



## Sustainable Products & Solutions Program Annual Report 2014-2015

Center for Responsible Business  
Haas School of Business  
University of California, Berkeley

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## Greetings from the Executive Director

December 1, 2015

With this report, we present an overview of the activities and outcomes from the Sustainable Products & Solutions (SPS) program for the 2014-2015 fiscal year. Initially funded in 2008 by a generous contribution from The Dow Chemical Company Foundation, the SPS program has since engaged with leading companies and top researchers from across the University of California at Berkeley to generate leading edge sustainability-focused research.



I am convinced of the importance and the incredible opportunity represented by the SPS program. The program addresses real world sustainability challenges across the entire value chain by bringing together practitioners from our partner corporations and world-leading researchers from across UC Berkeley – with the Center for Responsible Business at the center of it all. The CRB serves both as the external interface of the program to corporate partners and as the internal convener of sustainability-minded researchers.

This past year we have significantly increased the institutional support to ensure the platform that is SPS is strong. We have established the executive director, co-research directors, and program manager positions for the SPS program and are already realizing the benefits of this structure. This has resulted in the creation of new case studies done in partnership with our SPS partners, forums bringing together stakeholders from across the supply chain, as well as connecting companies to leading researchers from across the UC Berkeley Campus.

SPS represents a growing community, and we are proud to have brought on Levi Strauss & Co. this past year. As we reflect upon our seventh year of work, I would like to thank and commend the many faculty across the UC Berkeley campus who have contributed to the success of this program, as well as to thank our corporate partners. Together, we can more effectively address our greatest sustainability challenges than any one of us could do individually.

Are you interested in joining the SPS community? Please let me know. I would love to hear from you.

Onward!!!

A handwritten signature in black ink that reads "Robert". The signature is stylized and cursive.

Robert Strand, Ph.D.  
Executive Director  
Center for Responsible Business  
rstrand@berkeley.edu

## Overview

The Center for Responsible Business (CRB) was established in 2003 at the University of California-Berkeley, Haas School of Business. Since 2013, the CRB is situated within the Institute for Business & Social Impact at Haas.



The mission of the CRB is *to develop leaders who redefine business for a sustainable future*. The CRB employs the terms “sustainable” and “sustainability” in their broadest sense to include social, environmental, and economic considerations. In this respect, sustainable and sustainability entail development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The CRB is committed to develop leaders who effectively utilize the positive potential of business to build a more equitable, inclusive and sustainable society.

Consistently ranked among the top business school sustainability centers, the CRB promotes responsible business leadership through:

- **Curriculum:** *Administering classes and student opportunities*
- **Events:** *Provoking important discussions*
- **Research:** *Encouraging relevant research and creation of useful materials*
- **Connections:** *Connecting great opportunities with capable resources*

Berkeley-Haas is a signatory to the United Nations Principles of Responsible Management Education, one of whose core principles is to engage in conceptual and empirical research that advances our understanding of the role, dynamics, and impact that corporations play in the creation of sustainable social, environmental, and economic value.

## The Sustainable Products and Solutions Program

A core program of the CRB since 2008, the SPS program is focused on generating business-relevant, multidisciplinary solutions to global sustainability challenges. It accomplishes this by engaging a diverse corporate community with a diverse research community to find new, innovative ways to integrate sustainability into products and business.

## SPS Sponsors

The Sustainable Products and Solutions Program is supported by generous gifts from our corporate partners. This year, we are grateful to Kimberly-Clark Corporation, and Levi Strauss & Co., for their financial sponsorship as well as for their creative input on our program.





## Sustainable Products and Solutions at UC Berkeley

The SPS program provides a gateway for corporations seeking solutions to sustainability challenges that require the integration of business thought and academic research. While its home with the Center for Responsible Business is at the Haas School of Business, its expertise draws from a variety of institutions across UC Berkeley. In addition to Haas' Center for Responsible Business and the Energy Institute, we have identified partners in the following groups:

- College of Engineering: Laboratory for Manufacturing and Sustainability
- College of Natural Resources: Energy & Resources Group; Master of Development Practice
- College of Chemistry: Berkeley Center for Green Chemistry
- School of Public Health: Department of Environmental Science, Policy, and Management; Berkeley Food Institute
- School of Law: Human Rights Center

## Launching SPS 2.0

After much engagement with our SPS corporate partners, our affiliated researchers, and partner centers across campus, we are proud to announce a re-invigoration of the Sustainable Products & Solutions research program.

Coming Spring 2016, we are developing a suite of options available to SPS corporate partners, including:

- Case studies developed in partnership with the [Berkeley-Haas Case Series](#), tackling real-world, and real-time challenges in sustainability within corporations
- Forums, bringing together diverse players throughout the supply chain, addressing key issues identified by the SPS partner, and working in partnership with PhD students and relevant departments across the UC Berkeley campus
- In-depth research projects conducted by a team of graduate and PhD students, catered to meet a sustainability question posed by an SPS partner
- Case challenges pitched to graduate student classes across the campus, including the [Master of Development Practice](#), and the [Master of Engineering](#).

In addition, faculty and researchers across the UC Berkeley campus now have the option of applying for SPS grant funding in order to support research or to host a forum in collaboration with a existent SPS partner, or proposed new corporation. This new funding proposal has already been piloted with long-standing SPS faculty researcher Dara O'Rourke with a proposed study entitled "Improving Worker Well-Being through Altering Compensation Systems in a Lean Apparel Factory". This research is being done in partnership with a leading apparel company.

By launching these new offerings for partners, we plan to best address industry challenges by bringing together leading researchers and corporations.

## SPS Leadership Team

Changes in the SPS program also include bringing on a new, defined leadership team. We are pleased to announce our SPS leadership team:



Executive Director: [Robert Strand](#)



SPS Co-Research Directors: [Dave Dornfeld](#) & Robert Strand



Program Manager: [Seren Pendleton-Knoll](#)

## Affiliated Researchers

The thought leadership of the SPS program is performed by its affiliated researchers across the Berkeley campus. This network of researchers is the single greatest asset of the SPS program.

