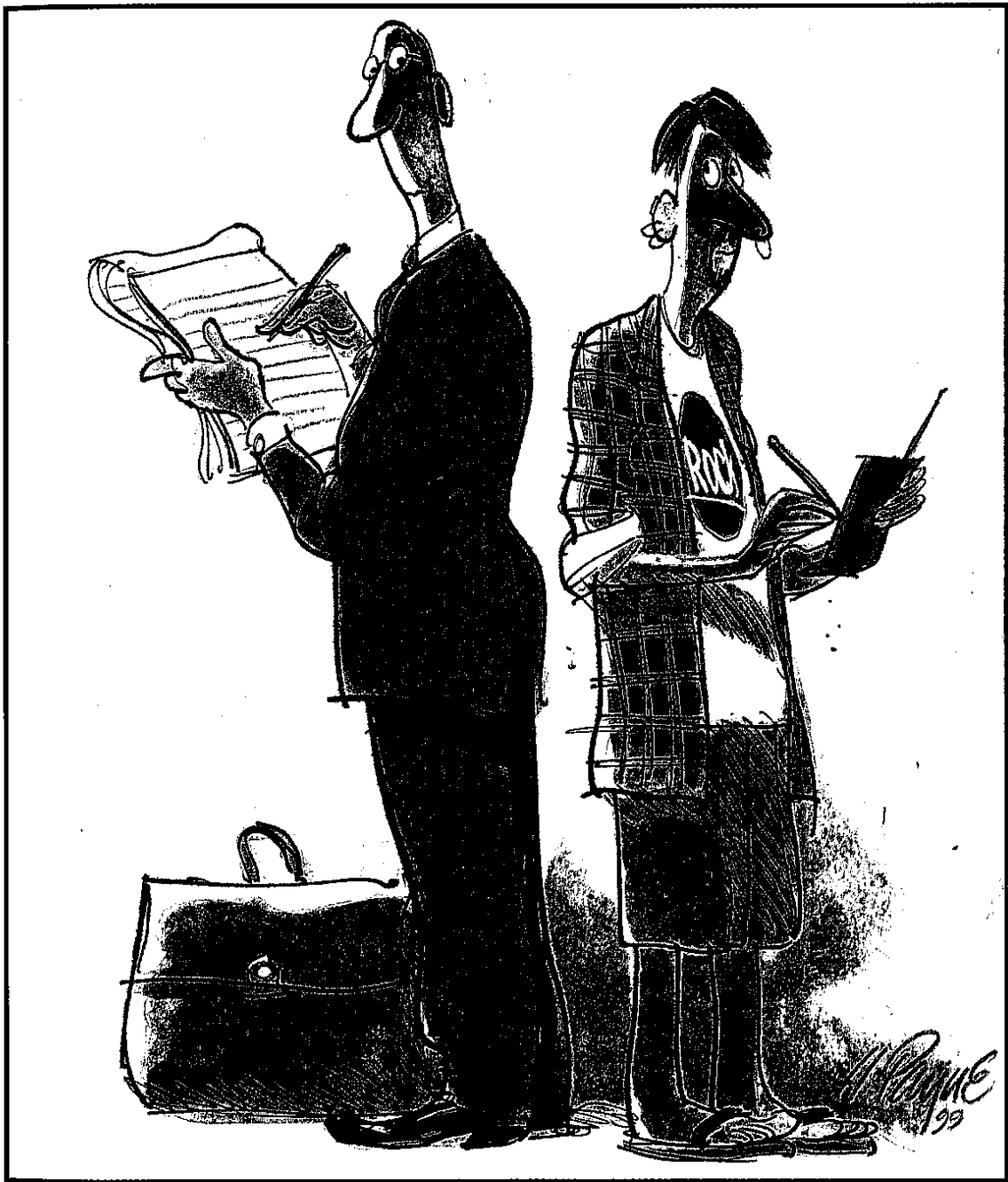


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Environmental Law Meets E-Commerce

THE END OF CITIZEN STANDING TO ENFORCE THE LAW?
CAN REGS BE DESIGNED TO GIVE BUSINESS A FREE LUNCH?

