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A COMPLEX(ITY) STRATEGY FOR BREAKING THE LOGJAM

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In this essay, we explore how the Environmental Protection Agency (EPA) might use technology to improve the agency's level of scientific expertise and to obtain useful information sooner to inform EPA policymaking. By creating a self-reinforcing collaboration between government and networked publics, new web-based tools could help produce change within government and without—namely governmental decisions informed by better data obtained through citizen participation and civic action coordinated with governmental priorities. The agency has the opportunity to help break the logjam of environmental policymaking by developing transparent and participatory mechanisms for expert citizen participation. The key insight is not to throw open the floodgates to undifferentiated public input, but to design group-based processes that enable online communities to collaborate on finding and vetting information for agencies.

After expanding on our core argument and addressing initial counter-arguments, we briefly discuss the current state of public participation. We then discuss the potential for technology to create more effective collaboration by uniting experts from multiple disciplines and both the public and private spheres. To illustrate how technology can facilitate collaboration between agency and public, we use the Peer-to-Patent pilot program, recently adopted by the United States Patent and Trademark Office. We conclude by discussing innovative ways that EPA

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could integrate similar methods into its decision-making processes.

I. A COMPLEX APPROACH

Extending the intelligence of governmental institutions by connecting them to networks of collaborating groups provides the prospect for evolving appropriately complex solutions to the world's increasingly challenging environmental problems. As Hayek pointed out, centralized planning is prone to failure due to the inability to aggregate distributed knowledge.¹ Rather than asking simply how the law can be amended to improve the environment (or how government or corporations should work), we can focus on how we can catalyze the rich social processes that allow both centralized governmental institutions and large numbers of people to work together to improve our environmental condition.

Individuals considered in isolation, perhaps participating one-on-one in voting or in markets, have little ability to spur environmental improvements. Though new pricing schemes might change incentives, individual members of the public lack sufficient information and power to affect broad change. They usually act according to self-interest and overgraze the commons. Thus, we tend to be skeptical about the value of changing our light bulbs or reducing the air in our tires when juxtaposed against a sweeping international treaty even when such treaties are slow in coming and easily countermanded.

But decentralized, individual action is not the only alternative. Connecting individuals to institutions through networks helps to produce large-scale social change. We think better when we think together. Collaboration yields better information and we should want government to make the best-informed decisions possible. But collaboration also enables individuals to become more effective. The more effective we can become as individuals by participating in communities of governance, the more powerful we can become as citizens participating in the life of our democracy.²

¹ See Friedrich A. Hayek, *The Use of Knowledge in Society*, 34 AM. ECON. REV. 519, 519-20 (1945). Though Hayek focused on the economic implications of disaggregated knowledge, his contention also applies to the law.

² "When done well, public participation improves the quality and legitimacy of a decision and builds the capacity of all involved to engage in the policy process. It can lead to better results in terms of environmental quality and other

In addition to changing outmoded laws, we should also strive to create new social organizations that bring government institutions and the public together to collaborate on setting environmental priorities and affecting widespread change.

Congress has failed to pass a major piece of environmental legislation since 1990. As the organizers of the Breaking the Logjam symposium note: "The result is that many environmental problems remain unresolved: the oceans have become increasingly degraded and their fish stocks depleted, urban sprawl and traffic congestion threaten our ecosystems, and factory farms contaminate the environment in many parts of the country. And the U.S. has been unable to successfully deal with many new environmental problems, most prominently climate change."³ This volume's reformist call-to-arms—consonant with a growing body of legal scholarship about regulatory and institutional pluralism⁴—also imagines that new ways of working are necessary, such as developing approaches that cut across regulatory silos and using market mechanisms as leverage, such as in congestion pricing strategies.

But this vision assumes the unchanging permanence of the design of government institutions. In particular, it assumes that the administrative state must continue to be the expert decision-maker, rather than envisioning the state as a coordinator of actions by a wider array of participants. At the very least, traditional reform approaches, even ones that attempt to be cross-institutional, fail to envision a role for greater citizen participation in decision-making.

The new science of complex systems⁵ suggests that people

social objectives. It also can enhance trust and understanding among parties." COMM. ON THE HUMAN DIMENSIONS OF GLOBAL CHANGE, NAT'L RESEARCH COUNCIL, PUBLIC PARTICIPATION AND ENVIRONMENTAL ASSESSMENT DECISION MAKING 9-3 (Thomas Dietz & Paul C. Stern eds., 2008), available at <http://www.nap.edu/catalog/12434.html>.

³ BREAKING THE LOGJAM: AN ENVIRONMENTAL LAW FOR THE 21ST CENTURY, BACKGROUND OF THE BREAKING THE LOGJAM PROJECT, <http://www1.law.nyu.edu/conferences/btl/background.html> (last visited Oct. 20, 2008).

⁴ See, e.g., Paul S. Berman, *Global Legal Pluralism*, 80 S. CAL. L. REV. 1155 (2007).

⁵ This is a vast new field of scientific inquiry, spurred by collaborative work at the Santa Fe Institute and applicable to biological, economic and social systems. Many in the environmental area will find this familiar. Outlining the substance of this science is obviously beyond the scope of this article, but we

could become a key component of any solution to environmental problems when organized together in groups (online) and when coordinating their actions with those of others (most importantly including government). This is because social organisms have the ability to repair themselves and replicate; they evolve when interactions reach a critical level of complexity. Through social interaction—when specific roles and tasks are well-defined to enable collaboration—groups of people can better achieve their goals. Rethinking environmental policy demands becoming better at creating the conditions under which group power flourishes.

