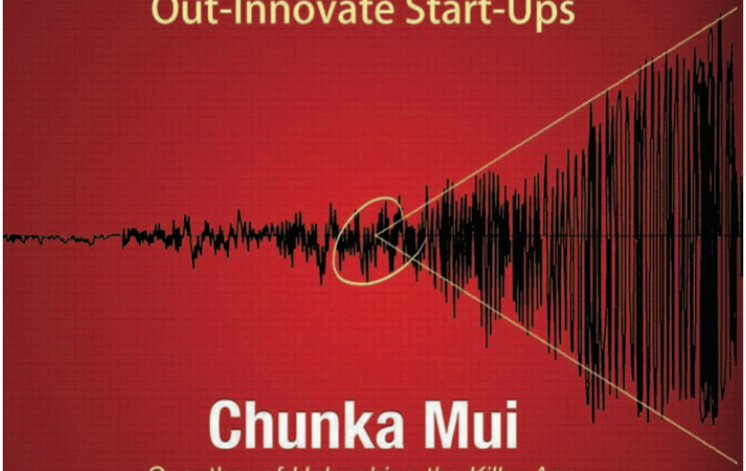
SAMPLE CHAPTERS

The New Killer Apps

How Large Companies Can Out-Innovate Start-Ups



Chunka Mui

Coauthor of *Unleashing the Killer App*

Paul B. Carroll

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Foreword by James L. Madara, M.D.
CEO, American Medical Association

The New Killer Apps

How Large Companies Can Out-Innovate Start-Ups

Chunka Mui and Paul B. Carroll

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The New Killer Apps: How Large Companies Can Out-Innovate Start-Ups
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About The Authors

Paul Carroll spent 17 years as an award-winning reporter and editor at the *Wall Street Journal* in the US, Europe and Latin America, getting as broad an exposure to business as that world-class newspaper could give. During his time at the Journal, Paul published *Big Blues: The Unmaking of IBM* in 1993, analyzing the rise and fall of what was once the world's most profitable company.

Chunka Mui, meanwhile, led groundbreaking research on how emerging technologies would affect business. The research culminated in the best-selling *Unleashing the Killer App: Digital Strategies for Market Dominance*, which he cowrote with Larry Downes in 1998.

Our collaboration began in 1996 at Diamond Management and Technology Consultants, where Chunka was chief innovation officer and Paul directed research and publishing. At Diamond, we assisted scores of companies on radical innovation efforts.

We refined our perspectives at the Devil's Advocate Group, which we cofounded in 2008, and where we continue our research, writing and consulting. In particular, we (assisted by 20 researchers provided by our friends at Diamond) spent nearly two years examining the 2,500 major business failures that led to our 2008 book, *Billion Dollar Lessons*. We continue to help large public and private-sector organizations design and stress-test their innovation strategies.

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Foreword

When I joined the American Medical Association as CEO in 2011, I became part of an organization with an extraordinary history and a wonderful mission ("To promote the art and science of medicine, and the betterment of public health"). Founded in 1847, the AMA brought science and professional standards to a field that was still in its snake-oil phase in the United States. In the early 1900s, the AMA spurred a review of medical schools that led to the closing of scores of diploma mills that would graduate almost anyone willing to pay. An era of thorough training for prospective physicians began. In the mid- to late twentieth century, the AMA played a major role in highlighting the links between tobacco and cancer and in shaping policy on other issues of crucial importance to the nation's health.

But, like many large and successful organizations, the AMA also built, over time, an unwieldy organizational portfolio that tried to do everything. It became difficult to capture the AMA in a focused narrative. In other words, we found ourselves in the position of many of the companies whose failure stories are chronicled in this book. We had become big and diffuse.

Meanwhile, medicine had grown enormously complex and was changing rapidly. There are now some 4,000 medical and surgical procedures and 6,000 drugs to treat 13,600 conditions that may ail our patients. Information technology is accelerating progress through the aggregation of data in electronic health records and through

personalized medicine. The spread of minute sensors and powerful new medical devices (otherwise known as smartphones) are together making it possible to monitor patient conditions around the clock and providing instant connections with doctors. In the last decade, the number of genes found to be related to disease has jumped from a few to some 5,000, while the cost of genome sequencing has plummeted. At the same time, the Affordable Care Act and other laws and regulations are introducing major changes in how care is paid for and organized.

It became clear that incremental changes in how the AMA pursued its mission would be insufficient to meet the demands of this dynamic environment, and the Board of Trustees charged me with bringing impact through focus. The portfolio of approved policies formed by the 185 medical societies that constitute the AMA House of Delegates provides a rich resource from which to build focused strategies.

We're now working hard to become big and agile

To ensure that we act with agility and keep up with the pace of change in medicine, we've embraced many of the lessons on stress-testing strategies that came out of the Devil's Advocate techniques that Chunka Mui and Paul Carroll developed in their much-admired 2008 book, *Billion Dollar Lessons: What You Can Learn from the Biggest Business Failures of the Last 25 Years*. We've also begun applying the Think Big, Start Small, and Learn Fast approach to innovation that they lay out in this book. Their analysis has been enormously helpful.

As this book recommends, we took out a clean sheet of paper and imagined what the AMA would look like if it were ideally positioned to accomplish its mission. We streamlined a list of 115 strategic initiatives down to three truly strategic pillars, which we announced in 2012. We're leading the effort to bring medical education radically up to date, after almost a century of incremental change that has left medical schools out of sync with how medicine is practiced. We're working to improve health outcomes across the nation, focusing first

on preventing Type II diabetes and reducing hypertension. And we're helping physicians increase their job satisfaction and make their practices more sustainable, to ensure a continuing supply of doctors who represent the best and brightest of their generation.

