

**An interview with John Sterman**

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## A Sober Optimist's Guide to Sustainability

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**John Sterman**, head of MIT Sloan's System Dynamic Group, explores how to get people to think for real on sustainability, why the conventional wisdom about energy is just a myth, and how to live as if there's just enough time left to save the world.

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Above all else, MIT Sloan professor John Sterman is a world-class "systems guy"—he leads the school's System Dynamics Group, is a trained scientist, is co-leader of MIT Sloan's Sustainable Business Lab (S-Lab) and perhaps unsurprisingly brings to any conversation about sustainability a certain impatience with views that refuse either to confront the evident facts or, for that matter, to see the problem whole instead of in parts, to see it as the systemic set of interdependencies that it is.

But—if indeed this should register as a "but"—he is a humanist, too. And "a true optimist." And it is impossible to come away from talking with him without feeling that there is work to do, yes, but that it can be done. And that for businesses, doing that work presents an opportunity, not just a threat.

For more about Sterman, and key links to his work, see the bottom of this article. Here he talks with Michael S. Hopkins, Editor-in-Chief, MIT Sloan Management Review, about how managers misunderstand sustainability, the impediments that block organizational change, and the benefits that flow when change is made to happen.

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## STERMAN ON SUSTAINABILITY--TAKEAWAYS

### DEFINITION

#### How do you define sustainability?

- 3 principles: can't use renewable resources faster than they are regenerated; can't produce wastes faster than they are rendered harmless; can't use nonrenewables over the long haul at all
- Sustainability not just about ecological issues but economic issues, social issues, political issues, and personal issues as well

### DRIVERS

#### Which sustainability issues will have the biggest implications for managers?

- "All so tightly connected that in some sense I don't think it matters where you start"
- People at every level of organizations hungry to participate in personal and institutional ways to decrease impact

### THREATS AND OPPORTUNITIES

#### What threats and opportunities will sustainability-related concerns present?

- Threat: Companies leery of short-term costs
- Opportunity: Huge cost savings from more efficient operations; untapped passion among all levels of society to help fix the problems

### IMPEDIMENTS

#### What obstacles keep organizations from acting on sustainability problems/opportunities?

- Deeply imbedded myths about costs and disadvantages of taking action
- Fundamental "worse-before-better" tradeoff – investments and need to redesigning processes will cause short-term performance dip
- Misconception despite all conclusive research that happiness/fulfillment achieved by having "more" and material success

### ETC.

PERSONAL PURSUITS OF HIGH LEVELS OF INCOME AND CONSUMPTION "SPEEDS THE DEGRADATION OF THE PLANET" . . . CONVERSATION ABOUT WANTS IS "NOT PERMISSIBLE IN OUR SOCIETY" AND "THE ENGLISH LANGUAGE DOESN'T ALLOW IT" —THERE'S NO WORD SUCH AS "LONGAGE" FOR EXCESS DEMAND . . . "SUSTAINABLE GROWTH" IS AN OXYMORON . . . MODELING IS A GOOD WAY TO MAKE VIVID THE ALIGNMENT OF ISSUES . . . PRACTICE DANA MEADOWS' MESSAGE TO LIVE AS IF THERE'S JUST EXACTLY ENOUGH TIME TO FIX THINGS — ENOUGH TIME TO DO IT, BUT NO TIME TO WASTE.

**You have an intriguing way of raising sustainability issues with students. Can you describe it?**

For years in my system dynamics classes we've done several sections on environmental issues. Before I introduce that material I always start out by having students fill out a little questionnaire. The questionnaire is very simple. It says, "How much money per year would be enough for you?" Say, an annuity you're going to get every year, automatically adjusted for any inflation, after all taxes. What you and your immediate family need.

People routinely will write down \$5 million to \$10 million per year. Some of the undergrads and engineering students will say \$20,000, \$30,000, very low numbers. The median response for MBA students is around \$300,000. Three hundred thousand to consume every year. If you were to turn that back into a pretax income in the real world, where you have to pay taxes, you have to save for retirement, you have to defend against future inflation and so forth, you'd have to at least double that figure. That's a lot of money.

