphere using bubbles trapped in the Vostok ice core from Antarctica and its correlation with climate using proxy biological and chemical signals as a particularly exciting contribution to the sustainability debate: "It is also useful for politicians. It tells them that the present concentration of carbon dioxide in our atmosphere is higher than it has been for the last 160,000 years" (Ibid, 32). Satellite imagery, remote sensing, and geographic information systems are additional forms of technology that have made significant recent contributions to human understanding of planetary functions, notably biophysical processes that operate over an enormous scale. Moreover, rapid advances in artificial intelligence allow different types of knowledge² to be logically considered in the search for better, more sustainable decisions about resource use and environmental protection. Moving from understanding to application, heat pumps, space-conditioning control systems, high efficiency lighting, and advanced recycling technologies are already helping to steer society toward sustainability.

A familiar example underscores the merits of the technological path to sustainability. Fax machines transmit documents electronically using one-half to one-seventh of the primary energy needed to send a letter by postal or courier service. More pointedly, the energy from a barrel of oil can send roughly 25,000 pages by courier, but if converted to electricity to run a fax machine, can send 175,000 pages. The emergence of e-mail is arguably even more sustainable than fax technology as it reduces paper consumption (Eblen and Eblen, 1994).

Many of the technological innovations that facilitate sustainability are already here, what is needed is the will to use them more creatively. For example, low temperature superconductors and microprocessors are increasing the efficiency with which electricity is transmitted, stored and used commercially; the same technology could help to optimize residential electrical use by integrating appliances and exploiting off-peak power.

Quite apart from leveraging existing technology to other quarters, there is an opportunity to develop and commercialize new technologies, what John Elkington (1997) calls "super innovations" which re-shape social possibilities. Two examples are the electric car and the hypercar. The Sacramento Municipal Utility District (SMUD), as part of an integrated sustainable energy strategy³, operates a fleet of 110 electric vehicles – recharged by solar energy (Lerner, 1998), and Amory Lovins of the Rocky Mountain

² Examples include empirical knowledge about organisms and their environment; situational knowledge about local environmental conditions; judgmental knowledge about human beliefs and priorities; theoretical knowledge about environmental phenomena; and normative knowledge about policies and acceptance criteria.

³ In addition to electric cars, SMUD operates two of the world's largest photovoltaic power plants; the first commercial-scale, utility-owned wind farm in the United States; a cogeneration plant; and is actively investing in fuel cell technology. The utility has also given away 200,000 trees to help Sacramento residents shade their houses from the sun and save on air conditioning costs (economic and environmental benefit).

Institute has demonstrated the feasibility of hypercars (cited in Hart, 1997). The latter are fully recyclable, twenty times more energy efficient, and one hundred times cleaner than existing cars. They retain the safety and performance of conventional cars but achieve radical simplification through the use of lightweight, composite materials, fewer parts, virtual prototyping, regenerative braking, and small, hybrid engines. The Department of Energy (US) is sufficiently committed to electric vehicles as a sustainability option that it has established a hybrid electric vehicle propulsion program, and has subcontracts with General Motors, Ford and Chrysler to produce production feasible electric vehicles by the year 2000.

There is a tendency to fear technology, to run from what Edward Tenner calls technology's "revenge effect". This fear, which is very real, is a good thing. It is a check on unrestrained technology, but it should not be used as justification to straightjacket technology and rely on an economic system that has treated the environment with malignant neglect, or societal ethics that change, if at all, very slowly. Life cycle assessment and product stewardship are increasingly being used to screen prospective technologies and identify those that are sustainable. Viewed in this light, perhaps Kenneth Boulding was right when he remarked that "Man's potential is quite terrific, you can't go back to the Neolithic." (cited in Thomas, 1956, 1087).

The Price is Right: Economics to the Rescue

Economists smile in the face of the technological argument because the best way of applying technology to the resolution of environmental problems is to "get the price signals right". If prices do not reflect the true cost of using environmental resources, companies and households will not value the environment as they value labour and capital and they will not be interested in increasing their productivity in the use of the environment, through technology or any other means. For the economist, the issue is not to rely on technology, or ethics for that matter, but to acknowledge that "people pollute because it's the cheapest way they have of solving a certain very practical problem...the disposal of the waste products remaining after consumers have finished using something, or after businesses have finished producing something." (Field and Olewiler, 1995, 5). Technology and ethics are details; important details to be sure, but not the crux of the sustainability debate.

The economists' argument, at least in part, says that society makes decisions with respect to production, consumption, and disposal within socially prescribed institutions – markets, corporations, commercial law, public agencies – that provide incentives for behaviour. To move toward sustainability, you don't need technology or ethics, you need to change the institutions and incentives. And so it is that taxes, subsidies, and tradable emission permits are receiving increasing play as economic levers for sustainability. As Tom Tietenberg (cited in Daly and Townsend, 1996, 316) put it:

"Instead of mandating prescribed actions, such as requiring the installation of a particular piece of control equipment, this approach achieves environmental objectives by changing the economic incentives of the agents. By changing the incentives an individual agent faces, that agent can use his typically superior information to select the best means of meeting his assigned responsibility. Among other virtues, approaches relying on economic incentives can reduce the

conflict between environmental protection and economic development, can ease the transition to a sustainable (rather than exploitative) relationship between the economy and the environment, and can encourage the development of new, more environmentally benign production processes.”