Electronic Impact

The era of e-commerce has arrived. Selling and purchasing by both consumers and businesses will change form, and demand will be created for new products and services and how they are delivered. It's time to start thinking of the environmental impact, and how unlikely our present regulatory system will be able to address it

DAVID REJESKI

Ten years from now, the environmental policy community may wake up and realize that they missed the Information Revolution. That would not be surprising. Revolutions are cruel, as Jacob Bronowski once noted, precisely because they move too fast for those whom they strike. Internet prophet and cyber-cowboy John Barlow recently commented in *Wired* that "only a very few people are aware of the enormity of this shift, and fewer of them are lawyers or public officials." Why should environmental policymakers pay any attention to something like electronic commerce? After all, environmental policy has worked rather well by focusing on manufacturing rather than services, on technology and regulation rather than information and knowledge, on the details of the law rather than the dynamics of systems. Electronic commerce is about convenience, not the environment, isn't it?

Maybe it is worth taking a closer look. Americans spent about \$2.2 billion on goods and services on the Internet in 1997, an amount that should reach \$7 billion by the year 2000, according to the Department of Commerce. Some believe these figures are low, by as much as a factor of 10 to 20. Business-to-business transactions are even greater: \$43 billion in 1998 expected to rise to over \$1 trillion by 2003. What is fueling this growth and enthusiasm? Few retailers can turn their backs on a potential global customer base of 100 million Internet users, a figure projected to grow to 510 million by 2003, and up to 1 billion by 2005. By 2000, even China is expected to have 4 million people online. The faster the growth, the greater the potential payoffs, a phenomena described by the inventor of the Ethernet, Bob Metcalfe, who noted that the value of a

network goes up as the square of the number of users. Studies have shown that the Internet is achieving much faster acceptance than previous major technologies. In just four years, 50 million people connected to the Internet. Correspondingly, it took 16 years for personal computers to reach that mark and almost 40 years before radio listeners reached that number. In less than four years, the number of Internet servers grew from about 100 to over 400,000. Volker Jung from Siemens summed up the rate of change when he commented that "in the age of the Internet, a year has only three months."

At the moment about 7 percent of U.S. households have purchased something online. In Great Britain, a study by InternetTrak showed that, of the 7 million people online, 3.3 million had bought something over the Internet during a recent six-month period. A study by Ernst & Young found the average Internet user is now middle class and middle aged, no longer the 20-year-old computer geek with limited disposable income. For those on the business side of the Internet connection, the cost of reaching customers through an e-commerce site is dropping, with some Internet service providers offering a Web presence for less than \$50 a month. For small and medium-sized businesses with limited marketing and advertising budgets, this is a dream come true. A study of emerging enterprises found that at least 25 percent believe that e-commerce will provide a majority of their revenue growth in the coming years. A recent survey of senior executives by EIU and Booz Allen & Hamilton found that half of them believed that the Internet would have a "major impact" on the global marketplace within the next three years.

Anticipating large growth and profits, computer hardware and software compa-



nies have been aggressively positioning themselves. A visible player has been IBM, but recently, software giant Oracle acquired Concentra Corporation, which produces software that supports Internet product ordering, and will be offering turnkey solution for businesses that want to venture into electronic commerce.

In addition, companies have been working to place their e-commerce sites within various Internet browsers and portals. Portal positioning provides fast access to huge customer bases (the search engine Alta Vista receives over 30 million hits per day, up from 13 million in mid-1996). Microsoft incorporated Walt Disney Company's retailing Web site, Disney Online, as an active channel in its Internet Explorer 4.0 browser. Amazon.com has cut a deal with America Online to position its site in front of AOL's subscriber base, Border's Books can be found in Infoseek, and Music Boulevard has placed its site in Netscape.