Complex systems science teaches us that organisms (indeed, life itself) flourish(es) at a “sweet spot” between randomness and rigidity. That is to say, the complex flow of signals among autonomous agents becomes richer and more diverse when ambient conditions allow just enough flexibility to adapt to new challenges and just enough order to allow the persistence and replication necessary to enable evolution to operate. For more complex social systems, this means that the primary goals of any governmental effort should be to (1) recognize whether relevant social subsystems have moved too far towards the random or rigid side of the continuum (as they do when we become constrained by outmoded environmental legislation and regulation) and (2) intervene to nudge these systems back towards the sweet spot in the middle, opening it up to new signals and interactions.

We believe that one answer to our environmental challenges is to be found in enabling people acting together in groups to accomplish goals they conceive to be in furtherance of an environmental improvement. Want to clean up a local park? Enlist the neighbors. Want to shut down a polluting company? Enlist the customers. Want to encourage everyone to use less energy? Enlist a movement of people who will spread the word about the benefits of energy conservation. Want to find out what level of protection is appropriate for certain areas of the sea?

include in the body of the article the main points we think are relevant for planning new approaches to governmental (and public) action to solve environmental problems. *See generally* THE BIOLOGY OF BUSINESS: DECODING THE NATURAL LAWS OF ENTERPRISE (John Clippinger ed., 1999); JOHN HOLLAND, HIDDEN ORDER: HOW ADAPTATION BUILDS COMPLEXITY (1996); STUART A. KAUFFMAN, THE ORIGINS OF ORDER: SELF-ORGANIZATION AND SELECTION IN EVOLUTION (1993).

Enlist an army of volunteers to collect and study the relevant data. Make a movie. Make a movement. Do not just write laws. Do not just complain to those who do.

II. CHANGING NATURE OF EXPERTISE

Before we move to addressing concrete examples of how EPA might beneficially adapt to networks, we must first unpack two ideas—and thereby address two counter-arguments—implicit in this discussion of collaboration and complexity. First, in this section, we address the myth that government knows best. This applies whether we are talking about Congress or agencies, government at the federal, state, or local levels. In the next section, we address how networked publics are in any way different from the corporations, interest groups, and other organizations that currently populate the Beltway ecosystem and participate in policy-making.

In a democracy, citizens typically rely on a professional elite to make specific administrative decisions in the public interest. Governmental professionals decide on acceptable levels of mercury emissions in the air, anti-discrimination rules in education and the workplace, and the standards for cross-ownership of newspapers and broadcasting stations.

The notion that government officials can deal in a limited amount of time with complex information regarding the global economy is a myth. Poor decision-making leads to grave consequences for jobs, the economy, education, healthcare, and every issue of importance. Even in the absence of personally corrupt motives (and independent of political value preferences), the bureaucrat in Washington often lacks access to the right information or to the expertise necessary to make sense of a welter of available information. In a survey of environmental lawyers, for example, only 8 percent of respondents strongly agreed that the EPA has sufficient time to search for relevant science before making a decision about environmental policy and only 6 percent strongly believed that agencies employed adequate analysis in their decision-making.⁶ In the United States Patent Office, the examiner, who is tasked with deciding which invention will

⁶ J.B. Ruhl & James Salzman, *In Defense of Regulatory Peer Review*, 84 WASH. U. L. REV. 1, 26 (2006).

receive a twenty-year grant of monopoly rights, has little more than a dozen hours in which to do all the research and write up a decision.

A handful of professionals in a government agency is unlikely to possess as much information as the many dispersed individuals in the field. Indeed, in the 2006 IBM Global CEO Study, when asked where they looked for fresh ideas, corporate chief executives cited clients, business partners, and employees far more than their own research and development labs.⁷ This supports the popular adage: No matter who you are, most of the smartest people work for someone else. Known as Joy's Law (for Bill Joy, the co-founder of Sun Microsystems), this quip pinpoints the core challenge faced by all organizations in an exploding information ecosystem, where most knowledge is outside the boundaries of the institution, including government.⁸ In today's age of networks, Joy's Law implies opportunity through shared resources, not the problem of limited resources.

Empirical work demonstrates that people are more effective when they work together as a group. As Stephen Kosslyn, Chair of the Harvard Department of Psychology and head of the Harvard "Group Brain" project explains, working together allows us to utilize many different tools. Because we "simply [do not] have enough genes to program the brain fully in advance," we must extend our own intelligence with what he terms social prosthetic systems.⁹ At the most basic level, we need to pool our diverse knowledge and skills. Even institutions need prosthetic extensions to make themselves smarter and more effective. We can use the Internet to assemble more capable teams, drawing on expertise across disciplines and the public/private divide.

Similarly, dividing a policy problem into smaller parts so that collaborative teams can work on it facilitates openness and innovation. This openness may not just help government do its job

⁷ Press Release, IBM, Majority of Global CEOs Plan Fundamental Change and Expect New Forms of Innovation to Drive Growth (Mar. 1, 2006), available at <http://www-03.ibm.com/press/us/en/pressrelease/19289.wss>.

⁸ Karim R. Lakhani & Jill A. Panetta, *The Principles of Distributed Innovation*, 2 INNOVATIONS: TECH., GOVERNANCE, GLOBALIZATION 97, (2007), available at <http://www.mitpressjournals.org/doi/pdf/10.1162/itgg.2007.2.3.97>.