Research shows clearly that people judge their happiness by much they consume, how much wealth they have relative to others in their social networks and in the society in which they're embedded. So if you're an MBA student, you're constantly exposed to people flaunting their wealth through what you read and the role models put in front of you in case studies and in the media—CEOs and their salaries, partners in consulting firms who dress very sharply when they come here to persuade you that you'll be successful if you join their firm. It biases people's aspirations. The engineers and the undergrads haven't yet been exposed to that same level, and so their numbers are lower. Worse, the more you make, the worse it makes everyone else feel, and then they have to strive to make and spend even more. Psychologists call this the "hedonic treadmill" but we know it better as the rat race.

The conversation is quite discomfiting for many, many people. But it's a very important conversation, and strongly linked to the sustainability issue, because the pursuit of all of that income and consumption speeds the degradation of the planet—and it doesn't make us happier.

**How does that view of consumption shape your definition of sustainability?**

Well, I like to joke that, paraphrasing Churchill, "sustainability" is the worst possible word for this—except for all the others. It's a terribly abused term. For one thing, the phrase "sustainable growth" is an oxymoron. We live on a finite planet, and therefore growth of any material activity, like the population or the economy, cannot go on forever. "Sustainable development" is fine, because you can have im-

## THE MIT SUSTAINABILITY INTERVIEW SERIES

The MIT Sustainability Interview appears every other Wednesday.

The interviewees will include thought leaders from arenas as diverse as management, urban studies, history, energy science, civil engineering, and design.

The conversations will be wildly varied, but at root their goal is to help leading managers answer just two questions: "As sustainability—economic, environmental, social, and personal—becomes the defining business issue of our times, what decisions will I need to face, and what will I need to know when I face them?"

provement of the human condition, of our moral and spiritual and intellectual activities, without material growth.

**What definition works for you, then?**

Having been trained originally in the sciences, I like Herman Daly's definition. He's a pioneer in ecological economics, and he boiled sustainability down to its thermodynamic essence: To be sustainable, a society cannot use renewable resources faster than they are regenerated; cannot produce wastes faster than they are degraded, dissipated and rendered harmless; and cannot use nonrenewables over the long haul at all. Those three principles are fundamental. They are based on the laws of physics. They are necessary conditions for a sustainable world. They are not sufficient, but they are necessary.

**How would Daly say we're doing?**

Badly. When you look at the world today, it's abundantly clear and exceptionally well documented that none of those three principles are being met. We're consuming renewable natural capital of all kinds—whether it's forests, fisheries, soils, fresh water supplies—far faster than they can be regenerated. We pump greenhouse gases into the atmosphere far faster than they can be absorbed out of the atmosphere by the ocean and biomass. And we're utterly dependent on nonrenewable resources, primarily fossil fuels. We're nowhere near

to satisfying the three fundamental necessary conditions for sustainability, and that fact is not widely appreciated.

But the perspective of those of us at the S-Lab is that sustainability is much broader than just an ecological concept. We think of sustainability as encompassing not just ecological issues but economic issues, social issues, political and even personal issues. You can't have a sustainable ecosystem if there's extreme poverty, if there's no opportunity for people to meet basic human needs and realize their potential. And of course you can't have a healthy economy if the result of that economic activity is the degradation of the environment.

Framing this as loggers versus spotted owls, growth versus green, economy versus environment—as opposition—doesn't work and isn't right. These things are fundamentally aligned. And I think people are hungry for that alignment.

**“Personal issues?” That's interesting. How do personal issues fit into your integrated view of sustainability?**

The personal isn't always part of the conversation, but I really do believe that we can't have a sustainable society if people are constantly overworked, burned out, sleep deprived, and don't have time for friendships or relationships or community, for participating in civil society. When everybody's striving so hard to have more—more income, more consumption, more stuff—and then is so tired and has so little time that they can't enjoy it, the pursuit of all of that stuff undermines the things that actually contribute to a fulfilling, meaningful, happy life. And then we feel this great dissatisfaction—and strive for even more.

