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Biotechnology, Sustainability and Trust

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This paper explores the relationship between technology, trust, and sustainability. It will focus on the critical role that a particular form of trust—social trust—plays in helping societies have a genuine conversation about the many problems they face that are fraught with uncertainty. That role for trust offers a window into how social trust can be a building block for a more resilient society and how it can help societies become more sustainable.

Ulrich Beck has written extensively about what he calls the "unseen side effects of industrial production" and has explored how those unseen side effects have "morphed into a profound institutional crisis of industrial society itself." Now much of the uncertainty and risk that he describes are inherent to what we think of as modern industrial society. When unceasing technological innovation forces a constant reassessment of the relationship between scientific knowledge, technology, and public policy, we are constantly renegotiating this question of what it means to be sustainable.

Social trust can be a useful framework for evaluating that renegotiation. More often than we like to acknowledge, society struggles to reconcile its need for definitive answers with a profound uncertainty about factual and normative positions. Delay is often an unavailable luxury—there is a need to make a decision now. These decisions have real, concrete consequences for individuals. One side prevails in a court case. If it is a bailout, some get the money, while others do not, and someone has to pay. There are winners and losers.

The problem is that we make these definite choices against a backdrop of profound indeterminacy—without enough knowledge to be confident of what our options are, let alone which option is better. Lacking certainty about what we know or what we should do, we still have to make these decisions. We have to marshal our limited stored knowledge and make choices of profound importance for the present and for the future. This epistemological uncertainty which is, in many ways, the hallmark of modernity means that such decisions are always open to challenge.

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2. Id. See also ULRICH BECK, ECOLOGICAL ENLIGHTENMENT: ESSAYS ON THE POLITICS OF THE RISK SOCIETY 38-40 (Humanities Press 1995).
So, it begs the question: when government actors make official decisions in the face of uncertainty, what gives legitimacy to these decisions? This is a question that we will confront more and more frequently as we struggle with the problem of global climate change and its ramifications for society in general. At the same time that we are profoundly altering our environment, we also have to deal with globalizing markets and new technologies that challenge the pre-existing political and social fault lines.

As we struggle to keep pace with the accelerating pace of change, we encounter uncertainty at every turn. Despite, or perhaps because of, this uncertainty, the world is awash with a host of suggestions for how to regulate and how to manage. In contexts as diverse as regulating agricultural biotechnology, approving new drugs, overseeing new financial instruments, and responding to increased carbon in our atmosphere, the relationship between trust, uncertainty, and sustainability is constantly being reinterpreted.

The 1987 Bruntland Commission report defined sustainability for the international community as “meeting the needs of the present without compromising the ability of future generations to meet their own needs.”¹³ It is a pretty good definition, as long as you think about it in not just environmental terms but also in social and economic terms. Sustainability has three basic parts: economic, social, and environmental. It does not do us any good to talk about environmental protection if we are not also talking about the way the society, as a whole, sustains itself. That people can live; that people have food; that people have adequate lifestyle; and that social structures support a healthy and functioning society—these are not just side questions but are integral to the very idea of sustainability. To tease this out, I want to focus on the controversy surrounding adoption of agricultural biotechnology in the United States and around the world. This controversy offers a clear example of how critical social trust is to creating a regulatory system that remains sustainable and legitimate in the face of profound social disagreement.

The Cartagena Protocol defines modern biotechnology as “the application of: (a) in vitro nucleic acid techniques, including recombinant deoxyribonucleic acid (DNA) and direct injection of nucleic acid into cells or organelles, or (b) fusion of cells beyond the taxonomic family, that overcome natural physiological reproductive or recombination barriers and that are not techniques used in traditional breeding and selection.”¹⁴ Notice how the

³. WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT, OUR COMMON FUTURE 42 (1987). A situation is unsustainable when natural capital is depleted more rapidly than it can be replenished. Thus, at a minimum, sustainability requires that human activity not exceed the regenerative rate for natural resources and capacities.

⁴. Cartagena Protocol on Biosafety to the Convention on Biological Diversity, art. 3, 2000, 39 I.L.M. 1027. In limiting its definition to modern biotechnology, the Cartagena Protocol deliberately narrows the definition of biotechnology to exclude traditional processes used to make beer, cheese, yogurt, and bread. It does so because current public policy disputes do not refer to these conventional forms of biotechnology but instead refer to modern biotechnology—new and controversial techniques which involve the transfer of genes between species (genetic engineering/genetic modification) in a manner and at a speed not previously possible. The
definition focuses in on specific kinds of technologies. It is a very narrow definition, and I will come back to that point a little later on.