⁹ Stephen M. Kosslyn, *On the Evolution of Human Motivation: The Role of Social Prosthetic Systems*, in EVOLUTIONARY COGNITIVE NEUROSCIENCE 541, 543 (S.M. Platek, T.K. Shackelford & J.P. Keenan eds., 2006).

better; it can introduce the problem to more people, allowing competition for solutions to emerge. Impelled by a government mandate, the private sector and civil society might suggest their own solutions. If we use network technologies to construct the architecture of participation, we can elicit more valuable contributions from citizens. But making this happen requires some coordination. That is where state institutions can still play a vital role.

We already have an architecture of policy-making that involves a wide array of actors. Corporations participate through lobbyists and notice-and-comment rulemaking. Non-governmental organizations funnel information to government through think-tanks and their whitepapers and publications. Interest groups also lobby and enlist their members to respond—usually with postcards and email—in rulemaking and legislative policymaking. With so many groups already involved, it is not clear how online, networked groups are different. It is also not clear what will prevent new, networked publics from becoming as entrenched as the lobbying culture that contributed to the logjam in the first place. Inviting more public participation is not simply a duplication of current notice and comment processes or a recipe for a different form of lobbying. If we create the right practices, we create structures to reward participation and encourage high-quality contributions, hard work, and good behavior, even as we create disincentives for manipulation and abuse.

First, giving ordinary people—as distinct from corporations and interest groups—the right and ability to participate enables them to form new groups better suited to address new problems. Alone, there is not much any one person can do to bring about change or to participate meaningfully and usefully in a policymaking process. But, working together, a group can take action at scale. Additionally, the network structure allows groups to remain sufficiently adaptable, so that group action can continuously adjust to address the most pressing problems. Online groups can change their collective goals more quickly than can traditional organizations that hire full time employees and lock-in around their own institutional and individual priorities.

Second, working in networked groups that convene people of diverse skills and shared enthusiasm expands the range of ways in which people can participate. The practice of using technology to

make information gathering a more collaborative part of policy-making, not only by making more people aware of a problem but also by pulling more people into the work of government, begins to take the bureaucracy out of bureaucracy. It can augment the official's social toolbox with the capacities and skills of non-governmental experts.

Third, by opening up the decision-making process to group participation, we may begin to create feedback loops that go beyond mere data-gathering and, instead, create communities of collaborative action that engage even more people in environmental reform.

III. CITIZEN PARTICIPATION TODAY

At present, engaging with the public does not always produce good results. Traditional forms of notice-and-comment rulemaking solicit expertise too late in the process after draft regulations are already a *fait accompli*.¹⁰ The participation in response to notice-and-comment rulemaking suffers from problems of quality. Critics complain of a range of defects, from regulatory capture—excessive influence of regulators by those stakeholders whom they regulate—to excessive participation by individuals who carp but offer little information to inform the process.¹¹ Because the playing field is biased towards legal and interest group professionals, it is often only interested parties “inside the Beltway” who provide information to the agency.¹² At the same time, potential participants overburden the regulator with “postcard comments,” written and duplicated by an interest group without offering any new information to the decision-maker.¹³

While science advisory boards and peer review (and science review panels) help to introduce expert information into agency practices, these methodologies have limitations. At first glance, it would seem that peer review is a fairly conservative means to attack the information quality problem and provide much needed oversight and accountability. But the biases of participants chosen

¹⁰ Beth Simone Noveck, *The Electronic Revolution in Rulemaking*, 53 EMORY L.J. 433, 454 (2004).

¹¹ *Id.* at 455.

¹² *Id.* at 453.

¹³ *Id.* at 479–80.

for peer review inevitably skew the process. There is no assurance of transparency in participant selection. Peer review notoriously produces a buddy system in which insiders reward friends and punish enemies. And the high cost of having to select peers and administer review means that people can only wind the machinery into gear on limited occasions.

By empanelling peers, rather than allowing them to self-select, the agency misses out on relevant sources of expertise. Typically, decision-makers invite only certain kinds of industry and academic experts to participate in peer review processes. Those limitations need not be based on politics—though a political litmus test is sometimes imposed (as has often been the case in the Bush Administration)—but may also be based on profession and thereby foreclose disciplinary diversity. Or the practices might derive from status and thereby shut out otherwise qualified participants with meaningful contributions. There are those who possess a great deal of expertise but do not necessarily have the “right” credentials. Thus, science advisory boards have limited usefulness.

However, when agencies open regulatory processes to public comment, agencies often are overwhelmed by comments, many of which are unusable. The EPA received over half a million comments in response to its Clean Air Mercury rulemaking in 2004. Only 4,500 of these were unique.¹⁴ These postcard comments often have more to do with interest groups mining for data and donations from potential members than informing policymakers. Either rulemakings receive no response, or there is an avalanche of identical comments. In many cases, prolix comments arrive at the eleventh hour, hand-delivered minutes before the deadline to thwart instant electronic access to the comments of corporate rivals.