Some of our affiliated researchers are noted below.

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### Sara Beckman

Earl F. Cheit Faculty Fellow, Haas School of Business

Chief Learning Officer, Jacobs Institute of Design Innovation, College of Engineering



Professor Sara Beckman is Chief Learning Officer of the recently founded Jacobs Institute of Design Innovation within University of California, Berkeley's College of Engineering. Her 25 years of experience teaching product and service design and innovation-related topics at the Haas School of Business culminated in a course, Problem Finding, Problem Solving, which draws from design thinking, critical thinking and systems thinking literature. She once offered a class, jointly with the College of Environmental Design, on the Post-Dilbert Workplace. Her recent research focuses on the role of learning style diversity on design teams and on the pedagogy of teaching design. Dr. Beckman received her B.S., M.S. and Ph.D. degrees from Stanford University in industrial engineering and engineering management.

Dr. Beckman was a member of the founding faculty of the Berkeley Institute of Design and has supervised a number of Ph.D. students in the Institute. She co-founded the Cal Design Lab, a studio-style teaching space within the College of Environmental Design that serves the need for multi-disciplinary teaching across the Berkeley campus. In addition to her work at Berkeley, Dr. Beckman is active in executive education, running the Haas School's highly successful Product Management Program and teaching in a variety of other programs. She also actively consults with a range of companies on innovation and design.

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### Douglas S. Clark

Dean, College of Chemistry



Professor Douglas Clark's research is in the field of biochemical engineering, with particular emphasis on enzyme technology, biomaterials, and bioenergy. Current projects include the structural characterization and activation of enzymes in non-aqueous media, the development of metabolic biochips for high-throughput catalysis and bioactivity screening, protein design and assembly for the development of advanced biomaterials, and enhanced conversion of lignocellulosic feedstocks to biofuels.

Dr. Clark is currently Dean of the College of Chemistry and Professor in the Department of Chemical and Biomolecular Engineering at the University of California, Berkeley. He is also the Co-Director of the Synthetic Biology Institute, Faculty Scientist at Lawrence Berkeley Laboratory, and holds the endowed G.N. Lewis Chair.

He is currently Editor-in-Chief of *Biotechnology and Bioengineering*. He received his B.S. from the University of Vermont and his Ph.D. from the California Institute of Technology.

### Lucas Davis

Faculty Director, Energy Institute at Haas  
Haas School of Business



Professor Lucas Davis' research focuses on energy and environmental markets, and in particular, on electricity and natural gas regulation, pricing in competitive and non-competitive markets, and the economic and business impacts of environmental policy. His work appears in leading academic journals including the *American Economic Review*, the *RAND Journal of Economics*, and the *Journal of Political Economy*.

Dr. Davis is an Associate Professor at the Haas School of Business, and, prior to joining Haas in 2009, he was an Assistant Professor of Economics at the University of Michigan. He received a B.A. from Amherst College in 1996 and a Ph.D. in economics from the University of Wisconsin in 2005.

### David Dornfeld

Director, Laboratory for Manufacturing and Sustainability  
College of Engineering



Professor David Dornfeld leads the Laboratory for Manufacturing and Sustainability (LMAS; [imas.berkeley.edu](http://imas.berkeley.edu)) with research activities in several fields of manufacturing engineering: green and sustainable manufacturing; monitoring and analysis of manufacturing processes (e.g., cleanability, burr formation and micromachining); precision manufacturing; and intelligent sensors and machine interoperability for process monitoring and optimization. He has published over 400 papers in these fields, authored three research monographs, contributed chapters to several books, and has seven patents based on his research work. He is a consultant on green and sustainable manufacturing,

mechanical design, manufacturing productivity, sensors, automation, and process modeling and the associated intellectual property issues. He writes a blog on green manufacturing at <http://green-manufacturing.blogspot.com/>.

Dr. Dornfeld holds the Will C. Hall Family Chair in Engineering and currently serves as the Chair of the Mechanical Engineering Department. He is a Fellow of the CIRP (The International Academy for Production Engineering), Vice-President Elect and Chair of the Working Group on Energy Efficiency and Resource Effectiveness. Dr. Dornfeld received his B.S., M.S. and Ph.D. degrees in mechanical engineering from the University of Wisconsin-Madison in 1976 in the area of production engineering.

"LMAS has found our collaboration with the Haas School of Business and SPS to be effective in opening up a number of new avenues for research and interaction with leading industries for defining and implementing sustainability in business.

– Professor David Dornfeld

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**Rachel Dzombak**

PhD Candidate, Civil and Environmental Engineering  
Laboratory for Manufacturing and Sustainability



Rachel Dzombak is a doctoral student studying Civil and Environmental Engineering at University of California, Berkeley. She works within the Laboratory for Manufacturing and Sustainability to better understand the social, economic, and environmental implications of increased global production and consumption. In particular, Rachel's research examines how to accelerate the implementation of a circular economy, in which waste is viewed as a resource. Rachel received her B.S. in Bioengineering at Penn State University with an emphasis in Humanitarian Engineering and Social Entrepreneurship. She has extensive experience working with multidisciplinary teams to implement health and agricultural systems in East Africa. Rachel has published articles on medical device design, engineering education, and impact assessment. She recently led the editing team for a book on STEM Careers in Social Innovation and Sustainable Development, titled "Solving Problems that Matter (and Getting Paid for It!)."

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**Ganesh Iyer**

Edgar F. Kaiser Professor of Business Administration  
Haas School of Business



Professor Ganesh Iyer is the Edgar F. Kaiser Professor of Business Administration at the Haas School of Business, University of California, Berkeley. His research uses economic theory to study marketing strategy problems. His areas of research are the coordination of product distribution, marketing information, Internet strategy, strategic communication, and bounded rationality in marketing strategy. His research has won the Little Award in 2000 for the best paper published in *Management Science* and *Marketing Science*, and he has been a finalist for this best paper award on four other occasions (1998, 2003, 2005 and 2012). Two of his papers have also been finalists for the 2012 Informs Society of Marketing Science Long Term Impact Award.