The success of agricultural biotechnology depends fundamentally on society's willingness to accept and consume food produced via this technology. This willingness, in turn, hinges on the level of social trust that this technology is being developed and used in a safe, sustainable manner. This needed trust is multifaceted and multilayered. The consumer must trust that the researchers know what they are doing in developing the crops; that the companies marketing the crops are operating in a legal and ethical fashion; that the regulators are exercising proper oversight; that the farmers are obeying these regulations; and that all parties involved are not lying to the public. That is a lot of trust to have in quite a few distinct sets of actors. As you can see, trust, in this context, involves a nested hierarchy of factors relating to individual perceptions, specific situational and institutional contexts, and general societal relationships. Because there are so many parties involved and so many interrelationships, there are a lot of opportunities for the needed trust to break down.

Attempts to control the outcome of the discourse about agricultural biotechnology focus heavily on normalizing the framework within which the discourse takes place. The technology's purveyors argue that the technology should be considered in light of its potential to provide substantial agricultural productivity gains while reducing the carbon footprint and environmental stresses associated with agriculture. This frame keeps attention focused on the particular attributes of the technology and shunts aside broader questions about social choices embedded in the technology's adoption. But, that is not the only possible framework for examining the technology. Other possible frames include examining the technology in the context of a broader discussion of ecological or public health or through a frame that highlights the power dynamics of corporate ownership of the food supply or even through a frame that emphasizes the moral and ethical concerns over altering genetic codes. All of these framing options offer legitimate lenses through which to consider the technology—though each is likely to take the discourse down a very different path. All are in play at the same time. Each alternative frame has

advocates who are trying to shape the contours of the discourse.

One relatively successful tactic in this contest over framing has been the attempt to normalize the technology itself. For that reason, proponents of agricultural biotechnology are fond of comparing modern corn with its closest wild relative, teosinte, and pointing out that dramatic human intervention was necessary to get us from there to here.\(^5\) This observation is certainly accurate but whether it is useful is less clear. Related attempts to point out that human beings have been making bread for millennia and to characterize the process as involving "yeast-mediated biotechnology,"\(^6\) although factually true, are simply not responsive to the social concerns that animate the alternative frames for considering this particular technology.

The kinds of uncertainty that surround this technology cannot be tamed by superficial analogies or by statistical techniques. Imperfections in risk assessment and in social analysis make this area ripe for the kinds of distrust that undermine the legitimacy of decision-making. Even more fundamentally, there are large segments of society that feel excluded from the decision process and disempowered and ignored in the regulatory approval process. When advocates rely on normalization tactics to ignore these concerns, that tactic only underscores the desire to invoke alternative frames. The questions surrounding this technology are inextricably entwined with the reality that we live in a profoundly unequal world with differential accesses to power and resources. Ultimately, the question of who will allocate how much risk to whom and under what circumstances, a question embedded in the dispute over agricultural biotechnology, implicates fundamental questions of democratic decision-making and equality. Brushing those questions aside with glib analogies is not a recipe for trust. Nor can we move beyond polarization until people feel that their points of view have been heard and considered.

So to understand what needs to be done, we need to start by identifying the kinds and levels of trust that already exist with regard to this technology. Pew Research conducted a survey about who the public trusts with regard to biotechnology.\(^7\) Thirty-seven percent of consumers trust their friends and families a great deal as sources of information about biotechnology.\(^8\) This was


8. Id. at 6-7.
the highest percentage for any group or any organization listed in the survey. Farmers were next, followed by scientists and academics, and then the Food and Drug Administration (FDA). Notice who is at the bottom of the trust pile: the news media, biotechnology companies, food manufacturers, and government regulators. The reason I find this chart so interesting is that the Pew Center had conducted a similar survey a couple of years earlier. At the time, in 2001, the FDA had been the most trusted institution. Forty-one percent of people surveyed in 2001 said they trusted the FDA a great deal when it came to genetically-modified food. A lot has happened since 2001, much of it not very good for the reputation of the FDA. Its trustworthiness rating has declined significantly, and there is a lesson there: trust is fragile; it can be easily destroyed. Once trust is broken it is very difficult to reestablish.

At this point, it is worth taking a step back and asking the big picture question: what do I mean by trust? Part of the work I have been doing lately is trying to figure out an answer to this question. As I see it, the ways we think about trust can be grouped into three distinct approaches based on the characteristics of the trust relationship involved. Those approaches are: thick trust, calculative self-interest, and social trust. Thick trust is the idea of social capital based on kinship or other personal relationships. Calculative self-interest, which comes from game theory, focuses on rational value-maximizing individual behavior. Then there is this idea of social trust—impersonal trust rooted in social structures that facilitate interactions between strangers. It is important to understand what exactly we are talking about when we talk about trust because these three trust theories lead us in very different directions.

My suggestion is that institutions that are deliberately structured to nurture and support social trust may be able to scale hurdles that otherwise seem insurmountable. Organizational studies tell us that trust is correlated with the ability to accept unfavorable decisions, particularly those deviating from one's normative preferences. If so, identifying what makes for stronger

9. Id.
10. Id.
11. Id. at 7.
12. Id.
14. I have explored these varying conceptions of trust elsewhere. See Rebecca Bratspies, Regulatory Trust 51 ARIZ. L. REV. 555 (forthcoming Fall 2009).
bonds of social trust is a critical first step toward a new way of organizing regulatory decision-making. With this understanding, we can begin to cultivate the reservoir of social trust needed to allow regulatory agencies to govern effectively in the face of fundamental uncertainty.