Some agencies have attempted to introduce technology into the consultative process, but these have not improved decision-making practices as much as they might. In the United States E-Government Act of 2002, Congress legislated “e-rulemaking” to put the APA public comment process online and “improve the

¹⁴ U.S. ENVTL. PROT. AGENCY, CONTROLLING POWER PLANT EMISSIONS: PUBLIC COMMENTS, http://www.epa.gov/mercury/control_emissions/comment.htm (last visited Oct. 23, 2008).

quality and use of Federal information to strengthen decisionmaking".¹⁵ While thirty agencies were already using the Web to put notice of rulemaking activity on the Internet and make relevant documents available in electronic form, e-rulemaking consolidated activity and spending (and therefore power) around one, centralized website under the control of the Office of Management and Budget.¹⁶ But the digitization of citizen participation practices has not worked well. The Regulations.gov website merely lists a draft rule and provides a box and a button to "click here for comment." The web has made it easier for machines or "bots," rather than people, to send electronic comments via the website, further deluging the agencies with unusable information. The FCC received hundreds of thousands of comments in response to its proposed rule weakening the standards for cross-ownership of broadcasting outlets.¹⁷ Online participation is evolving from notice-and-comment into "notice and spam."¹⁸

The design of the electronic process, as distinct from the traditional, paper-based form of participation, does not encourage better-informed participation or greater representation of those who are not participating in the process. While e-commenting makes the opportunity to comment more accessible, employees do not organize nor sort the blizzard of comments on regulations.gov by any meaningful search criteria. Comments are not deliberative; they do not respond to one another but are one-off communiqués between submitter and agency. When the Forest Service ran a controversial rulemaking in 2000 to make one-third of the lands under the National Park Service's control free from road construction, it allowed people to submit comments online but did not allow submitters to see one another's comments.¹⁹

With so many comments, commentators as well as agency officials do not have the resources to consider the merits of each and formulate considered replies. In some agencies, the review of

¹⁵ E-Government Act of 2002, 44 U.S.C. § 3501(4) (2000).

¹⁶ REGULATIONS.GOV, <http://www.regulations.gov> (last visited Aug. 15, 2008).

¹⁷ Cary Coglianese, *Citizen Participation in Rulemaking: Past, Present, and Future*, 55 DUKE L.J. 943, 954, 956–57 (2006).

¹⁸ Noveck, *supra* note 13, at 441.

¹⁹ Stuart Shulman et al., *Electronic Rulemaking: A Public Participation Research Agenda for the Social Sciences*, 21 SOC. SCI. COMPUTER REV. 162, 163–64 (2003).

comments has to be outsourced. In a study of Regulations.gov in 2003, the U.S. General Accounting Office found that the website did not generate a steadier stream of useable comments.²⁰ As University of Pennsylvania rulemaking scholar Cary Coglianese notes, the introduction of online commenting “has not had any substantial impact on public participation in rulemaking.”²¹ Perhaps surprisingly, the advent of e-commenting has increased paper-based submissions as some believe that taking up space on the regulator’s desk will increase the likelihood of being heard.

IV. TECHNOLOGY’S POTENTIAL IMPACT

Technology has the potential to greatly improve public contributions to regulatory decision-making. A technological turn toward networked, collaborative governance would enable us now to work in groups across distance and institutional boundaries. Technology can reinforce the sense of working as a group by recreating some of the conditions of face-to-face work environments that build trust and belonging even without the benefit of physical proximity.

Sixty million people use the Firefox Browser. Ten thousand of them participate in building and testing it. By asking a community to help fix bugs in the software and rewrite the code, the organization begins to rely more and more on its community. As the community comes to be more involved, control becomes dispersed. Everyone in the network has an influence. What begins as a set of practices for information gathering may result in feedback loops that, in turn, create communities of collaborative action and engage even more people.

Similarly, if we start to think about taking a policy problem and dividing it up into smaller parts so that it can be distributed and worked on by collaborative teams, we begin to drive towards openness and innovation. And this is why inviting more public participation is not simply a recipe for a different form of lobbying. As in the Mozilla context, if we create the right

²⁰ Cary Coglianese, *The Internet and Citizen Participation in Rulemaking*, 1 I/S: J.L. & POL’Y INFO. SOC’Y 33, 52 (2005); Coglianese, *supra* note 17, at 954–55. The study was conducted shortly after the site’s creation but even a year after its creation, the site had not generated significantly more comments.

²¹ Coglianese, *supra* note 17, at 954.

practices, we can evolve norms and structures to reward participation and encourage high-quality contributions, hard work, and good behavior, even as we create disincentives for manipulation and abuse.

V. FROM DECISION-MAKER TO COORDINATOR: ASKING GRANULAR QUESTIONS

“Crowdsourcing will not create any genuinely new things,” unless people know what is being asked of them.²² Wikipedia users know what to do because they understand what it means to write a “neutral viewpoint” entry to an encyclopedia. People share a common image of that collective goal. Few people have a strong preconception about how best to participate in governmental decision-making. Thus, it is essential to articulate the questions, a task that is just as hard for those asking as for those answering. The online collaborative endeavor that produced the Linux operating system took off because Linus Torvalds, then just a teenager living in Finland and not yet the leader of a world movement in Silicon Valley, asked for help porting the Minux how-to-make-an-operating-system teaching tool to his own computer.²³ His very specific question galvanized the contributing community.

Ask a hard, specific question and you will get a good, specific answer. A granular question will attract a larger potential pool of self-selected solvers. Getting governmental authorities to communicate their needs to citizens so that people understand what is being asked of them is vital to ensuring that environmental activists can supply information to government in manageable and useful ways.

What does this mean in practice? Imagine if, in connection with every notice-and-comment rulemaking, an agency had to articulate ten questions to which it needed responses in order to draft the final rule. Or, better yet, what if it asked these questions

²² Video recording: Jay Rosen, *The Future of Professionally Created Content*, Address at the Legal Futures Conference, Stanford Law School (Mar. 8, 2008) available at http://www.law.stanford.edu/calendar/details/1594/#related_information_and_recordings.

²³ ERIC STEVEN RAYMOND, *THE CATHEDRAL AND THE BAZAAR* (2000), available at <http://gnuwin.epfl.ch/articles/en/cathedralbazaar/cathedral-bazaar.pdf>.

before the drafting process begins. Technology can make it possible to disseminate specific questions and gather useful responses in every domain.