Succeeding in any one of these three initiatives would represent a great step forward for our mission, but we intend to succeed in all three. So, we've been conducting other exercises laid out in these pages. For instance, Chunka and Paul helped us imagine ourselves five years into the future and developed "future histories" that crystallized our thinking about the long-term aspirations of the organization and about the challenges facing us. By producing a chronicle of what could be our major successes or our most dreaded failures, we gained clarity about the levers we need to pull to succeed and the pitfalls we need to avoid. We saw ways that the three initiatives could reinforce one another, rather than be largely independent. The exercise also helped everyone in the organization—even those not directly involved in the three initiatives—understand how they fit and could play important roles.

We've also begun developing a portfolio of potential killer apps for medicine. "Killer" and "medicine" aren't words that you often see in the same sentence, but we expect to find ways to make radical improvements for medical students, for physicians, and, most importantly, for patients.

Innovation is hard. It may actually be harder in successful organizations because they have developed such a clear way of doing things that it may be difficult to adapt to a changing environment. Certainly, at the AMA, we have a strong culture that has served us well for more than a century and a half, but we must adapt if we are to keep pursuing our mission in a world where so much is changing.

The book you hold in your hands offers a very smart approach to innovating in confusing times, even if you're a large organization with a long history of success doing things a certain way—actually, especially if you're a large organization with a long history of success.

James L. Madara, M.D.
CEO, American Medical Association

Getting Started

~ *Introduction*

A Road Map for Corporate Innovation—Big and Agile Beats Anyone

This book aims to reverse a bit of conventional wisdom that's taken root in recent decades: that start-ups are destined to out-innovate big, established businesses. The conventional wisdom just isn't true. Or, at least, it need not be. Yes, small and agile beats big and slow, but big and agile beats anyone—and that combination is now possible.

We say that based on the lessons we've learned during three decades of writing, researching, and consulting on innovation with giant, established institutions. Since the start of the Internet boom some two decades ago, so many companies have looked to information technology to innovate that there's now a track record showing what works and what doesn't. Having studied hundreds of those efforts—and lived through many of them—we're ready to apply those hard-earned lessons to the new wave of technological capabilities now before us.

The possibilities are startling. And tapping into them isn't optional. Being big and agile isn't just feasible; it's essential.

A perfect storm of six technological innovations—combining mobile devices, social media, cameras, sensors, the cloud, and what we call emergent knowledge—means that more than $36 trillion of

stock-market value is up for what some venture capitalists are calling "reimagination" in the near future. That $36 trillion is the total market valuation of public companies in the ten industries that will be most vulnerable to change over the next few years: financials, consumer staples, information technology, energy, consumer goods, health care, industrials, materials, telecom, and utilities.[1] Incumbent companies will either do the reimagining and lay claim to the markets of the future or they'll be reimagined out of existence.

No history of success will protect you if you find yourself on the wrong side of innovation, and problems can appear quickly. Borders, Circuit City, Blockbuster, and many others went from thriving business to out of business in almost no time. Think of how recently Nokia and BlackBerry were on top of the world and how they're now irrelevant. The near future will be even more brutal and more lethal, with faster cycle times.

That may sound like the kind of thing people always say: Every catastrophe is the worst ever, every breakthrough the biggest ever. In fact, in a world of exponential change like technology, each new wave of innovation, which comes along every ten years or so, *is* the most disruptive ever. That's because of a phenomenon sometimes called "the second half of the chessboard."

The name refers to a story about a king who told an adviser he could name his own reward for some stunning achievement. The adviser asked for what sounded like a modest prize—just one grain of rice on the first square of a chessboard, followed by twice that many on the next square, twice as many on the next, and so on until there was rice on all sixty-four squares. By the time half the board was covered, however, the total grains of rice would have exceeded four billion, and the board would have been on its way to holding grain equal in weight

1 Nicholas Carlson, "Mary Meeker's Latest Stunning Presentation about the State of the Web," *Business Insider,* May 30, 2012, http://www.businessinsider.com/mary-meekers-latest-incredibly-insightful-presentation-about-the-state-of-the-web-2012-5#-86.

to a million fully loaded aircraft carriers. (According to some versions of the story, the adviser was also on his way to losing his head, because he was clearly too smart for his own good.)

Each new square contained one more grain of rice than the total amount on all preceding squares. In other words, each new placement of rice more than doubled what was already on the board. That doubling might not have meant much in the early stages, but it became overwhelming once the king got to the second half of the chessboard.

The same is true of Moore's Law, which states that the number of transistors on a chip will double approximately every two years. Each new generation builds on what came before and represents as much innovation as occurred in all prior generations combined. And we're now on the second half of the chessboard. The changes documented by Moore's Law didn't matter much when the number of transistors was doubling from two to four, or from sixty-four to 128, but there are now hundreds of millions of transistors on single chips, and the power is spreading in all directions—including into the six technologies that we expect to lead the new wave of innovation.

So the pace of innovation is about to surge. Again. And more powerfully than ever before.