For the customer, this means quick, unparalleled access to goods and services (Buyer's Index provides a search engine to over 8,000 listed companies with 19 million products). E-commerce gives the consumer the ability to quickly undermine the one primary advantage of the seller — the consumer's lack of knowledge of competitive pricing — and couples this advantage with global reach, reducing barriers to international commerce. For increasing numbers of people with disposable incomes but no disposable time, e-commerce provides obvious advantages.

Are there dark clouds on the growth horizon? Focus groups have shown that security issues still dominate customer concerns and they probably should, since only one-half of the existing e-commerce sites have the encryption capabilities necessary to protect consumer data. Y2K problems could cripple e-commerce sites, but are unlikely to affect serious users. There are also uncertainties regarding state and local taxes. The Internet Tax Freedom Act, signed into law

last fall, provided a three-year moratorium on the imposition of state and local taxes on Internet transactions. States are quickly awakening to the potential loss in revenue. Tennessee has estimated it is losing \$50-100 million in sales tax revenues annually. Finally, some observers have noted a widening gap between haves and have-nots in the information economy and worry that electronic commerce will create a subclass of market and techno-savvy consumers empowered with the latest technology and global access to goods and services. Despite these problems, most analysts believe that the real question will not be growth but whether the growth of electronic commerce

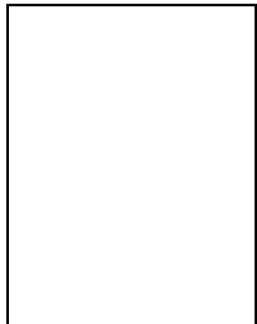
will be geometric or exponential. Andy Grove, the CEO of Intel, has gone so far as to predict that "in five years time all companies will be Internet companies or they won't be companies at all."

For environmental policymakers, the prospect of going to electronic commerce is bound to bring back memories of the "paperless office" or the long-awaited end to highway congestion due to telecommuting. Substituting electrons for materials and energy sounds good. However, electronic commerce is about more than simple material substitution. Anything that funda-

mentally affects the way business is transacted, and what is actually transacted, can have significant environmental implications. One can imagine buying a CD online and downloading it directly to a digital storage medium — no travel to the mall, no traffic congestion, no 10,000-square-foot store to heat or cool, no packaging to produce or dispose of. This strategy will work well in cases where products can be reduced to their information content, such as games, CDs, books, or software. E-commerce also favors what economists commonly call "search goods," where the main barrier to their purchase is finding the right combination of price and other attributes, versus "experience goods," which

The complexity and connectivity of the Web means potential for feedback loops leading to environmental effects much larger than anticipated — and in ways that are unanticipated

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must be experienced to evaluate their utility.

Electronic commerce can impact the environment in a variety of ways, all of them difficult to predict and quantify. The reason for this uncertainty was explained many years ago by the sociologist Charles Perrow and more recently by Edward Tenner in his delightful book whose title explains it all: *Why Things Bite Back: Technology and the Revenge of Unintended Consequences*. E-commerce is not a stand-alone technology, but a technological system (what economist Brian Arthur

calls a "technological ecology"). Not only is this system exceedingly complex, but the pieces are highly interdependent and tightly coupled. These two characteristics, complexity and tight coupling, cause system effects, both good and bad, to multiple rapidly and in unpredictable ways. This means that environmental effects could be much larger than anticipated — and in ways that are totally unanticipated. The environmental policy community needs to cast an ever-vigilant eye on a number of areas where electronic commerce might affect the environment.

First, there may be impacts associated with changes in the rate and means used for the transportation of freight as well as the substitution of Web sites for retail outlets. Second, there may be more indirect effects associated with the information

technology underlying e-commerce, specifically, the ability to exchange environmental information between businesses and between businesses and customers and the increased capability of customers to search for products and services with specific environmental attributes. Finally, electronic commerce may change the general level of consumption and its associated environmental impacts.