It may seem simplistic to propose this as a core innovation because its absence from the practices of public policymaking is profound. We are suggesting that government ask relevant and useful questions of more audiences. Because of our entrenched culture of expertise, believing that institutional actors are in the best position to make decisions in the public interest, agencies rarely ask the public for more than an opinion on pending regulation.

Asking questions specifically not only helps to identify the tasks that need to be done but provides the rationale to the participating contributors for doing them. If people are to give of their limited time, they need to know the context for their involvement. Framing the question is important to ensuring that work that is being asked of them is not mere "make work" nor unduly broad in scope (i.e., solve the climate change crisis) because in most cases it will not be paid labor. People need to be able to accomplish something working in short bursts of online collaboration.

Certain kinds of decisions lend themselves to aggregating answers across a network. Sometimes those are questions that require brute numbers of participants. This aggregation may be automated. The SETI@Home project is an experiment that uses Internet-connected computers in the Search for Extraterrestrial Intelligence (SETI). Networking software allows people to break large projects into discrete units that multiple users or computers can complete, combining small efforts of thousands to complete large, complex and time-consuming tasks. The SETI@home project²⁴ links hundreds of thousands of computers together to share their excess processing power, allowing researchers to search for extraterrestrial life among millions of images.

Other projects, rather than just use surplus processing power, harness individuals' brainpower. The NASA Clickworkers project, rather than just use surplus computing power, trains individuals with no prior scientific background to classify the age of craters and landforms on Mars from images taken by various

²⁴ SETI@HOME, <http://setiathome.berkeley.edu/> (last visited Aug. 15, 2008).

spacecraft.²⁵ NASA combined the volunteers' contributions to create a map of the ages of different regions of Mars.

Networks can also allow thousands of users to contribute and aggregate their own information. Photosynth lets large numbers of people take pictures and assembles their work whether for citizen science or other goals, including documenting geographic spaces and communities.²⁶ Mapufacture²⁷ enables collaborative map building. Mapufacture lets people build maps and data sets on their own or by building off of publicly available geospatial documents, assisting a "non-profit that wants to share information about an area you're helping—or a relief worker who wants to make it easier for people in the field to get the information that is useful to them when and where they need it."²⁸ It is a small step from this to asking citizens to provide GIS locations for environmental hazards or to crowdsource data about clean air or water in their communities.

More complex collaborations are also possible. Some questions require more than a yes/no or multiple choice answer. An organization may need to identify but not aggregate a large number of answers across a network. Many problems lend themselves to different solutions. This "wiki-style" approach to collecting information engages people in identifying the pieces to solve a complex problem. Where there is no one right answer, this approach can help in forming a strategy and setting regulatory priorities.

Networking technology also makes prediction markets possible. Prediction markets take advantage of new technology to automate the aggregation of discrete votes from people.²⁹ James

²⁵ Michael Szpir, *Clickworkers on Mars*, 90 AM. SCIENTIST 226 (2002).

²⁶ MICROSOFT LIVE LABS, Photosynth, <http://labs.live.com/photosynth/> (last visited Aug. 15, 2008).

²⁷ MAPUFACTURE, <http://mapufacture.com/> (last visited Aug. 15, 2008).

²⁸ *Id.*

²⁹ Some examples of prediction markets are Simon and Schuster's new MediaPredict project, which encourages readers to guess which manuscripts will become best-sellers, MEDIAPREDICT, <http://mediapredict.com> (last visited Aug. 15, 2008); the Iowa Electronic Markets, which have been successful at guessing the results of presidential elections, UNIVERSITY OF IOWA COLLEGE OF BUSINESS, IOWA ELECTRONIC MARKETS, <http://www.biz.uiowa.edu/iem> (last visited Aug. 15, 2008); and the Hollywood Stock Exchange, which does remarkably well at predicting Oscar winners, HOLLYWOOD STOCK EXCHANGE, <http://www.hsx.com> (last visited Aug. 15, 2008).

Surowiecki's *The Wisdom of Crowds* has popularized the idea that people can use technology to create aggregated predictions that are more accurate than those of any individual.³⁰ Such "prediction markets" are empirically good at reducing uncertainty and can be useful for identifying "big mistakes."³¹ Business is increasingly turning to online predictive mechanisms to aggregate private information to inform decision-making. Unlike traditional voting or polling, such "markets" require the participant to back up his guess with a bet, usually using fake currency or points. A tool site called "Kluster" allows users to set up projects and then to "invest in" those projects.³² In other words, it makes it possible to bet on a project's likely success and thereby establish a futures market to drive good ideas. These probabilistic mechanisms are not always accurate and we are still learning when they work, but they are one way of aggregating discrete answers to inform a decision.

In addition to questions to which there is an answer that people can arrive at by prediction or those which require aggregating information, there are those questions for which the pieces of the answers are already identified but demand evaluating, drawing connections, and making sense of conflicting information. Again, new technology can be useful at enabling distributed networks to collaborate on data analysis and evaluation.

VI. PEER-TO-PATENT

By way of example, the Peer-to-Patent: Community Patent Review pilot (www.peertopatent.org) is a new architecture of participation.³³ This first experiment with web-based collaboration

³⁰ JAMES SUROWIECKI, *THE WISDOM OF CROWDS* (2004).