Even Walmart, which has historically put so much pressure on so many businesses, faces a heightened attack from online retailers because of the six technologies, principally mobile devices and cameras. A study found that Amazon's prices are, on average, 19 percent lower than Walmart's.[2] While someone in a Walmart wouldn't have known that a few years ago, a practice known as "showrooming" has taken hold among consumers: They look at items in a physical store but check online prices on a mobile phone before they buy and, if the difference is great enough, order from the electronic retailer. With customers who are willing to share their location via the GPS in their

2 "Walmart vs. Amazon," *Minyanville,* June 20, 2011, http://www.minyanville.com/special-features/articles/infographic-walmart-infographic-amazon-infographic-amazon/6/20/2011/id/35159?camp=syndication&medium=portals&-from=yahoo.

smartphones, Amazon could even know that someone was checking a price while standing in a Walmart and lower the price to accentuate the difference. The Amazon price advantage will diminish as it begins collecting sales taxes in more states, but Amazon will retain a huge advantage because of the extreme efficiency of its centralized model. Best Buy has already wilted under pressure from e-tailers such as Amazon, which generates $900,000 of revenue per employee per year versus Best Buy's $200,000.[3]

America's higher-education system, long the envy of the world, may be forced kicking and screaming into radical change as technology makes college courses widely available online at a fraction of today's costs. One critic, writing in the policy magazine *The American Interest,* predicts that within fifty years, half of the 4,500 colleges and universities in the United States will be out of business and tens of thousands of professors will be out of work. Meanwhile, the critic says, the gold standard will be so highly valued that Harvard will enroll ten million students a year.[4]

Although established organizations sometimes seem resigned to the possibility that new technologies and start-ups will overrun them, the problems that have stifled innovation in large companies are now known and can be avoided. These problems are not inherent to bigness. Incumbents should be optimistic that they'll beat the start-ups this time around.

3 Jeff Jordan, "The Case for E-Commerce Acceleration (a.k.a. Bye-Bye, BBY?)," *All Things D,* June 28, 2012, http://allthingsd.com/20120628/the-case-for-e-commerce-acceleration-a-k-a-bye-bye-bby/?mod=tweet.

4 Nathan Harden, "The End of the University as We Know It," *American Interest,* January/February 2013, http://the-american-interest.com/article.cfm?piece=1352.

For one thing, start-ups aren't all they're cracked up to be. Yes, Silicon Valley has the cachet, but Harvard Business School research shows that the failure rate for start-ups runs as high as 95 percent.[5] Start-ups, as a group, succeed largely because there are so many of them, not because of any special insight.

Vinod Khosla, a billionaire venture capitalist and cofounder of Sun Microsystems, tweeted a revealing line from an executive at one of his companies in 2012: "Entrepreneurs really are lousy at predicting the future….VCs are just as bad."

What's more, the National Bureau of Economic Research (NBER) found that start-ups shift rewards to financiers while saddling entrepreneurs with most of the risk.[6] Venture capitalists sometimes do very well, but start-ups rarely pay off for the entrepreneurs who slave away at them. Entrepreneurs invest their time, reputations, and accumulated expertise for modest salaries and long hours in the hope of gaining huge rewards at "exit," when the start-up goes public or is acquired. NBER researchers found, however, that 68 percent of companies that reached an exit (after a median time of forty-nine months from first venture funding) resulted in no meaningful wealth going into the pockets of the entrepreneurs. If financiers continue to stack the odds in their favor, interest in start-ups will decline. Prospective entrepreneurs will find other intriguing alternatives to starting a business, such as helping market leaders to reimagine themselves.

The second reason that we focus our innovation work on incumbents is that they *should* win. Yes, we all know that big companies are sometimes complacent about threats, especially if those threats start small. But big companies have everything they need to continue to dominate: unmatched people, resources, supply and distribution

5 Carmen Nobel, "Why Companies Fail—and How Their Founders Can Bounce Back," *Working Knowledge* (Harvard Business School), March 7, 2011, http://hbswk.hbs.edu/item/6591.html.

6 Robert E. Hall and Susan E. Woodward, "The Incentives to Start New Companies: Evidence from Venture Capital," *National Bureau of Economic Research,* April 2007, http://www.nber.org/papers/w13056.

capabilities, brand power, and customer relationships. And in the context of today's immense technological opportunities, incumbents have growth platforms that would take start-ups years to build. Incumbents have products with which to leverage new capabilities such as mobile devices, networks, the cloud, cameras, and sensors. Social media can amplify their brand power and customer relationships. Incumbents already sit on mountains of market and customer data and are therefore in the best position to extract knowledge from it. Incumbents just have to get out of their own way and marshal their resources appropriately.

In this book, we've taken our experience with thousands of innovation efforts—both successes and failures—and distilled it into eight simple rules that help incumbents stay ahead of start-ups and continue to thrive even in a confusing, rapidly morphing world.

While we'll talk mainly about big businesses, because that's where our research and other work has focused, these rules can be applied to companies of any size, from Walmart all the way down to the local cigar shop. The scale of the problems and opportunities differs, obviously, but the process of innovating is quite similar. Also, while we'll focus on the role of senior management, the principles we describe apply to anyone in an organization at any level who's concerned with innovation and wants to contribute to it.