These impacts should not surprise us. The advent of the printing press changed our notions of intellectual property, the telephone restructured business activities, both geographically and organizationally, and rural free delivery gave rise to the mail-

order business. Communication and commerce have always been linked, but because many linkages are complex, assessing them is difficult, especially before the fact and over long time horizons. However we can use a number of vignettes to get a sense of the direction of the environmental impacts of e-commerce (positive or negative) and examine some potential trade-offs.

Overnight mail. Retailers trying to duplicate the experience of shopping at the local store, whether through catalogs or online venues, have an enormous incentive to reduce the time between purchase and product delivery, ensuring speedy gratification. Added to this push on the consumer end are pressures to reduce on-site inventory and provide more just-in-time delivery of parts and products. This drive for speed has two effects: it often results in trucks moving with their cargo spaces half empty and it shifts packages into faster transportation modes. When we opt for trucks instead of boats or rail, energy use goes up by a factor of four to five (from 400 or 500 BTUs per ton-mile to over 2,000). Moving the same package by air freight again increases the energy use dramatically (to over 14,000 BTUs per ton-mile). Patagonia, the high-performance outdoor clothing retailer, studied the impact of transportation decisions on the energy used to manufacture and ship its products and found that if the company used overnight mail, transportation accounted for a much larger part of the total energy needed to create and deliver a product, rising from 6 percent to 28 percent.

Though these effects may seem small on a per-package, per-truck, or per-plane basis, they become significant when multiplied by millions of packages. (FedEx alone moves over one million packages through its Memphis, Tennessee, hub on an average day.) Department of Energy studies have shown that the amount of energy used to transport freight in the United States has been steadily increasing since 1984 and now exceeds five quadrillion BTUs — enough energy to run the economy of Britain for six months. This energy use is associated with a variety of mobile-source pollutants such as sulfur dioxide, nitrogen oxides, particulates, carbon monoxide, and of course carbon dioxide.

To the extent that electronic commerce results in moving more packages less efficiently, transportation-related energy use and its associated environmental impacts will increase. In addition, online retailers have

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been aggressive in negotiating low-cost deals with overnight package movers to guarantee fast delivery. For instance, Net Grocer has negotiated delivery services with FedEx and can ship an average order of 40 pounds of groceries for about six dollars. FedEx is trying to tap into the Web-based business market directly with its "Virtual Order" service. Other package delivery companies will obviously follow, further driving down the cost. With real energy prices at a 30-year low, there are no price penalties to impede this trend.

Footprint size. Each system of retail — store-based, mail-order catalog, or electronic — leaves a distinctive footprint on the environment. Factors that shape this footprint include the amount of ecologically productive land needed to support the activity as well as other resource demands for energy, water, and materials associated with the creation and maintenance of the retail function. Catalog shopping, for instance, avoids the physical footprint of the retail outlet but has other environmental burdens associated with the production and distribution of 14 billion catalogs per year in the United States alone — 125 per household. E-commerce both avoids catalog-related environmental burdens and "dematerializes" the sales infrastructure. For instance, Amazon.com, with its Web site and half-dozen warehouses, is competing with Barnes & Noble, which has over 1,000 stores, all of them using land, energy, water, and scores of materials. Besides large differences in site-specific impacts, one could add the cumulative impact of the traffic flow to these stores, the energy consumed, land used for parking, and the potential productivity loss due to time in traffic congestion.

In their book *Our Ecological Footprint: Reducing Human Impact on the Earth*, Mathis Wackernagel and William Rees calculated that the average American needs 12.2 acres of farmland, forest, mines, and dumps to support his or her lifestyle. Of that sum, 2 acres are needed for transportation and consumer goods. A recent four-country comparative study by the World Resources Institute found that our consumption of energy, food, transportation, consumer products, and infrastructure mobilizes over 180,000 pounds of materials per-person per-year — 600 pounds per dollar of GDP. Reducing this resource footprint, while supporting basic needs for goods and services, is an important strategy for dealing with the environmental impact of increasing consumption levels.

