BUILD YOUR COMPANY'S CAPACITY TO CHANGE THE WORLD

SUSTAINABLE INNOVATION

ANDREW HARGADON

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The original research project that laid the foundation for the central arguments of this book began with a phone call from Andre de Fontaine, then Markets and Business Strategy Fellow at the Pew Center on Global Climate Change (now the Center for Climate and Energy Solutions). He was calling to offer support for investigating low-carbon business innovation by companies. The project culminated in a published report, *The Business of Innovation: Bringing Low-Carbon Solutions to Market*, that summarizes lessons learned and distills insights on how to further advance low-carbon business innovation. The leadership at Pew Center, including President Eileen Claussen, Judi Greenwald, Janet Peace, Sam Wurzelmann, Nick Nigro, and especially Meg Crawford, enabled and encouraged me to look beyond the usual suspects in the management of innovation to find those capabilities that directly addressed the challenges of low-carbon innovation.

Many individuals, companies, and organizations contributed to the development of that report. I thank the following people for their assistance in developing the case studies: Tina Edvardsson, Amy Ericson, Bob Hilton, John Marion, Guillaume Mehlman, and Scott Sherrin at Alstom; Brian Burton, Martin Daum, Randy DeBortoli, Mark Groeneweg, David Hames, Paul Menig, Alan Pearson, and Amy Sills, Jessica Altschul, Oliver Britz, Steve Cannon, Helge Janzon, Markus Kemner, Berthold Keppelar, Klaus Land, and Markus Paula at Daimler; Mark Gorzynski, Peter Hartwell, Engelina Jaspers, Nancy Keith-Kelly, David Lobato, Chandrakant Patel, and Tony Prophet at Hewlett-Packard; and Don Albinger, Mike Andrew, Bruno Biasiotta, Iain Campbell, Mark Chatelain, Kim Metcalf-Kupres, Clay Nesler, Craig Rigby, Derek Supple, Mark Wagner, Tom Watson, and Mary Ann Wright at Johnson Controls.

Over the course of the research project and in the workshops and lectures that followed, it became clear that the arguments of the report were equally applicable to areas of sustainability that went beyond carbon and even climate change. The established companies and new startups taking on issues and opportunities of water scarcity, environmental destruction, toxic waste (or toxic raw materials), famine, obesity, and social inequities faced the same challenges as those companies attempting to reduce the carbon emissions of their offerings. This initiated a second phase of research involving companies and people pursuing the range of sustainable ventures, including Susan Mac Cormac, founder of Morrison and Foerster's clean technology practice; Kristin Groos Richmond, cofounder and CEO of Revolution Foods; John Bissell, cofounder and CEO of Micromidas; Michael Clayton, founder and CEO of Trace and Trust; and many more entrepreneurs and innovators fighting this good fight from the trenches. Their conversations, insights, questions, and answers contributed greatly to the ideas of this book, and I wrote it with the next generation of leaders like them in mind. The focus of the book is on the challenges of sustainable innovation in many different sectors and the capabilities needed for it, and it's my hope that executives facing these challenges will find it useful.

You might say I was raised in innovation—my undergraduate and master's degrees are from Stanford's Product Design program, and I worked for IDEO Product Development and Apple Computer, did my early research on some of the most innovative companies in history, took a job researching and teaching innovation, and founded the Child Family Institute for Innovation and Entrepreneurship. Beyond a childhood spent hiking in the Sierras, my introduction to sustainability began in earnest when Dan Sperling, founder and director of the Institute for Transportation Studies at University of California, Davis, and I cofounded the Energy Efficiency Center at UC Davis in 2006. It was the country's first such center dedicated to the identification, development, and effective commercialization of energy efficient technologies. It represented the combination of Dan's understanding of the issues surrounding the technologies and policies of clean technology and energy

efficiency with my focus on innovation and commercialization. Much of what I learned about the challenges of sustainable innovation came from working with Dan, Ben Finkelor, Joe Krovoza, and the gang of dedicated and talented researchers at the center, as well as the network of external partners that surrounded and supported the center, like Sacramento Municipal Utility District, Pacific Gas and Electric, Sempra, Southern California Edison, the Public Utility Commission, the California Energy Commission, Walmart, and the National Resources Defense Council.

Many of my direct experiences with entrepreneurs taking on the challenges of sustainability came from working at the Institute for Innovation and Entrepreneurship. In the ten years of its existence, we have worked with over a thousand researchers interested in commercializing their work. The lessons we've learned in working with them, codified in our Entrepreneurship Academy programs, are similarly focused on providing them with a growth mind-set—that they can dramatically expand the bounds of their influence by learning new skills and connecting with others whose capabilities complement their own. I am grateful to my friends and partners at the institute for their support throughout this project: Cleve Justis, Nicole Starsinic, Niki Peterson, and particularly, Wil Agatstein, a great friend, mentor, and colleague who left us far too soon.