First, I will mention very briefly thick trust. This is when cooperative actions occur wholly between persons of known dispositions and character. Thick trust shows up in the Pew Survey about agricultural biotechnology as the strongest form of trust with regard to information concerning GMOs. Many traditional societies function on the basis of thick trust. A precondition of a society based on thick trust seems to be a small, tightly knit, homogenous society. When every individual’s identity is bound up with group membership, thick trust within the group can be a powerful force for organizing and maintaining society. Once the conceptualization of the individual as a unique and isolated unit takes hold, however, thick trust becomes very difficult to maintain. As societies become more complex, with stark divisions of labor and increased interactions with strangers, the social bonds that make thick trust possible weaken. Such societies need to find a new means for facilitating trusting interactions. As an example, we are wholly dependent on the skill and care employed, or at least we hope employed, by the anonymous engineers of the subways we ride, the manufacturers of the medicine we take, and the workers who assemble the various things we rely on, including child safety seats. We have little chance of meeting these individuals, and we do not interact with them on the basis of any individual relationship that might lead to thick trust.

Our inability to rely on thick trust in these relationships does not mean that we cannot repose trust in those fulfilling those roles, but it does mean we have to find a different way, other grounds, for trusting. For these kinds of interactions, the confidence to trust arises from the context in which the action occurs rather that from the attributes of a specific trusted individual.16 Individuals are embedded in social systems, with rules and resources that powerfully constrain or enable individual interactions. Although certainly aspects of these social systems are powerfully influenced by “thick trust,” they depend much more heavily on what Luhmann called “system trust”17 than on interpersonal trust. It is precisely this kind of trust that is absent in the context of agricultural biotechnology. Indeed, the fight over agricultural biotechnology highlights the problems with relying on thick trust to respond to complex social issues calling for social trust. The developers, manufacturers and adopters of the technology are strangers to most of those making decisions

16. However, the Pew Data cited above suggests that when that context fails, many people retreat into thick trust. Hence the change from trusting FDA to trusting one’s family and friends with regard to information about genetically-modified foods. See Memorandum from The Mellman Group, Inc., supra note 7.

about whether they think the technology is trustworthy. Those with whom the general public has thick trust relationships (each other) generally have little or no direct knowledge upon which to form an opinion. Thus we wind up with an echo chamber in which like-minded individuals reinforce their initial beliefs, and society grows more and more polarized. What is needed is not more thick trust, but a credible regulatory system capable of inspiring trust across society as a whole.

The neo-conservative take on this move from thick trust to social trust tends to be one of lamentation. Many of you may have read Robert Putnam’s work *Bowling Alone*\(^{18}\) or Francis Fukuyama’s book *Trust.*\(^{19}\) Both are pretty much jeremiads bemoaning the loss of thick trust in society. Both thinkers conflate thick trust with social trust and offer a vision of trust that places the entire burden for making society work onto voluntary associations and traditional family membership. In doing so, they elide the central challenge of modernity, which is the complexity and anonymity of the urban, industrial existence.

As society changes and becomes more complex, thick trust is no longer the main source of knowledge about those who are to be trusted and, by corollary, can no longer be the principal means of assessing trustworthiness. A new way to grease the wheel of social interaction becomes necessary. It seems to me there are two basic responses to this problem: rejection of the need of trust in favor of relying on calculative self-interest or, in the alternative, the invocation of social, rather than inter-personal trust.

So now we turn to calculative self interest and the prisoner’s dilemma.\(^{20}\) This is one of the ways that game theory insights about trust have influenced law. The prisoner’s dilemma starts from the premise that individuals “are motivated to maximize their personal gains and minimize their personal losses in social interactions.”\(^{21}\) If you start from that position, you must first assume that all individuals already know what counts as a personal gain as opposed to a personal loss. Having made this (unrealistic) assumption, rational choice theorists posit that most social interactions can be explained through a self-interested instrumental lens.\(^{22}\) The classic iteration of the prisoner’s dilemma

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20. Merrill Flood and Melvin Drescher first posited the Prisoner’s Dilemma in 1950. Their work was formalized and popularized by Albert Tucker, who gave it the name “Prisoner’s Dilemma.” For a brief historical overview of the evolution of game theory, see Phillip D. Straffin, Jr., *Changing the Way We Think About the Social World, 14 TWO-YEAR COLLEGE MATHEMATICS J. 228 (1983).* For an in-depth description of game theory’s birth, see **WILLIAM POUNDSTONE, PRISONER’S DILEMMA** (Anchor Books 1992).