These rules apply to both defense and offense. The defense, based on two years of research on 2,500 failures that our team conducted for *Billion Dollar Lessons* (2008), identifies the major junctures where innovation efforts often falter. The offense comes out of work that went into *Unleashing the Killer App* (1998), Chunka's pioneering best seller on how information technology must drive corporate strategy. That book, written with Larry Downes, took the concept of a killer app out of Silicon Valley and introduced the rest of the business world to the idea of products so revolutionary that they cause massive creative destruction and huge shifts in revenue and market value. The book also laid out prescient concepts such as the Law of Disruption, which

states that, while people change incrementally, technology improves exponentially; so, from time to time, technology will get so far ahead of people that an earthquake will have to happen to get the tectonic plates back into alignment.[7]

Unleashing the Killer App explained why transaction costs like those represented by insurance agents face withering pressure, presaging the success of agentless insurers GEICO and Progressive. The book also predicted novel marketing concepts such as giving away books to build an audience for future ones; accurately forecast a massive shift of power to consumers; and correctly argued that businesses would do away with the traditional three- to five-year forecast in favor of a more dynamic approach. In addition, the book prescribed principles such as outsourcing to the customer and building communities of value. Sure enough, today, Dell and other companies outsource much of their customer service to zealots on social media, and many incorporate customers into product development in new and profound ways. Communities of value, now expressed primarily as social media, have taken the world by storm. Fantasy sports leagues, one type of community singled out in the book, are so popular that media cover relevant stats almost as assiduously as they provide game scores. *Killer App* also warned that companies need to cannibalize their markets before someone else can and singled out newspapers

7 The Law of Disruption draws on two well-known principles in the world of information technology: Moore's Law and Metcalfe's Law. Moore's Law, named for Intel cofounder and chairman emeritus Gordon Moore, states that the number of transistors on a chip will double approximately every two years. This principle has held since Moore formulated it in the mid-1960s and seems likely to hold for the foreseeable future. Metcalfe's Law, named for 3Com cofounder and Ethernet inventor Robert Metcalfe, states that the value of a telecommunications network is proportional to the square of the number of users connected to the system. The idea is that one fax machine didn't do the world any good. The second, third, and fourth created some utility, but not a lot. By the time there were a few thousand, though, the network of fax machines became so important that every big office had to have one—and adding their machines to the network increased the value even more, so that small offices needed fax machines, and soon many individuals even installed them at home.

and the US Postal Service as being especially vulnerable. Newspapers and the Post Office still seemed very healthy in 1998. Today? Not so much.

Killer App obviously didn't get everything right. Nobody could, given the chaos of the online environment. But now we have the benefit of hindsight: We can see the results of hundreds of projects where *Killer App* principles were applied and can draw on fifteen years of subsequent research and consulting.

That body of work, together with our research for *Billion Dollar Lessons: What You Can Learn from the Most Inexcusable Business Failures of the Last 25 Years*, has helped us identify scores of examples of companies that got things right at the critical moments, as well as scores that got things wrong. Using real-world, dirt-under-the-fingernails examples, we compare the two groups and lay out the principles that will help you join the successes.

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When we compared the successes and the failures, we found that three major issues separated them. The successful companies thought big, started small, and learned fast. The failures did not.

By Think Big, we mean that the successes considered their full range of possible futures. They debated, at a substantive level, every possibility from going out of business to building on current capabilities but moving in brand new directions. They dared to dream big, focusing on the killer apps that could rewrite the rules of a company or industry, rather than just looking for faster/better/cheaper, incremental change. The successes typically laid out a number of possible killer apps, rather than zeroing in on one.

Thinking big led Fujifilm to face up to the daunting threat from digital photography way back in the 1980s. Fuji realized that digital would mean the death of film, photographic paper, and related chemicals—and would mean the death of Fuji itself if it didn't do something. Rather than kid itself and hope it could manage the transition to

digital smoothly and keep investing in the traditional businesses—the fatal mistake at Kodak—Fuji treated those businesses as cash cows that could finance new opportunities. Fuji experimented with ways to apply its photographic expertise in new areas. Film, like skin, contains collagen, and Fuji found ways to make skin creams that are sold in Asia and Europe. Fuji also started making optical films for certain flat-screen televisions. For one sort of film, which enhances the viewing angle for LCDs, Fuji has 100 percent of the market.[8] While Kodak has filed for bankruptcy, Fujifilm had a market value of $10.7 billion as of August 2013.

The failures typically thought small. Like Kodak, they assumed that some level of continued success was guaranteed and that the future would be a slightly different version of the present. This kind of thinking is common. It's human nature to see change as incremental and to think that customers will stick with us. But incremental thinking can be very dangerous. While *Killer App* warned that threats to just one revenue stream for newspapers (classified ads) could kill the business models for metropolitan papers and recommended exploration of online alternatives, many executives couldn't imagine a significant change in ad revenue or diminished interest in print. Journalists sometimes refer to themselves as "ink-stained wretches"; how could they be ink-stained if ink went away? Because newspapers rarely faced up to their looming problems or imagined new forms for delivering news, papers have been dying a death of a thousand cuts.

Successful companies Start Small after thinking big. Our research found that, rather than jumping on the bandwagon for one potentially big idea, the successes generated multiple ideas and broke them down into small pieces for testing. They deferred important decisions until they had real data. Many companies make decisions early, based on intuition, which means that experience (also known as the past) unduly influences decisions that are all about the future. Relying on

8 "The Last Kodak Moment?" *Economist,* January 14, 2012, http://www.economist.com/node/21542796.

intuition protects vested interests and inhibits breakthrough innovation. In addition, successful companies took the time to make sure that everyone—the executive team, employees, partners, agents, and even customers—was working in unison, rather than having people pay lip service to a vision while actually working at cross purposes.