He received his Ph.D. from the University of Toronto, and he was previously on the faculty at the Olin Business School, Washington University in St. Louis. He has served as the Associate Dean for Academic Affairs and Chair of Faculty of the Haas School of Business from 2008-2010 and as the Chair of the Haas Marketing Group from 2010-2011. He is currently chair of the Haas School's Policy and Planning Committee. He is currently a Senior Editor for *Marketing Science* and has been an Associate Editor for *Marketing Science*, *Management Science*, and *Quantitative Marketing and Economics*. He is also a member of the board of the Informs Society for Marketing Science and serves as Secretary of the Board.

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**Daniel Kammen**

Director, Renewable and Appropriate Energy Laboratory  
Energy and Resources Group



Professor Daniel M. Kammen is the Class of 1935 Distinguished Professor of Energy at the University of California, Berkeley, with parallel appointments in the Energy and Resources Group, the Goldman School of Public Policy, and the department of Nuclear Engineering. He was appointed by then Secretary of State Hilary Clinton in April 2010 as the first energy fellow of the new Environment and Climate Partnership for the Americas (ECPA) initiative.

Dr. Kammen is the founding director of the Renewable and Appropriate Energy Laboratory (RAEL; <http://rael.berkeley.edu>) and Director of the Transportation Sustainability Research Center. He has founded or is on the board of over 10 companies, and he has served the State of California and U.S. federal government in expert and advisory capacities. Dr. Kammen has served as a contributing or coordinating lead author on various reports of the Intergovernmental Panel on Climate Change since 1999. The IPCC shared the 2007 Nobel Peace Prize.

Dr. Kammen was educated in physics at Cornell (BA 1984) and Harvard (MA 1986; PhD 1988), and held postdoctoral positions at the California Institute of Technology and Harvard.

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**Maxwell Micali**

Graduate Student Researcher, Laboratory for Manufacturing and Sustainability  
College of Engineering



Maxwell K. Micali is a Graduate Student Researcher and NSF Graduate Research Fellow at the University of California, Berkeley in the Laboratory for Manufacturing and Sustainability (LMAS).

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**Marty Mulvihill**

Executive Director, Berkeley Center for Green Chemistry  
College of Chemistry



Dr. Marty Mulvihill is committed to meeting the challenges of global sustainability by pioneering interdisciplinary approaches to research and education—and especially the subsequent integration of this newly expanded understanding in social, political and business practices. Since 2010 Dr. Mulvihill has been the Executive Director of the Berkeley Center for Green Chemistry (BCGC) while continuing as a researcher in both Public Health and Environmental Engineering. He received his Ph.D. in

2009 from the University of California, Berkeley in chemistry and nanoscience. Subsequently, Dr. Mulvihill completed a postdoctoral fellowship at Lawrence Berkeley National Laboratories doing research in the materials science and earth science divisions.

Dr. Mulvihill's current work focuses on developing technologies that help provide access to clean drinking water and the creation of safer chemicals. He has a number of publications and patents related to the detection of arsenic in drinking water and he is currently partnering with students in Environmental Engineering to develop safe and affordable technology to remove excess fluoride from drinking water in India. He also works with professors in toxicology to design and produce safer chemicals including oil dispersants, catalysts, and bio-based platform chemicals. At Berkeley, Dr. Mulvihill has developed new green chemistry curricula for introductory chemistry as well as interdisciplinary graduate classes which incorporates the principles of green chemistry and sustainability by grounding them in the context of broader social challenges, such as access to energy or clean water. He also coordinates a new NSF fellowship program which uses green chemistry to guide a systems approach to green energy development.

"The SPS program connects my students and me to businesses interested in the next generation of safer chemicals and materials. The SPS program brings people together in ways that help us tackle some of this biggest material challenges of our times."

– Marty Mulvihill

## Dara O'Rourke

Associate Professor, College of Natural Resources



Professor Dara O'Rourke studies the environmental, social, and health impacts of global supply chains. As both a professor and a practitioner, Dr. O'Rourke teaches environmental and labor policy at the University of California, Berkeley and is co-founder and Chief Sustainability Officer of GoodGuide, the leading source of information on the health, environmental, and social performance of products and companies. Under Dr. O'Rourke's leadership, GoodGuide has been named: one of the world's "50 Most Innovative Companies" by *Fast Company*; the *New York Times* "App of the Week"; and the TechCrunch startup "Most Likely to Make the World a Better Place." Dr. O'Rourke has consulted to organizations such as the World Bank, the United Nations Development Programme, and the Organization for Economic Cooperation and Development. Dr. O'Rourke was previously a professor at MIT and holds an M.S. and Ph.D. from the University of California, Berkeley.

"I am very excited about the new energy and innovations coming out of the Sustainable Products and Solutions program at Berkeley-Haas. SPS is funding and supporting new research, courses, conferences, and convenings that are connecting professors and students across campus with firms working to solve sustainability challenges."

– Professor Dara O'Rourke

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**Omar Romero Hernandez**

Haas School of Business



Dr. Omar Romero Hernandez is a chemical engineer with graduate studies in economic policy and government and a PhD in process economics and environmental impact from Imperial College, London. He has worked for a diverse range of public and private organizations such as Procter & Gamble, PEMEX, Accenture, and Mexico's Ministry for the Environment and Natural Resources. From 2012 to 2014 he served as director of the Sustainable Products and Solutions Program at the Center for Responsible Business at the UC Berkeley's Haas School of Business. In 2010 he was appointed leader of Mexico's Business Summit task force on Economic Growth and Low Carbon Emissions, which delivers recommendations to the President.

He is the author of three books: *Renewable Energy Technologies and Policies, Industry and the Environment* and *Introduction to Engineering – An Industry Perspective* and several international publications on engineering, business, and sustainable development. Dr. Romero Hernandez was the recipient of the 2010 Franz Edelman Award, the world's most prestigious award on operations research and management science.