22. There is a vast literature on rational choice theory. Some of the best known introductions include: **JAMES S. COLEMAN, FOUNDATIONS OF SOCIAL THEORY** (Harvard Univ. Press 1990); **ROBERT ALEXROD, THE EVOLUTION OF COOPERATION** (Basic Books 1984); Russell
involves two prisoners arrested for some unspecified crime. The police do not have enough evidence to actually convict them, so they separate the prisoners and speak with them separately. They tell each prisoner "if you confess and agree to testify against your buddy and we convict your buddy, you go free and he gets a longer sentence." But, they are offering the buddy the same deal. If the two both agree to testify against each other, they will both get a moderate, but still lengthy sentence. If neither agrees to cooperate, the police have enough evidence to convict only on a minor charge.

For each prisoner, the game presumes the best individual result is attained by betraying another's confidence. The best overall result is attained by both prisoners remaining silent. But, a prisoner who remains silent while his or her accomplice defects is in the worst situation. Although the ultimate outcome depends on collective choices made by the accomplices, each one must choose without knowing what his or her accomplice has chosen. That is the 'dilemma' part of the game.

The game highlights the role of lack of trust poses for coordination under conditions of uncertainty, because prisoners, as a class, are better off if they can trust their accomplices. Individual prisoners are better off if they betray an accomplice who trusts them. Trust, or its absence, shapes which choice is rational. It makes no sense to remain silent, a choice that might make the player into the game's sucker, unless players trust one another.

There are clearly some lessons from game theory that resonate in any discussion of regulatory trust. But extrapolations from theory to the world must be done very cautiously. First of all, even in the highly artificial world of a game theory experiment, cooperation occurs. Researchers have run countless experiments testing various versions of the prisoner's dilemma game. It turns out that subjects in these games actually display much more trusting behavior than the theory suggests. Second, individuals acting to maximize their own collective rational interest may undermine the collective good.

There are other factors that limit the usefulness of these games. First of all, in the real world there are well-documented cases of false confession—not an issue in the game but of significant concern for a system based on justice. Moreover, disconnects between results in the game and results in the real world stem at least in part from the artificialities of the game. The players are subject to no enduring consequences for their choices, have no ties of loyalty, fear or love to anyone else in the game, and participate only for a limited

period of time.25 And, of course, in the world as opposed to the game, it is not always obvious whether someone has acted cooperatively or has defected, nor do games people play outside the laboratory have any clear endpoints or limits.

These critiques are methodological. But, I think there is a more fundamental problem with the whole line of analysis: it conflates trust with cooperation.26 This makes the analysis both over-inclusive and under-inclusive because there can be trust that does not manifest itself in cooperation and there can also be cooperation without trust. This theory does not really have a way to account for that problem, nor can it distinguish between trust-based cooperation and cooperation driven by other concerns, like fear.

That brings us to the third option—social trust. This vision of trust is premised on the insight that there are scarcely any activities in modern society that do not require the social collaboration of human beings who are unknown to each other.27 As a result, the trust necessary for social coordination must be institutional rather than intimate. Bernard Barber28 and Niklas Luhmann,29 two sociologists, have written some of the definitive works on this topic. According to these thinkers, social trust has some critical components. First of all, there is a shared set of background expectations. This is a very general principle, not necessarily specific shared values so much as a shared way of interacting. Another sociologist, Harold Garfinkel did a very interesting set of breaching experiments that demonstrated this point.30 Garfinkel had his students breach the expected social norms with the people they interact with. For example, he asked his students to treat their families like strangers.31 In these breaching experiments, social interactions simply did not go down the path people expected. The result was great stress for the students and great anger on the part of everyone else.

25. More realistic versions of the game cure some but not all of these evils. The iterated prisoner’s dilemma, for example, where the players have repeat interactions, induces more cooperation.

26. The analytical model has no way of distinguishing cooperation that occurs despite lack of trust from trust-based cooperation, nor can it distinguish a decision not to cooperate despite trusting with a refusal to cooperate based on lack of trust. These problems are inherent to an experimental model that treats trust and cooperation as interchangeable. For an exploration of these points, see Toshio Yamagishi et al., Separating Trust from Cooperation, 17 RATIONALITY & SOC’Y 275-76 (2005).


29. See LUHMANN, TRUST AND POWER, supra note 17.


31. In some of these experiments, Garfinkel had students try to pay more than the price for an item at a store, shop by taking items from the grocery carts of others, and change the rules of tic-tac-toe mid-game. He used these experiments to demonstrate the existence of an unspoken set of assumptions about the course of everyday interactions, what he called a “common moral order of the facts of collective life.” Id. at 242. His work showed that disruption of these expectations caused extreme distress, anger and anxiety. Id. at 245.
Expectations of technically competent role-performance are a second, very important component of social trust. We expect that people can do what they are supposed to do and that they can do it reasonably well. We also have expectations that people live up to their responsibilities and act on them. Anthony Giddons has written about how this aspect of trust is a "reflexive" phenomenon.\textsuperscript{32} As he describes it, social interactions give rise to trust, which creates the possibility of further social actions which further build trust and so on.