As e-commerce changes the mix of environmental impacts from traditional retailing in ways that we are only beginning to understand, it is important to note that over time its footprint could become smaller, or move to other parts of the globe. Amazon.com, for instance, is experimenting with new print-on-demand systems that would allow it to print low-volume books directly in response to an order, further reducing requirements for warehouse and inventory space. This represents a more general trend toward customer-driven, lot-size-of-one manufacturing, linking customers directly to remote production/assembly systems. Dell Computer sells \$15 million worth of computers per day online, and its Web site allows customers to design and build their own PCs as well as track assembly and shipping status, which saves on telephone or fax inquiries. Levi Strauss & Co. now has a system that allows customers to literally drive the production of their own custom-made jeans. Such systems could work for shoes, eyeglasses, and eventually cars from the virtual showroom. Very rapidly customer decisions in Michigan affect production systems in Texas, Mexico, or Indonesia, and, more broadly, can result in consumption-related environmental impacts being shifted offshore. This becomes problematic if production is shifted to countries with weak or non-existent environmental, worker safety, or labor laws. In the final analysis, we must be concerned not only with the size of footprint, but its position globally. Who, exactly, are we stepping on?

Information flow. Most of the news stories and media hype on e-commerce has focused on business-to-customer transactions. But the fastest growth is taking place between businesses. Business-to-business electronic commerce has actually existed for almost thirty years, supported by a complex and technically challenging system developed originally by the trucking industry called EDI, for Electronic Data Interchange. Over 100,000 businesses in the United States use EDI running on separate networks, but the expense of these systems has left many

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small and medium-sized enterprises outside of the e-commerce loop. Recently, EDI has been modified to work with Web servers (Internet/EDI), making it more cost-effective for smaller businesses to become electronically linked to other suppliers and purchasers of products and services. The result of this transformation will be a production system that is totally linked from supply through manufacturing to the customer — a seamless string of information carrying capacity or what some refer to as a “fully integrated value chain.” What goes on this chain is not limited to conventional pricing, ordering, and inventory information but could include a variety of environmentally related data as well as other capabilities, such as videoconferencing.

The expansion of inter-business networking provides the necessary infrastructure to support the flow of environmental information across organizational boundaries as well, creating a potential fulcrum for leveraging, and improving, the environmental performance of supply and production chains. This could include the expansion of environmental management systems (such as ISO 14001) beyond facilities to the larger system of suppliers and sub-manufacturers. Countries that are moving from an emissions-based to a product-based environmental policy realize the critical importance of supply-chain intelligence. The new Integrated Product Policy of the European Commission focuses specifically on the need to develop better measures for transmitting environmental information up and down the product chain. Business-to-business e-commerce can do just that and, over time, closer information links between businesses and between businesses and their

customers may allow us to track environmental impacts throughout the production lifecycle and beyond.

Eco-friendly “bots.” Bot is short for “robot,” in this case a software robot — actually a small artificial intelligence program. Like their mechanical counterparts, bots do things for us based on a set of rules. Bots can sort

through your e-mail, look for things on the Web, etc. They are part of a larger class of tools known as “intelligent agents” that are designed to help us find our way around the Internet. Unlike most familiar programs and search engines, bots can operate without us and can be trained so their performance improves over time. Eventually, they may be able to communicate with each other, ask questions, make decisions, and respond to changes.

Bots could be used to search the global marketplace for the best combination of price and environmental attributes for any given product or service. For instance, they could continually search for e-commerce sites that offer clothing with organic cotton, eco-tourism packages, recycled-content products, verified carbon credits, or the lowest priced mid-sized sedan with the best gas mileage and lowest emissions. If comparative data were available (scorecards, rankings, etc.), bots could search for firms based on their environmental performance and philanthropic giving, compare that to consumer prices or stock values, etc. The result is new competition among firms to deliver the best “value” in not only price and quality but social responsibility.