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**Stefanie Robinson**Associate Director, Laboratory for Manufacturing and Sustainability  
Mechanical Engineering Department

Stefanie is currently overseeing projects on data analytics and metric development, environmental and social impacts of manufacturing systems, and the circular economy. She has more than a decade of experience working in industry and academia in the areas of sustainable product design and manufacturing and energy efficient technologies. She has worked with organizations such as Caterpillar Inc., Autodesk Inc., and the Air Force Research Laboratory. She also has experience with life-cycle assessment of economic,

environmental, and social impacts, metrics development, process trade-off analysis, and engineering education. Her Ph.D. and M.S. are in Mechanical Engineering from the University of California, Berkeley and her B.S. is in Mechanical Engineering from the University of Maryland, College Park.

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**Robert Strand**Executive Director, Center for Responsible Business  
Haas School of Business

Dr. Robert Strand is the Executive Director of the Center for Responsible Business at the Haas School of Business at the University of California, Berkeley. He also maintains formal affiliation with the Copenhagen Business School as Assistant Professor of Leadership & Sustainability. Dr. Strand's research and teaching focuses on the strategic aspects of sustainability which includes the role of the Chief Sustainability Officer, corporate governance of sustainability, comparing global approaches to sustainability with particular focus on U.S. and Scandinavia, and



theory of the firm with a focus on ethics of the corporation. He is a frequent contributor to popular and academic venues including the *Financial Times* and the *Journal of Business Ethics*.

Dr. Strand completed a Ph.D. from the Copenhagen Business School focused in corporate social responsibility (CSR), an MBA from the University of Minnesota focused in international business, and a B.S. in industrial engineering from the University of Wisconsin. He was a U.S. Fulbright scholar to Norway, during which time he explored sustainability and CSR across Scandinavia. Prior to joining academia, Dr. Strand spent a decade in industry with IBM and Boston Scientific in a range of roles that include manufacturing, supply chain, marketing, strategy, and investor relations.

### Terry Taylor

Milton W. Terrill Associate Professor of Business Administration  
Haas School of Business



Professor Terry Taylor's research interests include contracting and coordination in distribution channels, the marketing/manufacturing interface, and operations management. His work has explored the role of ongoing relationships in supply chains, contract renegotiation, outsourcing, forecasting, and product line design. He has consulted on marketing and/or operational issues in the retail, high-tech, banking, and telecommunications industries. He is an associate editor of *Manufacturing and Service Operations Management*,

*Operations Research*, and *Production and Operations Management*. Dr. Taylor received Columbia Business School Dean's Award for Teaching Excellence in 2003 and the UC Berkeley Cheit Award for Excellence in Teaching in 2009.

"The Sustainable Products & Solutions Program provides a terrific bridge connecting faculty to companies facing sustainability challenges. These connections help faculty to frame and pursue their research in a way that it will have the most impact: addressing real problems and developing insights useful to a broad set of firms."

– Professor Terry Taylor

Dr. Taylor is an associate professor in the Haas School of Business. Prior to his position at Berkeley, Dr. Taylor was a professor at Columbia University's Graduate School of Business and Dartmouth's Tuck School of Business. Prior to his academic career, Dr. Taylor was a consultant for McKinsey & Company. He received his Ph.D. and B.S. from Stanford University.

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**Candace Yano**

Professor and Chair, Operations and Information Technology Management Group  
Haas School of Business



Professor Candace (“Candi”) Yano’s primary research interests are production, inventory, and logistics management, particularly on how to deal with various sources of uncertainty in these contexts, as well as interdisciplinary problems involving manufacturing and marketing. She has authored or co-authored over 70 articles and book chapters on these subjects and is the recipient of several National Science Foundation grants.

She is a Professor in the Department of Industrial Engineering and Operations Research (IEOR) and in the Haas School of Business at the University of California, Berkeley. She holds an A.B. in economics, a M.S. in operations research, and a M.S. and Ph.D. in industrial engineering from Stanford University. Prior to joining the University of California, she held positions as a member of the technical staff at Bell Telephone Laboratories and as a faculty member in the Department of Industrial and Operations Engineering at the University of Michigan.

Dr. Yano was the recipient of a Chancellor’s Professorship at UC Berkeley from 1997 to 2000, and is a Fellow of the Institute for Operations Research and the Management Sciences as well as the Institute of Industrial Engineers.

## Sustainable Products & Solutions Forum: Supply Chain Sustainability



In May 2015, the Center for Responsible Business, through its Sustainable Products & Solutions (SPS) Program, hosted a forum on the topic of supply chain sustainability. Attendees of the forum included representatives from companies such as Apple, Google, Cisco, Kimberly-Clark, and PepsiCo, as well as faculty and student researchers from departments across the university. The focus of this forum was on the topic of impact metrics for supply chain sustainability, with respect to best practices, current challenges, and where opportunities for research may exist. The forum lasted for an entire day, and the day was filled with presentations by the attendees, group discussions, and smaller breakout sessions focusing on more targeted discussion topics. In addition to the knowledge shared and generated over the course of the day, this forum also provided a valuable opportunity for attendees facing these challenges in different companies to network and discuss these salient topics on a precompetitive level.

There were several recurrent themes that naturally bore out of the conversations throughout the day, and these made it clear that while progress in metric development has been made by individual actors, more concerted efforts and emphases will be required to truly operationalize sustainability metrics in the supply chain. These recurring themes were:

1. Quantifying and Qualifying Social Impacts;
2. Moving from Compliance to Capacity Building;
3. Integrating Design and Sustainability;
4. Influencing Consumer Behavior; and
5. Collaborating to Achieve Shared Goals.

The identification of these themes will help to shape future forum discussions and research efforts.