As I go around and I talk to corporate leaders, managers, and workers at any level, from the most senior to the front-line operators, I find people suffering from this terrible dissonance. On the one hand, they see what's going on in the world, and it's greatly worrying to them. I don't mean they're worried about their 401(k) having collapsed. I mean they see the poverty in the world. They see the resource depletion. They see the political instability. They see the climate change issues. And they're gravely worried that unlike the sweep of history that made it possible for them to live far better than their parents and grandparents, they're leaving a world for their children and grandchildren that could very well be worse.

The dissonance comes from recognizing all that and not wanting to participate in system that involves all that destruction, and yet still going to work every day in organizations that are, mostly unintentionally but surely with great impact, creating and intensifying those very problems. People really

want the opportunity to work professionally in a way that is consistent with building a sustainable world instead of undermining it.

So people really welcome the opportunity to talk about what they personally can do—not just recycling and cutting their carbon footprint, which is surely important and needs to be done, but in their careers and at their corporations, where they spend the vast majority of their waking hours.

**The guiding principle of *more*: It's interesting to imagine what it would take to change that principle, even by degree. Because making that change seems so fundamental to what you're saying we're going to have to do.**

I think this is the most difficult issue. And it's not one you can tell people about. But you can show them.

One of the simulation models we use is a model of the overall interactions between population, resources, pollution, technology, and the environment. We'll run the model live in class. We'll say, “Okay, here is the simulation, and some very unpleasant things may happen yet in this century. But everything in the model is uncertain. Let's assume there's a whole lot more cheap oil and gas available. The marginal cost doesn't rise so quickly as we pump more out of the ground.” Then you just slide a lever in the model and instantly see the result.

What happens, of course, is that by relaxing the constraint that's limiting economic growth by lowering the availability and raising the price of energy, the economy grows even more, for an even longer time, until it hits some other constraint. So if you relax the constraint on the availability of fossil fuels, then you hit another constraint, which might be climate change. And if you go in and you relax that constraint, even magically assuming we can solve the climate problem right now, and for free, the economy grows even further until you hit another constraint, such as soil fertility or fresh water, and you see agricultural productivity fall. Relax that constraint, and you'll grow until you hit some other one.

Pretty quickly people discover for themselves that as long as everybody in the world wants more—as long as everyone in the world wants to be as rich as we are, and we all want to be richer than we are today, there's no solution.

What makes it particularly hard is that this is a conversation that's not permissible in our society. Even the English language doesn't allow it! There are words for not having enough—shortage—but there's no word for excess demand. There's no such word as a “longage” of demand.

**This sounds bleak. How do you create a vision that could get people to think about sustainability as an attractive aspiration as opposed to a “thou shalt not”?**

Well, we’re still groping towards better ways to do this. A lot of the work that Peter Senge and others have done on how to create and articulate a vision is very important here. It’s about where do we want to be, what world do we envision, and what’s that world like—not just how do we keep bad things from happening.

One of the most difficult things for people to do is to simultaneously look at and appreciate the trouble we’re in while holding out hope. There’s a very narrow path to be threaded between a kind of ignorant cheerleading—“there’s no problem! don’t worry, be happy! technology will solve all problems”—and denial and despair, the idea that it’s too late, there’s nothing we can do.

**That’s got to be one of the impediments that managers confront in trying to make progress toward addressing these problems, the sense that there’s not much they can do. What other impediments do you see blocking the way toward solving these problems—or, for that matter, seizing the opportunities they present?**

There are several. One is simply that there are a lot of myths out there that are deeply embedded and yet are just plain wrong.

In the energy domain, one of the myths is that investing in efficiency or developing renewables is just too expensive. Or that we can’t reduce our greenhouse emissions enough to stabilize the climate with no more than two degrees warming because it’ll disadvantage any country that tries, relative to competing countries that don’t—which in the United States means we’re not moving until China and India do. For the Chinese it’s exactly the same, “We’re not moving until you do.” That puts us at loggerheads. And it’s based on a myth.