The wide use of intelligent agents could have multiple impacts. First, they could open up the small niche markets for environmental goods and services to millions of new customers. Second, they could change the nature of competition and undercut the monopoly power of firms. Finally, they could impact transportation-related energy use since trips to stores are often related to consumer efforts to acquire more information on price, performance, and other product attributes. The Internet flips the dominant advertising equation from a *one-to-many* broadcast approach to a more personal *one-to-one* model. It will create a new generation of information-empowered buyers who have the capacity to seek out specific goods and services in real time rather than being dependent on a time-delayed flow of information from retailers. In the end, however, the emergence of environmentally smart buying using intelligent agents will still depend heavily on the intelligence of consumers — their environmental literacy and level of concern. If consumers are confused about the sources of pollution and the scope and consequences of resource depletion, they will have a hard time making informed environmental choices, online or otherwise.

The applicability of law to Internet-based commerce says nothing about its enforceability, and the borderless nature of the Internet raises questions about jurisdiction



More stuff. One of the largest unknowns is whether the ease of point-and-click purchasing will cause people to buy more, increasing the “mass” in mass consumption. That is exactly what retailers are hoping. In the mail order business, profits are very dependent on the size of the purchase. What retailers fear is a large number of small purchases where transaction costs eat away their profit margins. The hardware company W.W. Grainger has seen the average online transaction rise to the point where it is now double the offline average at their retail outlets. Data from Germany indicate that customers at online book sites are spending about twice the average spent in bookstores. Without more study, it is difficult to tell whether these trends indicate an absolute increase in consumption, a move towards larger but fewer purchases, and/or a shift from store-based to online purchasing. However, because changes in the level and nature of consumption can affect the environment, more research and monitoring of these trends from an environmental perspective is urgently needed.

These vignettes are the visible part of a new business model. Electronic commerce will alter the rules that have governed trade in the past, and it is in its infancy. Only bandwidth is keeping us from a form of e-commerce that is truly multimedia and multichannel. Soon you should be able to log on to an e-commerce site and interactive video allows direct visual and speech contact with a sales representative 3,000 miles away. The company knows exactly what you have bought in the past even if you forgot, and can compare your tastes in clothes to others with similar incomes and buying patterns. Based on this profile, the representative advises you as you pick and chose from thousands of items, trying them on using a virtual model of your body and examining yourself from any number of angles and in different lighting situations. You can even try on a new shirt with that jacket you bought last year (its specs are stored in memory). You buy with a click of the mouse and the goods land on your doorstep the next day.

This is about more than putting the Sears catalog online. Shopping has emerged as an art form. It is increasingly about entertainment, and the potential to entertain and

amaze with the Internet is boundless, especially for a new generation growing up with their feet planted firmly in cyberspace. Economists Hal Varian and Carl Shapiro have made the point in their book *Information Rules* that many of the old rules governing economic growth no longer hold in an information-based economy. That is why a company like Amazon.com, currently making no profits, can be valued at \$20 billion; why venture capitalists have pumped \$3.8 billion into over 500 electronic commerce companies since 1995, and why the semiconductor giant Intel has invested in over 50 e-commerce start-ups. People are investing in an image of the future. Exactly what rules might apply to this future are unclear but we are dealing with a phenomenon which changes the notions of property and ownership, the boundaries affecting jurisdiction, the dynamics of value creation, and the nature of competition.

It is likely that the myriad of impacts associated with rapid expansion of e-commerce will be hard to understand and analyze using today’s models and yesterday’s mindsets. Though the Internet is built on a physical infrastructure, the best metaphors to describe its function are biological, not physical, and its behavior is non-linear — characterized by random interactions, complex feedback loops, discontinuities, and trends that are not fully foreseeable. MIT scholar Charles Ferguson observes that the complexity of systems grows with the square of the number of nodes — which quickly undermines traditional approaches to centralized bureaucratic control. In such complex systems, policymakers can more easily make the wrong choices in terms of where and how to intervene; or their interventions, while achieving short-term objectives, can compromise the functioning of the system over the long term.