### **1. Quantifying and Qualifying Social Impacts**

While there has been much work on the material and energy effects of supply chains, these physical metrics do not necessarily capture all of the impacts of a given supply chain's structure. As long as a supply chain includes human labor at some point, social impacts, such as working conditions and employee welfare, must be accounted for. Unfortunately, social metrics are not just different to interpret; they are also very difficult to measure – if one even knows which measurements are the correct data to collect, and at which resolution. For example, a typical measurement is to count the number/frequency of accidents within a facility; however counting accidents sheds little insight toward how to prevent them from happening in the first place. There is a need for systematic analyses to establish processes for social impact measurement and evaluations, which are both more thorough and more efficient than the few that are in place today.

Another problem that must be solved with regard to social impact is the lack of transparency. With many companies and subcontractors failing to report or falsifying information about their labor practices, the social impact of a multitier supply chain can quickly become impossible to analyze. Additionally, it is often the case that high volume sellers are not even aware which subcontractors are handling their products several tiers upstream, much less their labor practices. In order to examine social impacts, there must be a solution, which grants transparency to labor practices throughout the network, while still maintaining the opacity required for competitiveness.

### **2. Moving from Compliance to Capacity Building**

Sustainability divisions of companies typically have tight budgets and operate outside of the core business mission, and they often must collect and report different metrics to different stakeholders. While the volume of information collected may increase, the quality of the dataset can get diluted. Is it possible for companies to transform this data from a labor of compliance to one of value generation? This question is central to incorporating sustainability into the corporate mission, and it results in self-sustaining momentum.

The question above can be broken into many constituent parts and approached in a piecemeal manner. What is the business case for sustainability, and how can it be incorporated into a complex, modern supply chain? What is the return on investment of capacity building, and will it manifest itself in obvious or in not-so-obvious forms? How can capacity building efforts be structured to build the capacity of employees? These questions represent just a fraction of potential research directions to elucidate the value of sustainability.

### **3. Integrating Design and Sustainability**

The status quo for product design is the design team creates a product, and then the sustainability team analyzes it. The complication this separation presents is that product markets rapidly change, leaving sustainability teams lagging behind. Perhaps a more effective

system would be to integrate sustainable design criteria into the set of criteria designers and engineers are already using to make design choices. This could come in the form of sustainable design tools, and more research is needed to understand what sort of design tools could be helpful. Some examples of tools could be a guide for chemical and material substitutions, a tool to evaluate the impact of the product across its entire lifecycle, or a procedure for understanding the context and customer use patterns around their products. Unilever, for instance, is now simply encouraging customers to take shorter showers, since 75% of the impact for shampoo occurs during its use phase, and is more a function of the fact that shampoo is used in the shower, than of the shampoo itself.

#### 4. Influencing Consumer Behavior

It is not surprising that consumers have influence on sustainable supply chains. However, despite self-reporting surveys in which consumers claim sustainability is a factor when shopping, other analyses have shown that price and peer networks have much more influence on consumer choices – so much stronger that only about 3% of consumers actually consider sustainability in their decisions.<sup>1</sup> To compound matters, “green” products are sometimes viewed by American consumers as less effective than their conventional variants. Vendors can play a role in influencing consumer behavior, either directly by altering preconceived consumer notions, or indirectly with price and peer networks. Additionally, vendors can bypass consumer behavior altogether by focusing on corporate buyers.

#### 5. Collaborating to Achieve Shared Goals

Several attendees stated that an obvious value the SPS Forum provided for them was an opportunity to hear how other companies approached sustainability, and this was also a draw for them to attend. Firms have tended to each collect sustainability information in different ways, but industry standardized processes present an opportunity to streamline the processes, as well as provide a way to benchmark against their peers and to share best practices. This forum provided a neutral, precompetitive environment to start a collaborative conversation, and future forums can serve in a similar role. Collaborative partnerships can also extend from industry to academia to further such an applied research agenda.