By contrast, companies that failed to innovate tended to swing from complacency to panic. They thought incrementally for too long and, being late to the game, risked everything on a single idea, only to have it not pan out. That's what killed Blockbuster, which ignored Netflix's DVDs-by-mail model for years, then bet big on its own version before fully working out the economic and operational implications. Blockbuster's business model didn't work without hundreds of millions of dollars of late fees each year, but management didn't realize that until after it promised to halt the hated charges. Starting big is also what killed Ron Johnson's attempts to turn around JC Penney. Rather than take small steps to test various possibilities, Johnson plunged into a wholesale remake of the store—even though, as the developer of the Apple stores, he had experimented with every little detail for months in a mock-up of a store before going to market. Johnson also threw out Penney's long-standing sales strategy, getting rid of discounts even though he hadn't tested his new approach and even though Penney had seen a similar strategy flop a decade earlier. (*Billion Dollar Lessons* contains other examples of retailers who tried the same shift away from discounts and whose failure should have given Johnson pause.)

The lure of starting big is pervasive. For many organizations, it's so hard to get an innovation through all the approval processes that there simply isn't the energy to bring more than one idea to market. Sometimes, a CEO decides that he has an insight, and the whole organization mobilizes behind that one idea, rather than place several smaller bets. But it's crucial to Start Small.

Companies that Learn Fast take a scientific approach to innovation. They conduct extensive prototyping before they even get to the pilot phase—let alone the big rollout—so they can gather comprehensive information about their attempts at innovation and quickly analyze what's working and what isn't. The successes also develop the institutional discipline to set aside or alter projects as soon as it's clear that they're not working.

If, instead, companies swing from thinking small to betting big, they typically have neither the time nor the inclination to learn. They fall into the "it's all about implementation" trap and end up expertly implementing a failed strategy. In the research for *Billion Dollar Lessons*, we determined that fully 46 percent of the 2,500 failures we investigated never had a chance to succeed, no matter how good the implementation, yet many companies don't take the time and apply the discipline necessary to get the strategy right before beginning the rollout.

For instance, in the early 1990s, Pepsi thought it could tap into a growing concern about purity by producing a cola that was clear. The company tested the idea a bit but rushed Crystal Pepsi to market. Pepsi launched a huge ad campaign, which debuted during the Super Bowl in January 1993. Sales surged—then stopped. It turns out that consumers associate a clear soda with something like Sprite and were confused by a cola that wasn't dark, but Pepsi never took the time to learn that basic fact. Pepsi pulled Crystal Pepsi after a year.

Yum! Brands Chairman David C. Novak, who introduced the Crystal Pepsi concept, later recalled, "A lot of times as a leader you think, 'They don't get it; they don't see my vision.' People were saying we should stop and address some issues along the way, and they were right.…Once you have a great idea and you blow it, you don't get a chance to resurrect it."[9]

9 Kate Bonamici Flaim, "The Education of an Accidental CEO: Lessons Learned from the Trailer Park to the Corner Office (Interview with David Novak)," *Fast Company,* October 1, 2007, http://www.fastcompany.com/60555/winging-it.

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We've applied these three principles—Think Big, Start Small, Learn Fast—to the junctures that are the most important for successful innovation. The result is a set of eight rules that will help you and your team build on your experience and creativity and ensure that you're unleashing killer apps, not killer flops. Those rules are:

1. **Context is worth 80 IQ points**. As you start to Think Big, you have to understand the information-technology environment that you'll be operating in.
2. **Embrace your doomsday scenario.** In other words, investigate all possible existential threats to your business.
3. **Start with a clean sheet of paper.** This means that you should design a perfect form of your business, as a goal to work toward.
4. **First, let's kill all the finance guys.** As you Start Small, you have to make sure you don't settle on financial projections too soon; they can't be accurate, and they hamstring innovation.
5. **Get everyone on the same page.** While the tendency is to leap into action as soon as a possible killer app is identified, it's crucial to take the time to make sure everyone is on board.
6. **Build a basket of killer options.** Now, you're finally ready to start generating ideas for killer apps, but you need to invest only small amounts in them and test lots of possibilities.

7. **A demo is worth a thousand pages of a business plan**. As you begin to Learn Fast, you must stay at the demo stage—testing and learning—far longer than you normally would.
8. **Remember the Devil's Advocate.** Make sure you have a process in place so that the tough questions keep getting asked and aren't swept away as a possibility builds momentum.

Following the eight rules will make sure that you fully consider the technologies that might destroy your business. The rules will then help you do a judo flip, turning potential danger into potential value: Let the dangers savage competitors, while you use what you've learned to find new ways to serve customers. Your organization will be able to leverage all its assets while getting out of its own way—internal obstacles are often more dangerous than external competitors. Finally, the rules will let you set up and learn from small, inexpensive experiments, then get the whole organization to rally behind the successes.

You'll wind up with killer apps that may seem like science fiction but will be so compelling that they'll be adopted with lightning speed and will change the world of business more fundamentally than most people can even imagine.

We'll look at each rule in the context of a single, continuing case study: Google and its driverless car.