Despite the difficulties in steering complex systems, and libertarian arguments against interference in the operations of the Internet, there are a number of existing legal frameworks that could be applied to both Internet-

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based transactions and the individuals and businesses engaging in these transactions. Three areas are particularly relevant to legal scholars and practitioners: intellectual property rights (e.g., The Paris Convention on the Protection of Intellectual Property, Berne Convention for the Protection of Literary and Artistic Works, and Universal Copyright Convention), contract law (e.g., the UNCITRAL Model Law on Electronic Commerce, Uniform Commercial Code, and Uniform Electronic Transactions Act), and state regulation (e.g., consumer protection, gaming, obscenity laws). The problem with these laws, especially those governing state regulation, is that the borderless nature of the Internet raises broad interjurisdictional issues and creates resource-intensive requirements for harmonization between sovereign states. In addition, the applicability of law to Internet-based commerce says nothing about its enforceability, which may be exceedingly difficult (consider the existing problems in enforcing copyright laws on Internet transfers). In a recent paper on *Constructing a Framework for Regulating Electronic Commerce*, Lar Davies has suggested that any regulatory framework applied to electronic commerce must remain highly flexible over time; he recommends an adaptive, layering approach as well as the use of regulatory arbitrage.

As an alternative to regulation, third-party auditing has emerged. Recently a joint task force of the American Institute of Certified Public Accountants and the Canadian Institute of Chartered Accountants designed an independent certification program for e-commerce sites called WebTrust which will be based on an audit of a firm's business practices, transaction integrity, and privacy and security provisions. Information gleaned from environmental audits or the lifecycle assessment of products could also be included in audit programs and used to competitive advantage by companies.

Finally taxation, including some form of taxation on environmental externalities, is theoretically possible but may be hard to implement and politically unpalatable. Though the Treasury Department has stated that it would set up "toll booths on the information highway" for tax purposes, most experts believe that the nature of the Internet would make that impossible. Some researchers are talking about the eventual collapse of taxation as the Internet makes financial transactions harder and harder to tie to localities.

It may be possible, however, for state and local governments to provide tax incentives to retailers who forgo bricks and mortar in favor of a cyberstore or for municipalities to set up electronic commerce centers for their local businesses.

What's left? Remember the mantra of the e-commerce world: "The buyer always wins." Armed with global reach and increasingly intelligent search capacity, our most powerful ally may be an environmentally literate consumer. That consumer could be a suburban family wandering through the eco-cybermall but it could also include the government, armed with an executive order mandating environmentally preferable purchases (modeled on E.O. 13101, signed last September), or businesses interested in managing their supply chains for environmental results. In this world, environmental literacy also becomes one of our most important needs. Consumer education is not a quick fix, but in a dynamic system plagued by political upheavals and shifting agendas it might provide the only long-term solution. In a recent book on the nonlinear, chaotic nature of politics, *Serpents in the Sand*, Courtney Brown has emphasized the critical role of an environmentally literate public in a rapidly changing world, declaring that "if nonlinearities dominate the political-environmental system, it may be futile to try to fine-tune current environmental policies in a rational-decisionmaking sort of way."

The Internet is today's frontier. Those on this frontier must confront the challenge of adapting to a shift from a physical to knowledge-based economy, a world where the central event, as George Gilder has noted, is the overthrow of matter. The traditional tools of environmental policy may not work well in a world like this, if they work at all. In the end we may have to relinquish our desire for control and replace it with the will to understand an exceedingly complex and dynamic system. In a world where prediction is difficult and the traditional rules of markets have been altered, flexibility, adaptation, and co-evolution represent the only viable strategy. Whether the larger environmental policy-making community is prepared to adopt such a strategy remains both the question and the challenge. •