There are many, many studies that show that there’re billions of tons per year of greenhouse emissions that can be abated and gigawatts per year of power consumption that can be avoided by investing in efficiency that actually puts money in your pocket.

Here at MIT, in the first year we taught our S-Lab class, the Laboratory for Sustainable Business, we had a student team look at MIT’s own energy use and carbon footprint. Three students over the course of one semester worked in close collaboration with our facilities department and identified about \$14 million of retrofit and other investments that MIT could make right now, today, with off-the-shelf technology. A lot of it is very simple stuff—swapping out inefficient

bulbs for more efficient bulbs, cleaning the steam traps in our buildings. The changes would improve the comfort for the occupants of those buildings and cut both our energy use and our carbon emissions by a very substantial amount. And they’d have an average return on investment in lower utility, maintenance and other costs for MIT of 30 percent per year. Thirty percent, I’ll note, is a whole lot better than the endowment is doing, even in a good year. And most of those things are now being implemented.

**What other impediments do executives and managers face?**

Another big impediment is that there’s a fundamental worse-before-better tradeoff. If you want to redesign your operation to use less energy, use fewer inputs, produce less waste, it’s likely to have a positive return on investment, but like any investment, in the short run performance will suffer.

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**John Sterman** is the Jay W. Forrester Professor of Management at the MIT Sloan School of Management, Director of MIT’s System Dynamics Group, and one of four faculty co-leaders of the Sustainable Business Lab (S-Lab). Sterman’s research includes systems thinking and organizational learning, computer simulation of corporate strategy, and the theory of nonlinear dynamics.

In this article in *Science* magazine, Sterman writes about why “the strong scientific consensus on the causes and risks of climate change stands in stark contrast to widespread confusion and complacency among the public.” New York Times reporter Andrew C. Revkin covered Sterman’s ideas about how to better explain climate change to the public in the paper’s “Dot Earth” blog. And one of Sterman’s tools for enabling people to explore the cause-and-effect relationships between climate change and greenhouse gas emissions, an online interactive simulator headlined “Bathtub Dynamics and Climate Change.”

This excellent MIT World video captures Sterman unfolding some of these ideas live. And on the MIT Sloan School of Management website is a Q&A with Sterman digging into his thinking and the activities of S-Lab.

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This goes beyond the classical “you have to invest so your cash flow is negative first and then becomes positive later,” although that’s part of it. There’s a much deeper issue there, which is reorganizing, redesigning processes, investing in process improvement. Doing all that work is disruptive in the short run.

But, you know, I’m fond of a quote from Thomas Hardy, who said—I believe the quote is, “If a path to the better there be, it begins with a look at the worst.”

**Thomas Hardy, noted optimist.**

There’s an old joke that the optimist proudly proclaims, “this is the best of all possible worlds!” while the pessimist grumbles, “that’s right.” I’m someone who believes that this is not the best of all possible worlds, and that makes me a true optimist, because I think we can change the world for the better.

My mentor, the late Dana Meadows, used to say that if you believe that the world is unlimited, that technology will

always be there with a solution that lets you have more, that markets always work perfectly, then we will never change what we’re doing and we will inevitably crash into the physical limits of the planet. On the other hand, if you say it’s too late, that there’s too many of us, that we’re too greedy, that no change is possible, then we might as well just give up and for sure we’re going to get what we expect.

What Dana worked for is to live as if there’s just exactly enough time. There’s enough time to do it, with no time to waste. Just exactly enough time, enough resources, enough environmental resilience and enough human compassion to bring about the change we need to create a sustainable world.

Living that way focuses your energy, gives you the hope that you need to get up every day and work towards a sustainable, equitable world of opportunity for all without glossing or denying any of the challenges and difficulties we face. We’re not very good at that. We need to get better.

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