Google may seem like an odd choice of an innovative, established business. After all, it still seems to many like an upstart, and it operates in the rarified world of Silicon Valley. Besides, Google was caught napping when Facebook, Twitter, and LinkedIn innovated in social media. How smart can the company be about innovation beyond the search engine that got it launched? In fact, Google has long been an incumbent. It was founded in 1998, fifteen years ago as of this writing, and has been public for nine years. The company has more than 30,000 employees and hundreds of billions of dollars of

market cap that it needs to protect—and expand. It's doing just about everything a big company needs to do to keep innovating. Through new projects such as the driverless car, it's demonstrating how to find killer apps even in industries that aren't thought of as being driven by the megatrends we've identified in information technology.

Google's driverless car turns out to be a great example of a potential killer app. The car feels like it comes straight out of left field. It's not just that the technology is so far-fetched; it's that innovation in cars has generally consisted of a new ad campaign or body style, not a redefinition of how cars can be used. Some will argue that driverless cars aren't possible—and the timing is, in fact, highly uncertain. Many in the auto industry won't see Google as a serious competitor, given that the company deals in bits and bytes while cars are bumpers and belts and a whole lot of other physical objects. Yet Google's driverless car puts into play some $2 trillion in revenue each year in the United States alone, by the time you add up all the revenue for carmakers, their dealers, rental car companies, body shops, insurers, health care providers, and more.

The Google car also shows how our thinking has evolved over the past fifteen years. Toward the end of *Killer App*, the prospect of a driverless car was raised, but the assumptions about the enabling technologies were wrong. The book laid out ways that roads could be made more intelligent and could control cars better than drivers could. But that approach would have required new infrastructure throughout the country—and a daunting level of investment. Switching to intelligent roads also would have required a master plan that needed to be right the first time, rather than allowing for the gradual adoption by consumers and incremental learning and adjustment that are possible with the Google car. Chastened by experience, we're much more careful about how to introduce killer apps into the market than we were in 1998. We're also more aware that, while concepts such as the

driverless car can be seen well ahead of time, they play out in ways that are hard to predict. That notion of inherent unpredictability drives much of what follows in this book.

So, we'll begin the main part of the book with a case study on Google and its driverless car, to show where the dangers and opportunities are and to explore just what a shock to the system a potential killer app can be. At the end of each of the three sections—Think Big, Start Small, Learn Fast—we'll continue the case study to show Google is implementing each of those three main ideas and to show how others need to respond.

For some time now, people writing about innovation have cited some great advice from hockey legend Wayne Gretzky: Skate to where the puck is going to be, not to where it is. We think innovation needs to be even more radical than that—and it can be, if you follow the rules outlined in this book. Innovators need to invent some new space, so they and their customers can arrive at the puck at the same time.

Necessity may be the mother of invention, but invention is also the mother of necessity.

So, let's explore how you can go about not just reimagining your future, but inventing it.

~ *Case Study*

Google Cars and $2 Trillion in Auto-Related Revenue Up for Grabs

A video shows a man climbing into a small sedan and settling in behind the wheel. The car starts off—driving itself. Without the man's hands ever touching the wheel or his feet touching the pedals, the car goes smoothly around corners and halts at stop signs. The car takes the man to buy a taco at a drive-through window, then to the dry cleaners to pick up some clothes. The kicker: Toward the end of the clip, the man explains that he's 95 percent blind and never would have been able to drive himself.

This is the Google self-driving car. It has logged more than 500,000 road miles and has a driver's license in Nevada, Florida, and California; Michigan, New York, and West Virginia are considering granting a license. The car will only get better, too, by leaps and bounds, in the same way that all electronic devices do.[10]

While cars are generally thought of as an old-school, heavy-manufacturing industry, as of three years ago the largest single cost on a BMW bill of lading was software, and the Google car provides

10 Google, "Self-Driving Car Test: Steve Mahan," March 28, 2012, http://www.youtube.com/watch?v=cdgQpa1pUUE/.

a view into the almost indescribable potential for innovation in the automobile industry. The car also offers a great case study for other industries that are facing turmoil (in other words, almost everybody).

The self-driving car could change everything about the auto experience, from the way cars are designed, made and sold, all the way through how they are used. The car might even change forever that rite of passage that begins when a teenager climbs into the driver's seat for the first time and mom or dad has to relinquish control of the car and teach the youngster to drive (minimizing yelling whenever possible).

We're not saying the Google car will necessarily succeed. There are plenty of people who view it as a high-tech misadventure by a couple of brash young multibillionaires, Google founders Larry Page and Sergey Brin. But the car provides a useful proxy for looking at the disruption that is surely coming to cars, so let's at least consider Google's claims for the car:

- We can reduce traffic accidents by 90 percent.
- We can reduce wasted commute time by 90 percent.
- We can reduce the number of cars by 90 percent.[11]

To put those claims in context:

About 5.5 million motor vehicle accidents occurred in 2009 in the US, involving 9.5 million vehicles. These accidents killed 33,808 people and injured more than 2.2 million others, 240,000 of whom had to be hospitalized. These accidents were the leading cause of death for people ages five to 35 in the US.

The American Automobile Association studied crash data in the ninety-nine largest urban areas in the United States and estimated the total accident-related costs—including medical costs, loss of

11 Sebastian Thrun, "Google's Driverless Car," TED conference, March 31, 2011, http://www.youtube.com/watch?v=bp9KBrH8H04.

productivity, legal costs, travel delays, pain, and lost quality of life—to be roughly $300 billion. Adjusting those numbers to cover the entire country suggests annual costs of about $450 billion.

Now take 90 percent off these numbers. Google claims its car could save almost 30,000 lives each year on US highways, prevent nearly two million additional injuries, and reduce accident-related expenses by at least $400 billion a year. From the standpoint of all those who would have been injured or killed, and all those who would pay, those numbers represent glorious aspirations. But one person's savings are another person's lost revenue.