What does this have to do with agricultural biotechnology? The realization of all the exciting potential embodied in this technology will not happen unless we have a comprehensive and scientifically rigorous regulatory system that adequately addresses environmental and human health issues, and does so in a way that is credible to the public. In other words, the bitter controversy will continue until and unless the public trusts in the social, as well as environmental sustainability of agricultural biotechnology. That needed trust is necessarily entwined with broader questions about the role that a trustworthy regulatory system plays in creating a sustainable society and ensuring responsible use of this, and other, new technologies. We do not currently have such a regulatory system, to our detriment. Protecting the public's interest in this context will require government to assume a far more active role than the hands-off attitude that has been the hallmark of conventional agricultural policy.

An exploration of these components of trust—shared social expectations, competence, and legitimacy cast some light on the questions we will need to ask about this technology in order to build social trust going forward. That means going beyond the narrow framing of agricultural biotechnology as a wholly technical question offered by its proponents. We still need to ask all the questions that currently get explored in the regulatory process. But we need to expand the regulatory conversation to include the broad-based questions posed by other frames for viewing the technology. These questions, raised far less often in regulatory proceedings, are vital for assessing the future viability of this technology. While the former set of questions focuses on the details of the particular technology, the latter ask what kind of society we want.

The narrow question—the safe use of the particular technology—is really a series of questions about regulatory competency. But questions about whether a regulation has been competently implemented are not the only questions worth asking. There are also questions about legitimacy—about how this technology fits into a broader social policy and whether its adoption further a collective vision of the social good.

I am emphasizing these different sets of questions because they are at the heart of the debate over biotechnology. Because they approach the questions through different frameworks, some groups suggest that only the technical

\textsuperscript{32} Anthony Giddons, Risk, Trust, Reflexivity, in BECK ET AL., REFLEXIVE MODERNIZATION, supra note 1, at 184.
questions are legitimately part of the regulatory discourse, while other groups will never end their opposition until the conversation expands to include the legitimacy questions. This is not a situation in which the concerns, values, and priorities emphasized by one group are legitimate while those emphasized by the others are not. It is instead a situation in which different groups are focused on very different issues. To resolve this problem, we must consider competency and legitimacy as part of an assessment of the technical questions.

We will start with technical competency. Are regulators up to the task? Bundled within this question is a series of other, more specific questions: do we have confidence the regulators have asked the right questions, considered data in a reasonable manner, and reached logical conclusions? In terms of competence, regulation of this technology did not get off to the best start. The familiar litany of scandals surrounding discovery of unapproved GM crops in food, most spectacularly the StarLink Corn\(^33\) and Prodigene\(^34\) fiascos, suggests there may be good reason to worry that regulators have not fully considered many of the possible problems that the technology might create. And these were not the only instances where unapproved crops contaminated crops intended for use as food.\(^35\) All these failures to properly contain unapproved GM crops raise serious questions about competency: about industry’s commitment to and competence in stewardship, and about the adequacy and competence of regulatory oversight. These scandals raise fundamental questions about the competence of the overall regulatory process—a question that goes far beyond the legitimacy of any particular regulatory decision. Recent court decisions underscore these doubts about basic competency.\(^36\)

There are some other concerns that are worth mentioning for whatever light they shed on assumptions about competent regulatory activities. First is a concern that surfaced about a year ago about the unanticipated effect of Bt crop residues on aquatic insects.\textsuperscript{37} Now, much of the regulatory regime around Bt crops was based on assumptions about the way corn pollen behaves.\textsuperscript{38} Those assumptions are at least fairly good. While there is an ongoing argument about whether the regulatory assumptions fully capture the potential for transgenic pollen to spread into nearby fields or to pollinate related plants, we know a lot about corn pollen, including how far the pollen travels on average. The problem is that the regulators assumed in approving GM corn that pollen is the only part of the plant that travels. It turns out that corn detritus, the leaves and stalks, can also wind up traveling considerable distances, particularly after big storms.\textsuperscript{39} Much of that detritus winds up in streams, where it and the pollen it contains may affect aquatic organisms.\textsuperscript{40} This possibility was not considered at all in the regulatory process. There are also concerns about the possible release of Bt toxins into the soil,\textsuperscript{41} and some research has raised the possibility of horizontal transfer of Bt resistance to soil bacteria.\textsuperscript{42} I am not saying that these things are happening, but I am saying they are questions that have been raised in the scientific literature for a decade without really being considered in the regulatory process; that is a problem.