³¹ See CASS SUNSTEIN, *INFOTOPIA: HOW MANY MINDS PRODUCE KNOWLEDGE* (2006); see also KENNETH J. ARROW ET AL., *AEI-BROOKINGS JOINT CTR. FOR REGULATORY STUDIES, STATEMENT ON PREDICTION MARKETS* (2007), available at <http://ssrn.com/abstract=984584>. Its authors define prediction markets as "markets for contracts that yield payments based on the outcome of an uncertain future event, such as a presidential election." *Id.* at 1.

³² Bob Tedeschi, *Putting Innovation in the Hands of a Crowd*, N.Y. TIMES, Mar. 3, 2008, http://www.nytimes.com/2008/03/03/technology/03ecom.html?_r=1&scp=1&sq=kluster&st=cse&oref=slogin.

³³ For background on Peer-to-Patent, see PEER-TO-PATENT PROJECT: COMMUNITY PATENT REVIEW, <http://dotank.nyls.edu/communitypatent> (last visited Aug. 15, 2008). See also Beth Simone Noveck, *Peer To Patent: Collective Intelligence, Open Review, And Patent Reform*, 20 HARV. J.L. & TECH. 123 (2006).

between a government institution and a community of participating volunteers online links the United States Patent and Trademark Office to an open network of scientific/technical experts.

Launched in June 2007, the Peer-to-Patent program solicits public participation in the patent examination process via the Web at <http://www.peertopatent.org>. As part of the process by which the patent examiner determines whether the patent applicant has met the legal standards set forth by the Patent Act, the Peer-to-Patent program, serving as an adjunct to the U.S. Patent and Trademark Office (USPTO), frames questions so as to solicit only that information which is relevant to the pending patent application, and invites the public to respond. Because responding to the questions requires enthusiasm and expertise, participants are self-selecting. Because the questions are honed and targeted, the public submits information that is useful to the agency. Public citizens research the pending patent application, uploading relevant publications for use by the patent examiner. The public does not take over the substantive work of the official patent examiner, but augments it by collectively compiling pertinent citations to prior art. As a result, the public plays a significant role in the patent decision-making process.

On a small scale, Peer-to-Patent has empirically demonstrated the inadequacy of prior assumptions about the need to centralize all aspects of administrative decision-making. In this Patent Office experiment, non-governmental actors provide information—serious, expert, fact-based, experiential, scientific information—that government can use to enhance its decision-making. In its first year, the Peer-to-Patent pilot showed that the public is in possession of useful information not available to the patent examiner and, despite the complexity of the patent examination process, will take the time to contribute the information. Amateurs possess extraordinary expertise. The non-governmental public includes “experts” in a variety of fields, including scientific, economic, mathematical, and other relevant areas who can help produce and vet information in the decision-making process in a timely fashion.

Government officials would do their jobs more effectively if they could access better information through collaboration with those able to supply it. For example, in 2007 Congress mandated and the President signed a switchover to new, energy-efficient

light bulbs and instructed the EPA to implement the law into regulations.³⁴ The agency, however, did not have a plan in place for disposing of the 300 million mercury-containing fluorescents sold each year in the U.S. Understandably, given the demands of global climate change and the challenges of election year lame duck politics, the agency was too busy to have light bulbs on its radar screen. But without imposing any significant additional costs, the agency could have set up a simple, online platform whereby a network of concerned citizens, in coordination with the EPA, could have identified this problem and possible solutions. Had the agency articulated the question well, not only would it have received coordinated responses but private sector companies might also have stepped up to offer mercury reclamation programs; foundations might have funded prizes to social entrepreneurs who devised effective solutions.

Or, take another example (which we will discuss in greater detail). Under the Clean Air Act, EPA has to draft an Air Quality Criteria Document, setting forth a preliminary assessment of air quality prior to setting standards.³⁵ Instead of turning to a dozen agency-selected experts for help, it could consult a network of self-selected as well as invited online advisors. In developing its assessment, the EPA could put relevant queries to the scientific community. Experts can invite other experts. The consultation can take place both early in the process and, again, once the document is drafted.

Law professors Josh Eagle, James N. Sanchirico, and Barton H. Thompson, Jr., participants in *Breaking the Logjam*, suggest that the oceans be zoned to mitigate problems of overfishing, damage to marine habitats, accidental mortality of non-fished

³⁴ Claudia H. Deutsch, *No Joke, Bulb Change Is Challenge for U.S.*, N.Y. TIMES, Dec. 22, 2007, at C1, available at <http://www.nytimes.com/2007/12/22/business/22light.html?scp=5&sq=incandescent%20lightbulbs&st=cse>. For more on mercury in light bulbs, see U.S. ENVTL. PROT. AGENCY, MERCURY-CONTAINING LIGHT BULB (LAMP) RECYCLING, <http://www.epa.gov/epawaste/hazard/wastetypes/universal/lamps/index.htm> (last visited Aug. 20, 2008). For background on the situation preceding legislation, see Matthew Wald, *A U.S. Alliance to Update the Light Bulb*, N.Y. TIMES, Mar. 14, 2007, at C3, available at <http://www.nytimes.com/2007/03/14/business/14light.html?scp=1&sq=A%20U.S.%20Alliance%20to%20Update%20the%20Light%20Bulb&st=cse>.

³⁵ Clean Air Act, 42 U.S.C. § 7408(a) (2000).

species, and other challenges to the health of our seas. In this plan, commercial fisheries, recreational fishermen, conservationists, and other stakeholder groups would assume responsibility for different ocean zones. Now imagine that we apply a collaborative approach to this interesting proposal as well. A federal agency such as the National Oceanic and Atmospheric Administration might usefully set up a process and online platform for each of these stakeholder groups to develop policy, solicit information and feedback, and thereby take responsibility for managing its zone of the ocean in an informed, open, and expert fashion.