In addition to the deployment of economic incentives, there is another part of the economic argument that is particularly interesting. Here, proponents such as Herman Daly, John Cobb Jr., and Robert Costanza stake out new ground by arguing that growth and development should not be confused, as so many sustainability pundits have done. “When something grows it gets bigger, when something develops it gets different” (Daly, 1996, 268). The economy must eventually stop growing, but it can, and should, continue to develop by shifting to conceptions of wealth that are defined not by conventional metrics but by a throughput of matter-energy that is within the regenerative and assimilative capacities of the ecosystem. This line of thinking springs from a belief that economic indicators such as gross national product do not accurately reflect social welfare. “When a forest is cut down and sold, the country appears to grow richer – even though the trees may not be replaced, and their removal may result in soil erosion, flooding and the loss of food and fuel gathered by local people” (Cairncross, 1991, 36). Daly, and others, are leading economics into a new and exciting future that includes more than incentives to internalize environmental and social costs. They are forging a dialogue around new measures of wealth and prosperity, and in doing so are positioning economics as a compass to guide society onto a sustainable path. Steve Lerner (1998, 386), in a wide-ranging examination of sustainability in the United States, summarized the challenge and opportunity of economics in this context:

“Looking ahead it appears as if two significant changes must take place if we are to establish a more sustainable culture in the United States. First, we must shift the way we price goods and services to reflect more accurately their environmental costs. And second, we must develop a context within which commerce can take place within the limits of nature. Changing our laws, taxes, regulations, subsidies and economic indicators so that they promote sustainable activities now looms as the great task of the environmental movement.”

It’s an Ethical Question: Who Should Speak for the Earth?

If economists smile at the technologists, those who believe that ethics lie at the core of sustainability shake their collective head at any alternative proposition – much in the manner of a patient grandparent watching children in a playground. They view technology and economics as tools perhaps, but the blueprint is societal ethics. To achieve sustainability, the argument goes, you must foster an ethical awakening. For example, rising “consumer confidence” is routinely used as a surrogate for a prosperous economy even though the associated spending may have depleted natural resources and increased waste. It is therefore necessary to re-educate society with respect to prosperity. Of particular importance is the need to change what can only charitably be called the consumption “ethic”. The scientist, philosopher and scholar, Nicholas Georgescu-Roegen highlighted the dangers thusly:

“Once man expanded his biological powers by means of industrial artifacts, he became ipso facto not only dependent on a very scarce source of life support but

also addicted to industrial luxuries. It is as if the human species were determined to have a short but exciting life” (cited in Daly and Townsend, 1996, 86).

Ethics that support consumerism and continued economic growth are a formidable adversary to proponents of sustainability. In an article published in the September 23rd 1998 edition of The Globe and Mail, Nobel Laureate, Nadine Gordimer reported that global advertising spending exceeds \$435 billion (US) – more than five times the total annual income of all people in the poorest countries of the world. In the face of such an advertising blitz, you cannot rely on economic instruments or technology to chart a sustainable course, you need to change the way people think and the way they respond to such advertising. This will require changes to the education system that foster new generations of environmentally literate people. These educational efforts should point out that society is losing its endowment of natural resources and that societal change is necessary to arrest these losses. A new ethic that emphasizes non-material rather than material satisfaction, cooperation, and the recognition that society must live within its financial and ecological limits to protect a finite world is needed.

One of the interesting, and encouraging, features of the ethical argument is that it is not being driven exclusively by government, non-governmental organizations, or even concerned citizens. The business community, long the shadowy nemesis of the environmental movement, is playing an active role in the cultivation of a new competitive ethos. The International Chamber of Commerce, the World Business Council for Sustainable Development, and the Global Environmental Management Initiative are all high-profile examples of business organizations that are shifting the ethics, the values, and the beliefs of their members. The most striking example, however, comes from a new organization, the World Business Academy (WBA). The WBA is an international body of business leaders whose purpose is to forge an international dialogue about how businesses, as socially prescribed institutions, can foster a “sane, humane and ecologically sound global future” (Peat Marwick Stevenson & Kellog, 1993, 74). The ideas espoused by the WBA, and the notion that business might be part of the sustainability solution are new and refreshing. The old societal model is imperfect and no amount of technology or economics is going to correct it. A new ethical perspective is the prism needed to see the world in a new, sustainable, light.

So Who’s Right?

To ask the question is, in some respects, to miss the point. Each of the perspectives is tempting, and therein lies the fundamental challenge for society. To choose one over the others is to foreclose important opportunity. The trick for those of us with an interest in sustainability is to use all three of these perspectives in new and creative ways. Technology has some undeniable merit, but we must be wary of unintended side effects and the potential for efficiency gains to be offset by increased consumption. Economics has exciting potential, but is still bedeviled by the difficulty of identifying environmental and social costs (and benefits). Finally, few would argue with the desirability of moving society onto a “better” ethical plane, but even if agreement could be reached on what is “better”, such changes will not be reached quickly. The way ahead should therefore be based on an integrated approach in which society searches for opportunities where technology is particularly well suited – the understanding of planetary functions, for example – coupled to selected economic solutions that encourage technology investment and supported by efforts directed at ethical

awakening. Such a pluralistic approach acknowledges that the world around us is the most complex of systems and cannot be understood, must less managed, using one tool, technique or perspective (Nicolis and Prigogine, 1989).

In the ancient world, Alexander the Great was confronted with a seemingly intractable problem, the Gordian Knot. Unlike so many before him who had failed by using conventional logic and tools, he looked at the problem from a different perspective, resolved it quickly, and secured his future. As we contemplate the prospect of sustainability, we would do well to forge our own epistemological sword through an appreciation of the interplay of technology, economics and ethics and learn where and how to use our sword. Anything less is to forfeit passage on the “road less traveled by.”

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