That brings us to the issue of legitimacy. Do we have confidence that regulators are acting honestly and in the public’s interest? Some recent events raise questions. I have already mentioned the recent scandals involving the FDA, and there have also certainly been a lot of revelations about problems with regulatory oversight of the financial markets. We also have also seen, in the past eight years, far too much political interference with science. One of the more egregious examples is political appointee Philip A. Cooney’s decision to substantively edit scientific reports about global warming, despite having no

\textsuperscript{37} Thomas Bohn et al., \textit{Reduced Fitness of Daphnia magna Fed a Bt-Transgenic Maize Variety}, 55 ARCHIVES ENVT'L CONTAMINATION & TOXICOLOGY 584 (2008).
\textsuperscript{38} For a discussion of some of these assumptions, see Rebecca M. Bratspies, \textit{The Illusion of Care: Regulation, Uncertainty, and Genetically Modified Food Crops}, 10 N.Y.U. ENVT'L. J. 297, 312 (2002).
\textsuperscript{39} E.J. Rossi-Marshall et al., \textit{supra} note 37, at 16204.
\textsuperscript{40} Id.
\textsuperscript{41} Isik Icoz & Guenther Stotzky, \textit{Fate and Effects of Insect Resistant Bt Crops on Soil Ecosystems}, 40 SOIL BIOLOGY. & BIOCHEMISTRY 559 (2008) (surveying conflicting studies); Deepak Saxena et al., \textit{Insecticidal Toxin in Root Exudates from Bt Corn}, 402 NATURE 480 (1999).
\textsuperscript{42} Sandrine Demanèche et al., \textit{Antibiotic-resistant Soil Bacteria in Transgenic Plant Fields}, 105 PROC. NAT’L ACAD. SCI. 3957 (2008).
scientific expertise and a clear conflict of interest. Unfortunately, that is only one example among many.

At the same time, the mismatch between the rhetoric and the crops that are actually being developed further raises questions about legitimacy. Supporters of agricultural biotechnology like to talk about golden rice and to point out the potential for agricultural biotechnology to address food insecurity in a world where one in five people does not have enough to eat. Unfortunately, the rhetoric does not match the reality of these crops. Golden rice is a wonderful idea but has yet to live up to its promise. And where are the other crops targeted at the world's malnourished and hungry? What we have gotten so far is crops that grow better and more profitably in Iowa and wind up feeding cattle. This mismatch between rhetoric and reality does nothing to cultivate trust. Instead it offers support to those who assert that the public is being manipulated and lied to.

I am not saying that it is bad to have crops that can be grown more profitably in Iowa, but I am saying that trying to justify the existing uses of this technology based on saving the world creates a disconnect. Most transgenic crops have been developed (and patented) by multi-national corporations to address production constraints in the wealthy and developed world. Private research has focused on traits like herbicide resistance that offer lucrative tie-in opportunities and are best suited for large-scale commercial farming. The needs of small-scale and subsistence farmers are not served by these innovations. That is not to say that the technology might not yet save the world. Indeed, what I want to talk about next what its potential are to do just that and how this dialogue about agricultural biotechnology needs to be changed to make that outcome more likely.

If it all comes down to regulatory trust, and I think it does, we also have to ask the question of what will the consequences be in places without the capacity to effectively regulate these technologies, because there are a lot of them. Not only are there a lot of places without the capacity to regulate these technologies, but the United States regulatory system discounts the relevance of those questions for regulatory approval within the United States. This is important to remember. Even though successful use in the United States is offered as evidence of the safety of an agricultural biotechnology, the United States regulatory process explicitly brackets the question of what might happen in other places, particularly in centers of origin. It makes little sense under

43. Andrew C. Revkin, "Bush Aide Softened Greenhouse Gas Links to Global Warming," *N.Y. Times*, June 8, 2005. Mr. Toomey, a lawyer with no scientific training, had previously worked for the American Petroleum Institute in their campaign to prevent restrictions on greenhouse gas emissions.


these circumstances to point to United States’ regulatory approval as an argument for demonstrated safety in general.

Given the narrow scope of United States regulatory consideration, successful use in the United States does not necessarily provide any information about what might happen elsewhere. Unfortunately, it is likely that we will see the technology spreading across the world without any consideration of the unique consequences in particular places. We live in a globalized world. Things travel. As a result, “a release anywhere is a release everywhere.”

Now, that fact is not, in itself, an argument for not doing something, but it does mean that the consequences of mistakes are potentially really high.

At the same time, there is a compelling need to do something about hunger. One in five people on this planet suffers from food insecurity. That is more than a billion people; despite efforts to achieve the Millennium Development Goal of halving world hunger by 2015, the number is not shrinking much. Climate change is going to compromise food production even more, and the world’s population is expected to exceed nine billion by 2050. That is a very large number of people, and it will take a lot of food if we are going to feed them adequately—and I think we have an obligation to do that.