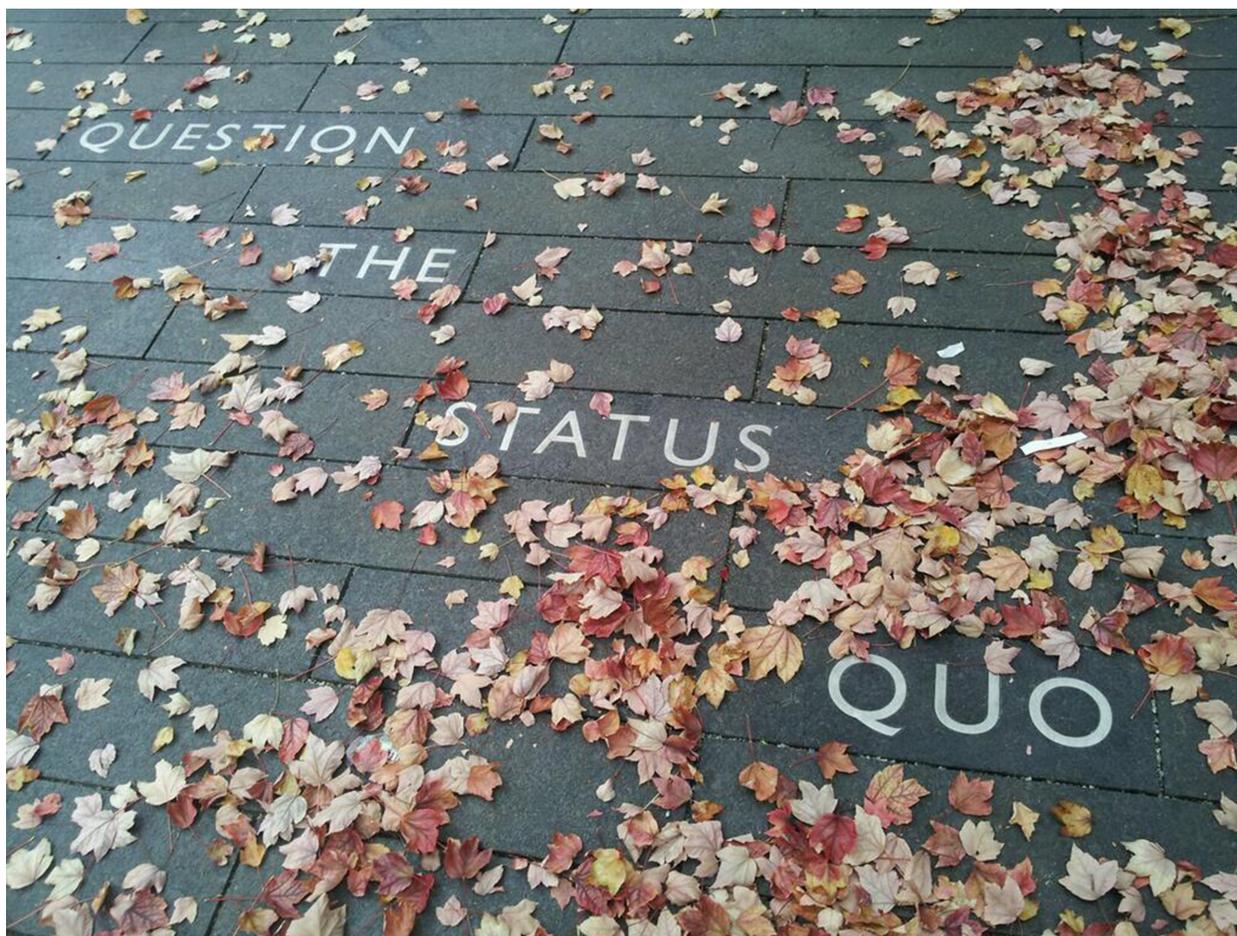


#### Conclusion

These five themes that emerged from the forum will serve as a guide for the researchers at UC Berkeley thinking about these problems, as well as for the industrial forum attendees. Defining the challenges is the first step toward meeting sustainable supply chain goals, and the SPS Program, by connecting global organizations to world class researchers, is poised accelerate the path.

<sup>1</sup> <http://www.nytimes.com/roomfordebate/2012/07/30/responsible-shoppers-but-bad-citizens/the-power-of-environmentally-conscious-shopping>

## Sustainable Products & Solutions in the News



The SPS program was proud to launch a collaboration with our umbrella organization, The [Institute for Business and Social Impact](#), in order to feature in-depth work that our SPS researchers have been conducting. Two pieces launched on the [Institute for Business & Social Impact Blog](#) based on work that was done in the 2014-2015 fiscal year:

- Dara O'Rourke: How to Make Sustainability Less Like Spinach
- Green Chemistry: From Blue Jeans to 3-D Printing

## Dara O'Rourke: How to Make Sustainability Less Like Spinach

By: Edmund L. Andrews, October 13<sup>th</sup> 2015

*This post originally appeared on the [Institute for Business & Social Impact Blog](#)*



When it comes to products that are “good” – healthier, safer for the environment, or produced by companies that treat workers fairly – what consumers say they want is often very different from what they buy.

In surveys, as many as 75% of respondents say they want sustainable products, and most of those people say they are willing to pay slightly more money for them. Yet such products only make up between 1% and 3% of the market.

Do people simply exaggerate how much they care about health and sustainability? Do they lack accurate information? If they do have solid information, how does it affect their buying decisions?

Now, a [new study](#) by [Dara J. O'Rourke](#) at UC Berkeley's Department of Environmental Science provides answers that are by turns encouraging and sobering.

The encouraging part: If a consumer is actively looking for information about a product's health impact, a favorable rating on that issue can make him or her more likely to buy it on the spot.

The sobering part: If consumers aren't looking for that kind of information, and simply run across it, they are not likely to change their buying decisions.

The uncomfortable part: Consumers generally don't care about a product's social or environmental impact. In fact, a high "green" rating can often make consumers *less* likely to buy a product.

The study, funded in part by the [Sustainable Products & Solutions Program](#) at the Berkeley-Haas [Center for Responsible Business](#), is based on an analysis of more than 40,000 purchasing decisions by people who had looked at sustainability ratings for products on [GoodGuide.com](#).

GoodGuide, which O'Rourke himself co-founded in 2007, provides meticulous ratings on more than 250,000 products – from shampoo and cosmetics to appliances and cars. The ratings cover health, environmental safety and responsible business practices. They are prepared by a staff that includes chemists, toxicologists, nutritionists, and sociologists. When consumers see products they want, they can click a "Buy Now" button and purchase them.

O'Rourke started GoodGuide largely as a research project – a "natural experiment" to study how ordinary consumers respond to information about health and sustainability when they are in the midst of shopping.

"The idea was to get beyond what mainstream research was telling us," he says. "Environmental and health advocates need to draw on the lessons of behavioral psychology. They can't just hope that telling consumers how bad something is will actually change their decision."

O'Rourke co-authored the new paper with Abraham Ringer, a graduate student at Berkeley's Department of Environmental Science.

O'Rourke says the new findings do not mean that sustainable products are doomed to fail.

The findings clearly show that "green" marketing claims can backfire, which O'Rourke suspects reflects a belief that "green" products won't perform as well and or taste as good.

But O'Rourke and Ringer note that environmental sustainability can confer social cache on certain products. The most famous example is the so-called "Prius effect," named after Toyota's wildly popular hybrid cars. The new study found more homely examples, such green dish-washing liquids and hand soaps. Many people, O'Rourke notes, conspicuously leave their green dish-washing liquid out where others will see it.

The difference is largely between purchases that are purely functional and those that have a social dimension.

"Decisions around products that 'just have to work,'" write O'Rourke and Ringer, "are very resistant to influence by sustainability information." It is a different case, however, for products that are tied to status or consumed in public.

The study also shows that consumers react very differently to health information about different products. Women between the ages of 25 and 35, for example, are heavily influenced by health ratings for baby shampoo – but much less by ratings for hair dyes. In general, health

scores had considerably more influence on purchases of sun care, skin care and baby care products than on deodorant and make-up.

The key, O'Rourke suggests, is to be smarter about what consumers want and about how to frame the issues.