VII. TWO PRACTICAL INNOVATIONS FOR ENVIRONMENTAL POLICYMAKING: CIVIC JURIES AND POLICY WIKIS

One example of citizen collaboration is the Danish Consensus Conference, a type of small-group “citizen jury” that the Danes convene to vet policymaking relating to complex scientific and technological issues.³⁶ The Danish Board of Technology is an independent body that advises the Danish Parliament about science and technology issues like food quality and human health, IT security, and free public transport. The Board uses a variety of deliberative methodologies, including the Consensus Conference methodology to give parliament a sense of public opinion on difficult, scientific policy issues. The method involves convening a focus group of about sixteen people from among interested members of the general public. Sometimes the group meets for two days at a time over several weeks; at other times the meeting lasts for five days. The citizen group reads background information and receives presentations from a panel of professional experts. At the end of the meeting, the participants develop conclusions, which are published and distributed to the Danish parliament. The Danish Consensus Conference method is used to analyze broad, complicated, and contentious social issues such as cloning and abortion.

When the Danish model was conceived, these juries had to meet face-to-face. As with other citizen consultation practices, the juries are largely discursive and not connected to day-to-day

³⁶ TEKNOLOGI-RADET (DANISH BOARD OF TECHNOLOGY), THE CONSENSUS CONFERENCE, <http://www.tekno.dk/subpage.php3?article=468&toppic=kategori12&language=uk> (last visited Aug. 20, 2008).

policymaking. But the Danish model does have some consequences in that these small groups write position papers on policy that are directly channeled to parliament. In addition, the Danish Technology Board has a great deal of experience that demonstrates that the small-group consultative model operates well.

Methods similar to those of the Danish Consensus Conference might easily be transposed for more active policymaking activities and scaled using the Internet. For example, instead of convening the jury to write position papers as in the Danish model, we can create such a small group jury to create greater accountability in policymaking by having the juries oversee the work of appointed officials. Each Assistant Administrator at EPA, for example, for air and radiation, solid waste and water, and each of the regional administrators would have a jury assigned to track his or her actions over the jury's term.

The environment is clearly a hot button issue. Ordinary citizens are yearning for a way to have an impact upon and some input into the environmental crisis. While these would be relatively easy to organize small group exercises, such juries would resonate beyond the few dozen or few hundred people who serve. The mere existence of an avenue for engagement, even by a small number of "us," creates an impetus for openness.

Unlike Federal Advisory Committees, which are closed-door in nature, the convening of such civic juries could be automated and transparent. Juries might be selected at random from a pool of self-selecting volunteers. Other approaches might be tried. EPA might convene multiple civic juries and assign them to oversee its officials' work. Civic jury participants could be drawn from a mix of volunteers, who work in environmental industries and research and others who come from diverse perspectives but have an interest in the topic. Potential members would specify their profession and their interests in response to a web-based questionnaire, making it easier for the software platform to convene and communicate with such civic jury communities automatically. Or, members might be chosen at random from among the most active participants in a policy wiki community or from among those who participate in rulemaking activities.

Civic juries would meet online and serve limited terms to ensure that members are not overburdened or entrenched. A jury

(or more than one) could be assigned to oversee the work of a political official. Volunteers (who might be paid as in traditional jury service) would log in regularly to read a private blog where the official discloses his actions to the jury. The jury could ask questions, request clarification, challenge the official's actions but, in every case, the existence of the jury would demand that the official articulate reasons why a particular action was taken. The official would be required by enabling statute or regulation to ask for the jury's recommendation. Failure to follow a consensus recommendation would trigger a legal requirement on the part of the civil servant to justify the decision. That departure from the group's recommendation would be a matter of public record.

This innovation is but one variation on the jury-model that could enable ordinary people to exert influence at the national level while informing policy and improving governmental practice.

Collaborative editing technologies, known as wikis (of which Wikipedia is the most famous example), now make it possible for a distributed team of individuals to craft a document together. An online group can consult about the science involved in setting the air quality standard, but it can also help EPA to draft the Air Quality Criteria Document. Rather than invite participants to comment on an already drafted document or regulation after-the-fact, experiments in crafting pronouncements collaboratively should be tried sooner and with a wider audience. Again, such experiments should eschew closed-door, individual practices that create problems in traditional consultative methodologies in favor of new ways of technologically-enabled working that allow people to self-select to participate on the basis of expertise and enthusiasm. As in Peer-to-Patent, such a process need not cede agency responsibility to the public but can augment its access to good information.

Some government authorities have caught the "wiki bug" and, often at the behest of consultants, created internal shared drafting platforms. But not every participant could or should put pen to paper (or to pixel) in the document. Good drafting requires so much more than good writing; there are numerous roles for people to assume. Hence a "policy wiki" should not simply be a way for everyone to write together. The agency should identify the roles that need to be played and construct the space for managing those roles and the resulting project. In other words, this would be a

website where the goal, such as drafting the Air Quality Criteria Document, is described and broken down into specific tasks that small groups of people can undertake.