That means thinking carefully about new technologies and trying to figure out how they can be used to alleviate poverty and hunger. To that end, I want to talk about what happened with Bt corn in Kenya, because there are some lessons that will be important going forward. Corn borers infect a vast portion of the African corn crop and cause significant damage. This damage often causes crop loss for subsistence farmers who are already marginalized. The problem is tremendous, and Bt corn might have really helped these farmers. But, Bt corn trials in Kenya faced two problems: 1) the trials were poorly managed; and 2) concern over patent rights created uncertainty. On the first problem, there were a number of scandals involving the Kenya trials that

46. Thomas Lumpkin, personal communication with the author (Oct. 2008).
51. Id. at 1499-1500.
53. Ochieng Ogodo, Islam Online, GMOs or Safety (Nov. 23, 2005), available at
decreased whatever public trust there might have been in this technology (and there probably was not that much to begin with). The second meant that, even though the relevant technology could no longer be patented in Kenya, researchers had a hard time establishing the needed freedom to operate. They obtained Bt genes from the University of Ottawa under a research license. When it came time to develop crops for distribution, the University got cold feet because of uncertainty over the liability consequences elsewhere. The University was concerned about its potential liability for patent infringement because the genes are patented in Canada. Even though there is no patent on the relevant Bt gene in Kenya, and thus there could not be a patent infringement issue in Kenya, the researchers were forced to contact the holders of intellectual property rights in other countries to beg for explicit permission to use materials in Kenya that were not subject to patent protection in Kenya! So, this project has yet to provide any Bt corn to resource poor farmers. This was a real failure, and it was also a public relations black eye.

Another story, also from Africa, offers a more optimistic perspective. Striga, also called witch weed, is a parasitic plant that has a devastating effect on corn harvests, particularly in fields planted by subsistence farmers in parts of Africa. Every season, the infestation by Striga in affected fields becomes worse, contributing to a downward spiral of poverty and food insecurity. In bad years, it can result in a one hundred percent crop loss. Striga affects twenty to forty million hectares of farmland cultivated almost exclusively by poor farmers in sub-Saharan Africa. Striga seeds are very tiny. They are carried by runoff, eroded soil, and easily contaminate other seeds. It is very difficult to detect them and very difficult for resource-poor farmers to eradicate them.

I want to emphasize the amount of damage Striga causes. It infects almost eighty percent of farmland in western Africa, accounts for about an estimated seven billion dollars in yield-related losses in sub-Saharan Africa.


54. Mugo et al., supra note 50, at 1493-1504.
55. Id. at 1494.
56. Id. This concern was based, in part, on Monsanto’s attempt to block Argentina from exporting Bt soybeans to Europe on the theory that the exported crops violated Monsanto’s European patent rights, even though Monsanto held no patent on the Bt soybeans in Argentina. *Soy Import Delayed as Argentina Fights Monsanto*, (May 18, 2006) available at http://www.foodproductiondaily.com/Supply-Chain/Soy-imports-delayed-as-Argentina-fights-Monsanto-over-GM.
59. Id.
60. Id.
61. Id.
(remember these are subsistent farmers), and affects the livelihood of a hundred million people. What Striga does is it attaches to the maize seed as it germinates and sucks nutrients from the maize seed. There are existing practices that can effectively control Striga. Unfortunately, they are not practicable for subsistence farmers either because their benefit can only be seen in the medium- or long-term but the techniques impose a significant, immediate cost, or because they require a sophisticated understanding of a life cycle of a plant which subsistence farmers often lack. There are also effective pesticide treatments, but they tend to be very expensive. This is why Striga causes the most problems for subsistence farmers; they are the ones without the resources to respond to Striga infestations.

There is a new technology called StrigAway that may change this sad situation. StrigAway is an herbicide resistant corn; it is not a genetically modified organism, but it was produced by the use of modern biotechnology. First, through mutagenesis, researchers developed a corn germplasm that is resistant to an herbicide that kills Striga. Next, researchers developed a technique to coat the corn seeds with this herbicide. So the Striga seeds are still in the soil, still germinate, and attach to the maize, but the maize seed is coated in an herbicide that kills the Striga plant. The effects are dramatic. This technology can increase yields by more than four times, and it is extremely inexpensive. The cost-benefit ratio is probably greater than twenty-five to one, and it is within the capacity of subsistence farmer to implement and to purchase. It is available this year. I am convinced this technology is the beginning of a new dialogue, because it offers a clear representation of how modern technology can, in fact, improve the lives of subsistence farmers. This reality will change the contours of the discourse.

Another game-changing event: one of the side-effects of climate change is drought. In the past, there was real criticism that, despite the rhetoric about this technology, private research has spent very little time and money on subsistence crops like cassava, and even less on problems like drought resistance that were of direct concern to subsistence farmers. Drought is a pressing and growing issue. Now, Monsanto thinks that it has some ability to transform corn to make genetically modified corn that is more drought-resistant. That is a much bigger deal than adding Bt resistance. It is a much

62. Id; see also A. Oswald, Striga Control—Technologies and their Dissemination, 24 CROP PROTECTION 333 (2005).
65. Id.
66. CIMMYT, STRIGA WEED CONTROL, supra note 59. For more detailed information about the Striga trials, see also LONG RAINS 2008 REPORT, supra note 63.
67. CIMMYT, STRIGA WEED CONTROL, supra note 59.
68. Monsanto, Drought Tolerant Corn, http://www.monsanto.com/droughttolerantcorn/default.asp (last visited Apr. 30, 2009);
bigger deal than adding herbicide-resistance or even than combining the two. We are no longer talking about adding a gene that is going to control a specific trait. We are now talking about adding a gene that is going to reshape a regulatory path. That is a much more significant change, involving a much more fundamental alteration of the host plant. We are not there yet, but Monsanto is confident enough about their progress that they are talking to the New York Times about rolling out drought-resistant maize in the next couple years.69