So, Google says its car will take hundreds of billions of dollars a year away from hospitals, car-repair businesses, car dealers, lawyers, and many others. While car sales might initially boom as the fleet shifted to driverless cars, they would soon fall off a cliff—and new and used car sales add up to a $600 billion-a-year business in the United States. Spending on highway construction would plummet. Gasoline sales would tumble not only because there would be fewer cars but because they would operate more efficiently—among other things, cars on highways would be able to travel in what are being called platoons, drafting off one another; they could be just inches apart because the lead car could instantaneously trigger the brakes in all the cars if it needed to slow or stop.

Auto insurers, which collect more than $200 billion in premiums each year in the United States, would initially see profits rise as accidents declined and payments to customers dropped but would eventually see something like 90 percent of premiums disappear. Health insurers would also have to give up revenue as car-related injuries plummeted. Governments would lose fines, because cars would all obey traffic laws, but police forces would need fewer officers on the road, and prisons would need less capacity as drunk drivers kept their freedom. Utilities would lose revenue because traffic lights would no longer be needed, and highways and streets wouldn't need to be

lit—after all, the cars can see in the dark. Parking lots, which cover a third of the ground in some cities, would pretty much disappear, while freeing land and reducing property values. And so on.

Add up all the pieces—$450 billion in crashes, $600 billion in car sales, $200 billion in auto-insurance premiums, hundreds of billions of dollars in health insurance, and so on—and you pretty easily get to the $2 trillion that we figure is the revenue associated with cars each year in the United States. Just about all of that revenue could be taken away from the incumbents.

On the plus side, if Google is right about how much wasted commute time it can eliminate, it will save Americans four billion hours a year. They'll do something with that time, whether it's spending more time with their families, working more, or just getting to know their smartphones better. Without having to worry about distracted driving, electronics companies and app developers could outfit cars with all the distracting entertainment they wished and earn billions off the now-free time in self-driving cars.

Lots of opportunities to coordinate use of cars would appear: Cars could go from being a product to being a service that takes you someplace or that transports goods for you. Autos could also be viewed as a platform, rather than as individual vehicles. Cars make great antennas, and they have all the battery power they need for communication, so it would be easy to integrate them with each other. The companies that take advantage of these new opportunities will win, while those that maintain the status quo will see their businesses fade, if driverless cars have anything like the projected impact.

But how much of a game changer is the driverless car? Let's look.

The Google car is operated by on-board software imbued with artificial intelligence (AI) capabilities, with a human in the driver's seat, able to take control at any point. While AI had a bad reputa-

tion for decades because it failed to live up to grandiose claims about rendering humans obsolete, the field is now delivering on its early promise, and the Google car is learning effectively all the time. [12]

In other words, while the car initially knew far less than a timid sixteen-year-old who just got her permit, it's basically been in driver's ed for years and for as many miles as some people drive in a lifetime. In 2008, a state-of-the-art driverless car could go two blocks on its own on a closed course at 25 mph; by 2012, a driverless car could operate in real-world conditions at 75 mph. The car will only keep learning and getting better, too—unlike humans, many of whom work to get a license but then lapse into bad habits. With the advent of the driverless car, some scientists find it amazing that humans are even allowed to drive.

If Google cars move into widespread use, the software will keep learning from all the cars on the road, and every car will be updated with that new knowledge. That's a key point: While we humans learn almost entirely from our own experiences, every Google car can learn from the experiences of every other Google car. If we start to see hundreds, then thousands, then millions of Google cars on the road, that learning will accelerate.

The learning won't just be about how to drive—it will be about the roads themselves. The Google car uses detailed maps to navigate, and, if Google puts massive numbers of cars on the road, those maps will improve rapidly while providing incredibly detailed, up-to-the-second information to the cloud about road conditions, traffic, and

12 Initially, AI scientists tried to develop rules that governed everything an expert would do when playing chess, using industrial equipment or whatever. It turned out that the rules couldn't cover every situation, so problems always arose. Now, scientists have moved away from the top-down approach and are going bottom up. AI systems learn a bit at a time by observing how experts act, and they keep refining that learning. With the Google car, the new approach means programmers don't write explicit instructions in code, for example, "In a roundabout, yield to cars to your left." Instead, Google uses a machine learning method that lets the software evolve based on real-life situations, sometimes watching a human drive and sometimes taking control, with a human monitoring and making corrections.

travel times. Each car will draw on that information and know to be extra careful at dangerous intersections or know, say, that there's black ice at a certain spot just ahead.

While the Google car drives itself based on data captured by cameras, radar sensors, and laser range finders that currently cost tens of thousands of dollars per car, all those devices are electronic, so their prices will keep falling rapidly even as capabilities increase. A gigabyte of memory cost $300,000 in 1981, but less than $10,000 a decade later, less than $10 a decade after that, and less than 10 cents today. From $300,000 to a dime in three decades—that's the trajectory of the electronics in the driverless car. Over time, all sorts of costs will come out of cars because they'll no longer need safety features such as airbags or bumpers and heavy frames designed to protect passengers in crashes, and so on. What's not to like?