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Martin Kenney participated in many of the crucial conversations, offering pints, provocations, and perspectives that run throughout this book; he served as one of the best minds in and memories of a field as eclectic as innovation. Margo Beth Fleming, my editor, provided patient, subtle, and sometimes not-so-subtle guidance that helped me shepherd my original research and ideas into the confines of this book. Thanks go to her and to everyone else at Stanford University Press who make this happen daily.

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Finally, my father, Fred, whose conversations over the years have left me so much to remember and reflect on, will always remain the first reader I write for. I will miss you.

CONTENTS

INTRODUCTION

SUSTAINABLE INNOVATION takes on a challenge confronting increasing numbers of corporate leaders today—responding to the emerging opportunities and threats collectively called "sustainability." Whether it's climate change, water scarcity, environmental destruction, toxic waste or toxic raw materials, famine in developing (and even developed) economies, obesity in developed (and even developing) economies, or the social inequities that amplify all these threats, the first questions to come up are usually strategic. If the effects of climate change are real and imminent (and they are), what should we do to remain competitive? If capital markets begin accounting for the true costs and risks of unsustainable environmental and social practices (and they have), what should we do? If customers and entire markets start shifting preferences toward more sustainable goods and services (and they are), what should we do? And if federal, state, and even local policies change what my company, my suppliers, and my customers may do (and they are), what should we do? Nobody wants to chase after every fad or jump at the sight of his or her own (carbon) shadow, but at the same time, nobody wants to miss a significant strategic opportunity or be blindsided by sudden transitions.

This book is written for the many executives who recognize their company's need for sustainable innovation—the ability to see the

changing conditions of their market, define the emerging opportunities and threats, and develop bold new strategies in response. To the question "What should we do?" the most important answer is that there is no single, simple answer. There is not even a short list. Every company, in every sector, will feel the effects of sustainability differently and, for the most part, indirectly—not through melting ice caps or distant famines but through the shifting market preferences, newly competitive technologies, and bolder regulatory policies of its customers, suppliers, competitors, and other market forces. Leaders need to determine their best path given their own circumstances. They need to stop looking for the right answer and start building organizations capable of recognizing and responding to their own emerging opportunities and threats through innovation and capable of maintaining the pace of change needed over the long term.

To be clear, sustainable innovation means two things. First, from the Bruntland Commission's formal definition, it means generating, developing, and launching new products and processes that "meet the needs of the present without compromising the ability of future generations to meet their own needs."[1] But as true sustainability remains a virtual impossibility in today's industrial society, I amend this definition to mean introducing new products and processes that are more sustainable than current alternatives—that consume fewer environmental resources, foster the health of individuals and communities, and are affordable for consumers and producers alike. Second, because a single innovation will neither support an organization nor drive fundamental change across an industry, it is also about building an organization capable of sustaining the pace of innovation over a decade or more. Companies that can do this will thrive; those that can't won't.

In conversations with company executives about sustainability, I find that few feel prepared to set bold new strategies let alone commit to the major innovations required to achieve them. Just a decade ago, that was fine—after all, the need to address sustainability affected only a handful of industries. For energy producers, carmakers, and chemical, seed, and pesticide companies, it was a threat to their core business models. For niche grocers and food and clothing companies, it was an opportunity

for differentiation and growth. And almost everyone else could ignore it. Now, nobody's safe. The opportunities and threats of sustainability are reshaping every industry, yet few leaders and companies are prepared to make the strategic investments necessary to respond through innovation—whether that means developing new products and services, new raw materials and manufacturing processes, new suppliers and distribution channels, or even new customers.

In part, that's because it's not clear what you're dealing with. Sometimes sustainability looks like shifting market preferences: high-mileage cars, energy efficient appliances, wholesome foods, or organic cotton (or conversely, boycotts, investor activism, or increased insurance rates). Sometimes it looks like competing technologies: rooftop solar, hybrid cars, biopesticides, and LED bulbs. Sometimes it looks like changing policies: mileage standards, Energy Star ratings, carbon cap-and-trade programs, or increases in the minimum wage. And sometimes it just looks like a quagmire of all three.

Three obstacles stand in the way of setting bold new strategies. First, when facing the uncertainties associated with sustainability, most companies (like most people) avoid taking action, preferring to wait for something to happen that will reduce the uncertainties for them. Unfortunately, that something tends to be someone else's innovation, at which point the die is cast. Second, when companies are moved to action, it most often means copying what others are doing. Organizational researchers call this "mimesis," and it means, essentially, seeking safety in the herd. Those who copy others often turn to the off-the-shelf solutions highlighted in the pages of the business press: hire a guru, appoint a chief sustainability officer, put solar on rooftops, and declare victory—all without changing your core businesses. Think of Ford Motor Company's much publicized $15 million, ten-acre grass roof installed over the iconic River Rouge factory that was once the very icon of innovation and is still churning out trucks getting twelve miles per gallon.[2] For a car company whose industry's products generate roughly a third of the carbon emissions in the United States, few actions could have generated more visibility with less impact. Ask anyone on Wall Street how that went. Third, companies develop a new line of green products that

compete with their existing offerings, confuse their customers, burden their suppliers, and strain the knowledge of their sales reps. Burned, these companies retreat to business as usual. Recall British Petroleum's $200-million-plus investment in solar and promises of moving "beyond petroleum," only to scuttle its BP Solar business in 2011, citing the lack of market growth and profitability—just as the industry was entering a phase of phenomenal growth.[3] These obstacles reflect an underlying issue in pursuing sustainable innovation: without the right capabilities—the right tools—companies cannot expect to see, let alone respond effectively to, the new opportunities and threats reshaping every market. This book outlines this set of capabilities and describes how to identify, assess, and develop those that fit your strategic goals.