If the ways of getting involved are well delineated (and that's something participants can also help to do), there are roles for experts and non-experts, scientists, and enthusiasts, alike. Besides the writing, such work might involve:

- Inviting experts and other participants to join the network
- Researching the claims in the document (or draft regulation) and identifying environmental impact
- Commenting on and editing particular provisions
- Vetting, evaluating, and rating the comments of others
- Summarizing and translating texts into plain English
- Analyzing positions of stakeholders and interested parties
- Creating visualizations (diagrams, charts, and illustrations) to reflect and represent the draft
- Identifying abuses, inaccuracies, and corruption, when such problems arise
- Moderating discussions
- Promoting the effort to other weblogs and websites, helping to get the word out, and prompting grassroots mobilization
- Putting an electronic "bumper sticker"—an icon or button—on one's own website to show support for and encourage others to get involved in the effort (the Mozilla Foundation encourages its users to post a Firefox button as a way to encourage others to download the software)

The software could do the work of showing people in an air quality drafting committee the roles and tasks they have taken on and the rules of engagement via the computer screen. By showing the group back to itself and making its goals and tasks intelligible, the computer screen can help to strengthen the group's sense of common purpose. The agency should post all the relevant data sets in usable formats so that members of the network can then use readily available data manipulation and visualization tool (Swivel or Many Eyes being two examples of such software), to make sense of and comment on that data.

If an agency builds an open, transparent, meaningful framework, participants will come. Keep in mind EPA does not need one hundred thousand people to join a policy wiki committee

on the issue of lead in the air. A few thousand participants working a few hours each helped the USPTO find information it did not otherwise have. Environmental activists, academics, corporate professionals, students, and environmental enthusiasts—more than just the usual corporate and interest group players—with useful knowledge to share will then have a way to contribute and get involved. The network will help to do the work of managing the process and evaluating submissions such that the entire burden does not fall to overworked agency officials. If we design the practices and platforms to split up tasks into many smaller, fact-gathering and decision-making exercises, we will have diversified against the risk of defection and corruption and made it easier for people to participate.

Some will challenge the efficacy and limitations of such collaborative strategies. Only a small percentage of open source software projects get built. The SourceForge repository for open source software collaboration is teeming with languishing programming projects. But the idea is not to generate only one solution. We want people to spark lots of ideas and to share in the work of vetting them. Perhaps most importantly, spurring this kind of engagement in the process will inevitably lead to increased efforts by civic groups to take action directly to affect the environment, better informed by understanding what government can and cannot do itself.

This reciprocal interplay between institution and network is not limited to the federal level. Community groups and a mayor's office could work together—enabled by software—to propose, organize, and execute local greening and environmental clean-up projects. Obviously, such a project has to be driven by the real needs and demands of actual communities.

Such a local project could exploit the latest web-based technology to allocate tasks and roles both to citizens and to the city, assigning sweep-up to volunteer participants while assigning the job of installing new locks on the gates of the park to the city. Photosynth, a new photo-documentation technology from Microsoft, might enable people to track visually the progress of such projects over time. Photosynth software assembles photographs of the same location taken by disparate people with different cameras and from different angles into a single picture, allowing many people to participate in the work of documentation.

By moving from experiments about technology's impact on collaboration in the lab to work designing the mechanics of real institutions and networks, we might create new opportunities for civic engagement and improve upon the citizen participation practices of the pre-Internet era. The goal is to enhance mutual accountability between government and citizens.

CONCLUSION

The loci for innovation in social organizations no longer lies only with governmental institutions or markets but also with online networked communities. One potentially effective way to improve the environment is to enlist the efforts of ordinary people, acting together to help government make better decisions and to help each other to accomplish environmental goals. The goal should not be to increase lobbying or complaining. We need to make it possible for more people to do more effective work in groups.

The environment is a complex system and environmental policy making must reflect this complexity. No one—not even the most talented governmentally funded scientist—can be sufficiently expert to make decisions about the world environment. It is simply not a matter of engineering. It is a matter of evolving complex and adaptable systems that can interact with each other, over time, co-evolving with the problem. And we must embrace the trend towards increasing diversity and complexity of such interactions.

Our strategies have to grow—have to evolve—through experiment and trial-and-error. We cannot be afraid, merely because we are in the traditional domain of law, to start small, see what works and try again. Inescapably, we are gardeners, not mechanics, and so we should think about our legal institutions as social organisms. In this environment, we can all play many productive roles by planting and weeding, fertilizing and building trellises.

To those who would rely on governmental authority (or a limited set of institutional actors) to make environmental decisions based on the limited amount of attention individual citizens have to give to this issue, it is worth pointing out what biologist Stewart Kauffman terms the “fourth law of thermodynamics.” He postulates that complex systems of autonomous agents tend to

become more complex over time because each time we add more interacting nodes in a network, we create far more potential interactions.³⁷ Precisely because we can all now spend small amounts of time collaborating with others, via the Internet, to take on projects to attack environmental policy goals, we should not entrust this mission solely to the government. And it is exactly because we all only have a limited amount of time that we need governmental institutions to help focus our efforts.

Government exists to do the work of the people. But the Internet enables the people to do some of their own work by acting in groups. Governments might prefer that people use the Internet at most to distribute information to people. If we care about the work of improving the environment, we should want to use the Internet to enlist more workers! Network technology opens up possibilities for distributed communities to collaborate with government to ensure that environmental decision-making is based on better information, and, because of the increased engagement of all of us, is more effective.

³⁷ Stuart Kauffman, *Investigations* 2–4, 151–52 (2000); *see also* Eric D. Beinhocker, *The Origin of Wealth: Evolution, Complexity, and the Radical Remaking of Economics* 141–59 (2006); David Warsh, *Knowledge and the Wealth of Nations: A Story of Economic Discovery* (2006). The point is that networks potentially increase the number of different ways for people to work together and exchange knowledge—and that an increase in the diversity of such interactions increases the number of solutions available.