Even skeptics seem to believe that, when it comes to the driverless car, the question is less *if* than *when.* Nissan CEO Carlos Ghosn says driverless cars will be in Nissan showrooms by 2020. A prominent engineering group estimates that 75 percent of cars will be driverless by 2040.[13]

And, *when* is less about the technology itself than a long list of legal, policy, and social challenges. There are two main ones. First, people are accustomed to driving and would, at least initially, find it hard to let go. Second, legal liability for automakers could be huge if a malfunctioning car injured or killed people.

Personal habits will surely slow adoption, but people will come to trust the cars as evidence of effectiveness piles up. New drivers, raised with the idea that cars can drive themselves, might be more trusting than older drivers. After all, lots of people used to be scared witless about flying, but that issue has largely faded.

13 Doug Newcomb, "You Won't Need a Driver's License by 2040," *Wired,* September 18, 2012, http://www.cnn.com/2012/09/18/tech/innovation/ieee-2040-cars/index.html?npt=NP1.

The liability issue is trickier—computers are completely capable of flying planes, including takeoffs and landings, yet, for liability reasons, every commercial flight has two human pilots. A study by Rand Corp. concluded that existing liability case law "does not seem to present unusual liability concerns for owners or drivers of vehicles equipped with autonomous vehicle technologies." Instead, the study predicted that the decrease in the number of accidents and the associated lower insurance costs would encourage drivers and auto insurers to adopt the technology—unlike with airplanes, where deaths are rare, there are tens of thousands of preventable deaths in cars each year.[14] A recent study found that one-third of drivers never even engaged their brakes before an accident and that 99 percent didn't engage them fully.[15] Surely, sophisticated electronics can do better.

The Rand study suggested that government might intervene and mandate self-driving cars if they prove to be half as safe as Google claims. After all, almost 370,000 people died on American roads between 2001 and 2009[16]—that is more than one and a half times as many as died in combat during the American Civil War. Although there are too many imponderables to imagine that the US government would get involved anytime soon, one can imagine scenarios where more interventionist governments, like China's, might intervene. Developing countries actually have much greater incentives to adopt driverless cars because their rates of accidents and fatalities per 100,000 miles of driving are far greater than in the United States.

14 One factor that might stem a potential flood of lawsuits is that the Google car's cameras and sensors will capture copious video and telemetry evidence about any accident. There will be no doubt about who did what to whom when.

15 Joseph B. White, "Self-Driving Cars Spark New Guidelines," *Wall Street Journal,* May 30, 2013, http://online.wsj.com/article/SB10001424127887323728204578515081578077890.html.

16 Tom Vanderbilt, "Let the Robot Drive: The Autonomous Car of the Future Is Here," *Wired,* January 20, 2012, http://www.wired.com/magazine/2012/01/ff_autonomouscars/all/1.

Driverless cars could well take hold in a developing country, get the kinks worked out, and then take over in the United States and other developed nations.

The Google car may not soon be on the road in numbers sufficient to revolutionize the auto industry, but it offers both earth-shattering possibility and highly uncertain timing—in other words, an opportunity to either make or lose an awful lot of money on a killer app.

Even if the Google car takes a metaphorical 100 mph crash into a wall, it's an amazing experiment that will spin off loads of innovation. If driverless cars can't prevent almost all crashes, technological assists will still soon be available that can take control of a car and stop accidents in the two scenarios where various studies find it's most likely to happen: at speeds below 37 mph, in traffic, and at high speed on highways. A combination of video and sensors is being used to monitor fleets of trucks to ensure that the drivers are being careful and to capture the few seconds before and after teen drivers make risky maneuvers, so parents can use those teachable moments to make their children safer behind the wheel.[17]

Plenty of other technologies could also disrupt the car business. For instance, companies that sell navigation systems, DVD screens, and other electronics for cars will find many capabilities migrating into smartphones and tablets. Ford has already announced that it will equip some cars with a smartphone jack and skip the pricy navigation systems that have been going into many models.

That's just the changes for automakers. Every company that plays a role in the auto world will have to prepare for major change. And big changes can happen long before driverless cars become pervasive. Studies have found that a relatively modest form of accident-prevention technology—adaptive cruise control—needs to be in only 20 to

17 DriveCam home page. http://www.drivecam.com/our-markets/family/overview.

25 percent of cars on the road for there to be a sharp drop in accidents[18] and in the revenue of carmakers, car dealers, insurers, body shops, attorneys, and others with business that stems from collisions.

The Google car is the work of a mere twelve engineers, and the company has spent perhaps $50 million on the project,[19] yet the car gives the company a shot at a major role in a $2 trillion-a-year ecosystem. With that much revenue at stake, and innovation so inexpensive these days, every conceivable player will take a shot at upending the car business. Intel, for one, has announced a $100 million Connected Car Fund to experiment with driverless technologies.[20]

The question—the central question of this book—is how to help traditional companies soak in all the innovation that's going on, combine it with their enormous advantages, and outpace newcomers, continuing to dominate in the brave new world that they will help shape.

18 "Relieving Congestion with Adaptive Cruise Control," *The Antiplanner,* December 5, 2012, http://ti.org/antiplanner/?p=7208.

19 Andy Kessler, "Sebastian Thrun: What's Next for Silicon Valley," *Wall Street Journal,* June 15, 2012, http://online.wsj.com/article/SB10001424052702303807404577434891291657730.html.

20 Eric Savitz, "Intel Capital Launches $100 Million Connected Car Fund," *Forbes,* February 29, 2012, http://www.forbes.com/sites/ericsavitz/2012/02/29/intel-capital-launches-100-million-connected-car-fund/.