Because drought resistance involves a much more complex alteration of the plant, the consequences and repercussions for failure in terms of stewardship are probably much more significant but so are the ramifications of success. Right now Monsanto has partnered with the African-Agriculture Technology Foundation, the Gates Foundation, and the Consultative Group on International Agricultural Research in a project called Water Efficient Maize for Africa (WEMA).70 The goal is to develop drought-resistant maize for use by small holders in germ plasma that is adapted to local environments.71

The Striga and WEMA projects might radically change the terms of the broader conversation about agricultural biotechnology. But, before that can happen, we need to acknowledge the roots of the conflict and be honest about how we got to the place we are in now.

So, what lessons can we draw from weaving together a more theoretical exploration of trust with these technological developments? Some insights that resonate in this context include the acknowledgement that public participation is crucial, that public concerns are valid, and that purveyors and regulators of the technology cannot afford to ignore the distribution of risks and benefits. I want to emphasize that achieving sustainability in this area will involve change. It will require a new, more inclusive dialogue that pays conscious attention to the need to construct social trust. Above all, we cannot begin from the position that other perspectives or other framings of the question are illegitimate.

So, now let us put those propositions into concrete terms. In this room, based on what I know about some of the people here and the conversations we have had, it is clear that the anti-GMO rhetoric does not resonate much. So, I am going to take the flaws in that rhetoric as a given and instead focus on the flaws of the pro-GMO rhetoric. I am continually amazed about how close-

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69. Pollack, supra note 68.
minded this side of the debate can be. I cannot count the number of times I have heard the objection "but the anti-GMO people are not rational. It is not possible to engage in dialogue unless they abandon the absurd complaint that ________" (Feel free to fill in the blank with your favorite complaint about anti-GMO rhetoric.). Most often, the blank gets filled by the demand that, as a precondition to conversation, GMO opponents abandon their contention that GM-food is dangerous.

We need to step away from that mindset. We need to accept that there are concerns that exist and that these concerns must be discussed in some fashion. They need to be heard and considered. To coin a phrase, what I am suggesting is that we need to “talk without preconditions.” That means you. That means everybody. Every participant in the dialogue needs to open his or her mind and his or her ears, not just the people on the other side. That does not mean we have to credit magical thinking, but it does involve acknowledging the legitimacy of the complaint that important questions, interests, and concerns were shunted aside when the initial decisions were made about what data to collect and how that data should be analyzed. No amount of reciting data is going to resolve this problem.

We must confront the reality that the regulatory scheme for GM crops was, either deliberately or accidentally (and it does not matter which), structured to avoid engaging in the concerns that matter to many people. GM advocates are very resistant to this reality. The responses from GM advocates almost uniformly point out that the GM opponents’ knowledge is invariably idiosyncratic, limited, and quite often wrong. Based on that concern, the EPA has spent two decades focusing on expert concern, rather than public concern. I am not disputing that lay concerns can by idiosyncratic and wrong. I just want to suggest that expert knowledge is also limited and quite often wrong.

Proponents of the technology must accept that the exciting potential embodied in biotechnology will never be realized unless we have a

72. During the 2008 presidential campaign, there was much discussion of Democratic Candidate Barack Obama’s professed willingness to talk with Iran without preconditions. Upon taking office, one of the first things President Obama did was reiterate that position. See, e.g., Julian Borger, Barack Obama: Administration Willing to Talk to Iran “Without Preconditions,” Guardian, Jan.21, 2009, available at http://www.guardian.co.uk/world/2009/jan/21/barack-obama-iran-negotiations.

73. A great example of the truth in this position comes from the 2002 Eurobarameter survey where people were asked to agree or disagree with the statement “ordinary tomatoes do not contain genes, while genetically-modified tomatoes do.” You would be amazed with how many people agreed with that statement.


comprehensive and scientifically rigorous regulatory system that not only ensures environmental and human health issues are adequately addressed but also ensures that these questions are raised and addressed in a fashion that is credible to the public. We do not currently have such a regulatory system. Protecting the public’s interest in this context will require government to assume a far more active role than the hands-off attitude that has been the hallmark of conventional agricultural policy.

The 2008 United States’ presidential election was a watershed moment for revitalizing public discourse about trust. We have a widely gyrating stock market; we have a war begun by falsified evidence; and we have regulatory failures that brought us the sub-prime mortgage meltdown as well as tainted baby food, cough syrup and toys. The public is left wondering and, for the first time in a long time, is discussing what it means to have trust in regulation. We are at a moment when we can actually have this conversation and I think we need to. To do that, we need to think seriously about trust, and we need to let go of polarizing rhetoric and to resist the temptation to demonize those who differ with us. We must to move beyond polarization if we are to continue to thrive on our shrinking, warming planet.