The Journey

Sustainable Innovation summarizes five years of research into the capabilities companies need to drive this type of innovation. In 2010, the Pew Center on Climate Change (now the Center for Climate and Energy Solutions) approached me to study successful low-carbon innovations that were developed and introduced into the market by large companies. I said no. I was concerned it would mean just greenwashing the same old advice for managing "regular old innovation." But after talking with executives, entrepreneurs, and policy makers, trying to figure out whether there was a difference between low-carbon innovation and regular old innovation, I found something that was both surprising and, in hindsight, obvious. Surprising in that, despite fifty years of research into the management of innovation, little if any effort has been spent exploring how best practices differed depending on the sector and situation of a company and its particular strategy. Obvious in that, once you accept that the challenges of innovation differ depending on where and when it takes place, there is no such thing as regular old innovation. The challenges you'll face and the capabilities you'll need to overcome them will differ dramatically depending on whether you're pursuing innovation in the early days of a new technology and market (such as the rapidly evolving landscape of smartphones today or the Internet in

the 1990s) or a century later, when the technologies, competitors, and market infrastructure are mature and deeply entrenched (such as the factories of the automotive industry or the fields of modern industrialized agriculture).

With this in mind, I changed my answer and agreed to investigate those contemporary companies and companies from earlier centuries that had succeeded in their sustainable innovations and those that had failed. These cases included new high-speed rail projects from across the globe; an innovative school lunch program launched in Oakland, California; the reinvention of the diesel engine; the development of gigabit virtual conferencing solutions; the first electric grids built over a century ago; and the smart grids of today. For contemporary companies, I spoke with the corporate leadership who oversaw these innovation projects, the development teams in the trenches working to make them realities, the scientists and engineers in research and development who supported them, and the sales and marketing teams who brought them to market. For historic cases, I dug deep into the archives and technical artifacts that documented the early days of the new ventures, new technologies, and new industries. I wanted to understand what made the development of sustainable innovations different. Were there common challenges facing corporate leaders and managers pursuing sustainable innovation, and if so, was there a common set of capabilities that enabled these companies to recognize and overcome them?

While the findings and recommendations that follow come from this intensive research program, they also come from working alongside many entrepreneurs, corporate leaders, scientist-inventors, policy makers, and investors who have successfully (and sometimes unsuccessfully) pursued sustainable innovations. In 2004, I founded what would become the Child Family Institute for Innovation and Entrepreneurship at the University of California, Davis. For ten years, the institute has been helping university scientists and engineers identify and develop the commercial potential of their research. That meant working with large companies as well as angel and venture capital investors looking to benefit from the almost $1 billion in research conducted at UC Davis in areas such as clean energy, sustainable agriculture, food, transportation,

and energy efficiency. In 2006, on the basis of the success of the original program, I helped found the country's first Energy Efficiency Center, dedicated to the identification, development, and effective commercialization of energy efficient technologies. Energy efficiency offers the most cost-effective way to reduce the carbon emissions that are contributing to global warming, and yet thirty years of energy efficiency technologies were sitting unused. The center's focus was again on bringing those technologies into the marketplace. The Energy Efficiency Center represented a groundbreaking public-private partnership—a true collaboration between industry, government, and university partners with the goal of meeting the demands for innovation in energy efficiency.

Working with inventors and entrepreneurs, emerging ventures and established firms, suppliers and customers, and state and federal regulators and nongovernmental organizations, I saw firsthand the challenges that stood in the way of even the most promising of opportunities. No matter what the technology, the need, or the regulatory goals, the same obstacles kept cropping up. While everyone knew the right thing to do—the right technologies to pursue, the right market opportunities to develop, the right policies to follow (or better yet, lead with)—few had what it took to get there. At the institute and the center it became clear early on that the most pressing need in commercializing university research was building the right set of capabilities around the core research and researchers, and "right" differed depending on the core technology, the target market, and the most promising business models. Roughly sixty companies and over $100 million in venture funding later (as well as valuable technologies now licensed to established corporations and significant changes to state and federal policies), the lessons of these innovation efforts have greatly informed the research and its findings presented in this book.

Finally, these findings come from two decades of research in the field of innovation management. My academic career has been focused on understanding the challenges and effective practices involved in innovation in general and entrepreneurship in particular. In that time, I have studied not only the detailed technical and social histories of some of the most profound technology revolutions but also the everyday work