"We have to take the attitudes of mainstream consumers very seriously," he says. "In the market, we are often overwhelmed by choices and constrained by time. In that setting, people fall back on their default settings – what they already know or what is cheapest. The more we understand their attitudes, the more we can help them follow their own stated values."

## Green Chemistry: From Blue Jeans to 3-D Printing

By: Edmund L. Andrews, November 11<sup>th</sup>, 2015

This post originally appeared on the [Institute for Business & Social Impact Blog](#)



When people talk about “green” business, they often think about renewable energy and products that have a smaller carbon footprint.

But there is also a burgeoning business interest in “green chemistry,” safer and more environmentally sustainable alternatives to chemicals that are used in everything from clothing and toys to food and electronics.

[Martin Mulvihill](#), executive director of UC Berkeley’s [Center for Green Chemistry](#), is at the forefront of that effort – often in partnership with the Sustainable Products and Solutions program at the Berkeley-Haas Center for Responsible Business.

Among his recent collaborations:

\*A project for Levi Strauss & Co. to find safer and more sustainable [chemicals to make wrinkle-free and water-repellant clothing](#).

\*A project for Autodesk to identify [bio-inspired materials for use in 3-D printing](#).

\*A project to find an alternative to isocyanate, a toxic chemical in [spray-foam insulation material](#) that the California Department of Toxic Substances Control would like to replace.

Having launched the Center for Green Chemistry in 2010 as a collaboration between College of Chemistry, School of Public Health, Environmental Science, Toxicology, and Engineering, Mulvihill is now expanding his partnership with the Center for Responsible Business in order to take on longer-term industry-wide challenges.

“We take challenges from industry partners, such as Levi Strauss, Method, and Autodesk,” he says. “These are industry-wide challenges for the middle-term, not just for the next quarter. We help students understand the technical function of a chemical and then look for alternatives using the tools of green chemistry, biomimicry, and sustainability.”

It’s one thing to find a “bio-mimetic” process that can substitute for an existing chemical, but another thing entirely to find one that is as cost-competitive and performs as well as the

original. And even when alternatives are found, they may come with their own toxicity problems.

“Just because something is new or even bio-based doesn’t mean it is inherently better,” Mulvihill cautions, “It is important to take a lifecycle approach to identify the potential tradeoffs or the toxicity associated with a replacement chemical.

That appears to be the case with BPS, an alternative to the plasticizing compound BPA that has been banned in many areas because of its health risks. Unfortunately, BPS poses its own health risks as an endocrine disrupter.

Part of the center’s strategy, Mulvihill says, is to think about a problem in an entirely new way. Instead of replacing a troublesome chemical, for example, the solution may involve re-designing a process to get by without the chemical.

It may also involve a fresh look at the conventional wisdom of how a product is used. Levi Strauss, for example, asked the Center for Responsible Business and the Center for Green Chemistry to analyze the biological impact of washing jeans less frequently.

Mulvihill argues that many companies are keenly aware of the business case for research on green chemistry, in part because of increasing pressure from consumers and the public at large.

“They need chemicals and materials that are safer for the environment, meet consumer demands for price performance and increasingly for health expectations as well,” he says. “What we can provide are the new technologies that meet all three of those needs. If you’re feeling pressure and want to be pro-active rather than reactive, and get a leg up on your competitors, we can help take you to the future.”

“We know that there are unmet needs in many sectors of the economy for safer chemicals,” he continues. “Some of the biggest challenges include creating safer and more sustainable methods for textile dyeing and finishing; new adhesives and coatings in the building industry; replacements for rare-earth and heavy metals in electronics; and better polymers, plasticizers, and additives for the plastics industry.”

In addition to the economic incentives for developing safer and more effective technologies, Mulvihill says that social and political drivers can play equally important roles in advancing the development and adoption of safer chemicals.

Consumer advocacy organizations can exert significant influence by pressuring companies to adopt safer and more sustainable materials. We have already seen this in campaigns that led to the [increasingly numerous bans of BPA in plastic bottles and childrens’ toys](#), as well as in [Greenpeace’s successful effort](#) in the European Union to ban the import of textiles produced with hazardous chemicals known as NPE’s.

There is also an opportunity for business investment within large companies to support entrepreneurs who are focused on developing safer chemistry. Increasing consumer

awareness and international regulation will drive manufacturers and brands toward safer and more sustainable chemistry.

For more information on the Center for Green Chemistry's outreach to business, contact Tom McKeag, the Center's new program director.

## SPS Research Projects

This year marked a new partnership for SPS with Levi Strauss & Co. Their engagement with SPS started with research on product life cycle with the Berkeley Center for Green Chemistry during FY 2014-2015, and is continuing on with a case study and forum come spring 2016.



## Updates of Past SPS Research Projects

This report contains summaries of research projects performed by the affiliated faculty of the SPS program. The three projects summarized below reflect updates on research that was funded in prior fiscal years of the SPS program.

- Consumer Decision-Making and Sustainable Products
- Regression Discontinuity Evidence for the Demand for Energy-Efficient Products
- Locally Appropriate Energy Strategies for the Developing World: A focus on Utility Scale Clean Energy Opportunities in Sarawak, East Malaysia

## Consumer Decision-Making and Sustainable Products

SPS Project Lead: Professor Dara O'Rourke

Environmental Science, Policy, and Management

*A report on the findings from this project will be published in the Journal of Industrial Ecology in the third quarter of 2015.*

This project centered on the topic of consumer decision-making, and how changes in sustainability information drive consumption decisions. A direct benefit of the knowledge gained from this study is a set of insights on how to possibly advance consumer behavioral change. This project is unique in that moves beyond surveys and small-scale experiments to large-N empirical data on actual consumer decision-making through access to anonymized data from GoodGuide.com, which has over 600,000 consumers per month using its web and mobile apps.

Concerned with how different types of information, timing, and delivery modes influence consumer behavior, this project investigated the following research questions:

- Whether information about a product or company's environmental, social, or health performance has an influence on purchasing decisions? What information (health vs. environmental, etc.) has the most influence? At what time in the purchasing process?
- Does information change behavior if it is delivered closer to the moment of purchase (i.e., near the "buy now" button online or via a mobile phone in a store)?
- How does price and quality information interact with (or trump) environmental, social, and health information?
- What is the impact of presenting different types of information? Pass/fail information versus detailed ratings? Only positive information vs. positive & negative?
- What are the most effective types of "feedback" loops in consumption information? Is it possible to create a "Prius screen" for purchases to show consumers the impacts of their decisions?

Through conducting a multivariate statistical analysis on over 40,000 online purchase interactions on GoodGuide.com, a few interesting conclusions were reached. First, this analysis found that certain types of sustainability information have a significant impact on purchase intentions, which varies according to the type of consumer, the type of issue, and the product category. Second, it is clear in this study that health ratings showed particularly strong influence over consumers, when compared to the influence from social or environmental ratings. Third, direct users – those users who intentionally sought out sustainability information – had an average purchase intention rate of 1.15 percentage points for each point increase in overall product score (0-10 scoring), and were the most influenced by sustainability information. In fact, sustainability information had little to no impact on nondirect users, on average, which suggests that their consumer behavior cannot be influenced by simply providing more or better sustainability information.

*This project also appeared in the previous SPS annual report. It is published here in order to capture all work from the fiscal year of July 1, 2014, through June 30, 2015.*

**Regression Discontinuity Evidence for the Demand for Energy-Efficient Products**

SPS Project Lead: Professor Lucas Davis  
Haas School of Business

Interest in energy efficiency has surged over the last several years, in large part due to unprecedented levels of public support. This increased attention to energy efficiency represents a substantial opportunity for manufacturers and retailers of energy-efficient products. The market is unusual, however, in that it involves a high level of cooperation between the private and public sector. With many energy efficiency programs, manufacturers and retailers work together with utilities to offer and administer rebates and other forms of direct incentives.

This study aimed to study the demand for energy efficient products by using a regression discontinuity (RD) analysis. Data was used from a large-scale energy-efficiency program that provided incentives for households buying energy-efficient refrigerators and air conditioners.

Overall, the graphical evidence provides a strong indication that program participation increases with higher subsidy amounts. However, the research also found that many households would have participated even for much lower subsidy amounts, and about half of the households would have replaced their appliances without any sort of subsidy. These latter participants add cost to the program without any attributable reduction in energy use.

The findings from this report are relevant to current energy policy focused on increasing energy efficiency, as well as to others who may adopt a similar method of RD analyses and conceptual frameworks to similar programs. For the full report in the *Journal of Public Economics*, please refer to the citation below.

[A Credible Approach for Measuring Inframarginal Participation in Energy Efficiency Programs](#)

(Judson Boomhower and Lucas Davis), *Journal of Public Economics*, 2014, 113, 67-79.

*This project also appeared in the previous SPS annual report. It is published here in order to capture all work from the fiscal year of July 1, 2014, through June 30, 2015.*

## Locally Appropriate Energy Strategies for the Developing World: A focus on Utility Scale Clean Energy Opportunities in Sarawak, East Malaysia

SPS Project Lead: Professor Daniel Kammen

Energy and Resources Group

Southeast Asian nations, along with China and India, are shifting the center of gravity of the global energy system. Since 1990, the region's energy demand has expanded two-and-a-half times and will increase over 80% between today and 2035, a rise equivalent to current demand in Japan. The power sector is fundamental to the energy outlook for Southeast Asia, and within it coal emerges as the fuel of choice. This leaves a significant space for exploring clean energy technologies. Emblematic of states pursuing rapid economic expansion, the Malaysian state of Sarawak, which is currently one of the world's largest producers of palm oil and timber, is embarking on a large industrialization project, the backbone of which is a series of up to 50 hydroelectric dams with a capacity of 20,000 Megawatts (MW)<sup>2,3</sup>. Despite these large-scale energy developments, most of these rural villages in East Malaysia are not grid connected, and rely heavily on high-cost diesel fuel for all electricity and transportation needs. The Sarawakian economy, based on large-scale agriculture and primary extractive industry, represents an ideal case study for exploring whether synergies between clean energy technology and abundant exploitable natural resource exist. Given the pace of growth of similar states in the Southeast Asian region, a study of this potential is timely.

The Renewable & Appropriate Energy Laboratory (RAEL) at UC Berkeley conducted a study to address this local and large-scale energy service debate in villages along the Baram River in Sarawak, East Malaysia where electricity from diesel effectively costs 2.24 RM/kWh (\$0.70/kWh), compared to a 0.31 RM/kWh (\$0.10/kWh) domestic electricity tariff for state utility customers. Using a hybrid energy resource optimization framework, RAEL explored optimal configuration for these villages based on cost and resource availability. They found the least cost options for energy services to come from a mixture of locally managed small-scale hydroelectricity, biogas generators and accompanying batteries instead of a claim of service provision based on large-scale regional electrification. A range of different renewable energy service scenarios are consistently 20 percent, or less, than the cost of diesel energy scenarios, without the social, economic, and environmental disruptions that would come with a large-scale hydropower plan for the river basin.

Over the past year, RAEL has identified technologies at both the local village and larger commercial scales that meet demands while minimizing damage to primary tropical rainforests, indigenous communities, biodiversity, and carbon stocks. A series of reports came out of this work, as well as meetings with the Chief Minister of Sarawak, Malaysia. In addition, this work has received much press in Southeast Asia, stimulating a regional dialogue. RAEL has been asked to perform similar clean energy planning projects in Laos and in the Philippines in response to this successful project.

*This project also appeared in the previous SPS annual report. It is published here in order to capture all work from the fiscal year of July 1, 2014, through June 30, 2015.*

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<sup>2</sup> The Regional Corridor Development Authority (RECODA) is the agency tasked with overseeing and managing SCORE: <http://www.recodacom.my>

<sup>3</sup> Bruno Manser Fonds (2012). *Sold Down the River: How Sarawak Dam Plans Compromise the Future of Malaysia's Indigenous Peoples*. Report, November 2012