EXPONENTIAL ORGANIZATIONS

Why new organizations are ten times better, faster, and cheaper than yours (and what to do about it)

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with MICHAEL S. MALONE and YURI VAN GEEST

FOREWORD by PETER H. DIAMANDIS

A SINGULARITY UNIVERSITY BOOK

Foreword

Welcome to a time of exponential change, the most amazing time ever to be alive.

In the pages that follow, Salim Ismail, my colleague, friend and one of the leading thinkers and practitioners on the future of organizations, offers you a first look at what this new world will look like—and how it will change the way you work and live. Salim has studied and interviewed CEOs and entrepreneurs whose companies are leveraging a newly available set of externalities and, as a result, scaling their organizations at many times the normal rate of typical companies. More important, he's thought deeply about how existing organizations need to adapt. For this reason, I can't think of a more perfect guide to those CEOs and executives interested in thriving during this time of disruptive change.

Have no doubt, *Exponential Organizations: Why New Organizations are Ten Times Better, Faster and Cheaper Than Yours (And What To About It)* is both a roadmap and a survival guide for the CEO, the entrepreneur and, most of all, the executive of the future. Congratulations on the successes that got you to this point in your career, but let me forewarn you that those skills are already out of date. The concepts in this book and the conversations that they spark are the new *lingua franca* for anyone wanting to remain competitive and stay in the game. In today's corporate world there is a new breed of institutional organism—the Exponential Organization—loose on Earth, and if you don't understand it, prepare for it and, ultimately, *become* it, you will be disrupted.

The concept of the Exponential Organization (ExO) first arose at Singularity University, which I co-founded in 2008 with noted futurist, author, entrepreneur turned AI director at Google, Ray Kurzweil. The goal was to create a new kind of university, one whose curriculum was

constantly being updated. For that reason SU was never accredited—not because we didn't care, but because the curriculum was changing too fast. SU would focus only on the exponentially growing (or accelerating technologies) that were riding on the back of Moore's Law. Areas like infinite computing, sensors, networks, artificial intelligence, robotics, digital manufacturing, synthetic biology, digital medicine and nanomaterials. By design and desire, our students would be the world's top entrepreneurs, as well as executives from Fortune 500 companies. Our mission: to help people positively impact the lives of a billion people.

The idea for SU came together at a Founding Conference hosted at NASA's Ames Research Center in Silicon Valley in September 2008. What I remember most clearly from the event was an impromptu speech given by Google co-founder Larry Page near the end of the first day. Standing before about one hundred attendees, Page made an impassioned speech calling for this new university to focus on addressing the world's biggest problems: "I now have a very simple metric I use: Are you working on something that can change the world? Yes or no? The answer for 99.99999 percent of people is 'no.' I think we need to be training people on how to change the world. Obviously, technologies are the way to do that. That's what we've seen in the past; that's what's driven all the change."

One of the individuals in the audience listening to Page was Salim Ismail, who had headed up Brickhouse, Yahoo's intrapreneurial incubator. He, too, was taken by that message, and within weeks, he joined Singularity as the university's founding Executive Director. Salim, having run several startups before, navigated the usual crises that come with an early stage company and played a crucial role in making SU the success it is today. But perhaps most important of all, Salim pulled together the diverse thoughts and case studies taught at SU and

wove them together into a vision for a new kind of company, one that operated at ten times the price performance of those just a decade ago.

It was my pleasure to help frame the attributes, concepts and practices exhibited by Exponential Organizations, and to join Salim, Yuri van Geest, and Mike Malone in developing this book. Together, we have had the great fortune to study and understand how accelerating technologies are changing the course of nations, industry and all of humanity, and to manifest Salim's "how-to guide" for the Exponential Executive. Some of the work described in the chapters ahead emerged from my own book, *Abundance: The Future Is Better Than You Think* (co-authored with Steven Kotler), as a framing of where we all could end up, but most of it applies to the companies of today and how they need to navigate there.

Salim's co-authors also deserve recognition. First is Yuri van Geest, a Singularity University graduate and one of the world's leading experts in mobile, as well as a keen student of exponential technologies and trends. Yuri has a background in organizational design and has been materially involved since early on in the project. Second is veteran high-technology journalist Mike Malone. Mike is not only a world-class technology reporter, but also the inventor of two influential organizational models that preceded this book: the Virtual Corporation (with Bill Davidow) and the Protean Organization.

Salim's vision of the Exponential Organization is a powerful one. Potent forces are emerging in the world—exponential technologies, the DIY innovator, crowdfunding, crowdsourcing, and the rising billion—that will give us the power to solve many of the world's grandest challenges and the potential to meet the needs of every man, women and child over the next two to three decades. These same forces are now empowering smaller and smaller teams to do what was once only possible via governments and the largest corporations.

Three billion new minds will join the global economy over the next half-dozen years. The relevance of this is twofold. First, these three billion people represent a new population of consumers who have never bought anything before. Consequentially, they represent a long tail of tens-of-trillions of dollars of emerging buying power. If they are not your direct customers, fear not; they are likely your customer's customers. Second, this group—the "rising billion"—is a new entrepreneurial class powered with the latest generation of Internet-delivered technologies—everything from Google and Artificial Intelligence, to 3D printing and synthetic biology. As such, we will see an explosion in the rate of innovation, as millions of new innovators begin to experiment and upload their products and services and launch new businesses. If you think the rate of innovation has been fast in recent years, let me be among the first to tell you: you haven't seen anything yet.

Today the only constant is change, and the rate of change is increasing. Your competition is no longer the multinational corporation overseas, it's now the guy or gal in the Silicon Valley or Bandra (Mumbai) garage using the latest online tools to design and cloud print their latest innovation.

But the question remains: how can you harness all of this creative power? How can you construct an enterprise that is as quick, adept and innovative as the people who will be part of it? How will you compete in this accelerated new world? How will you organize to scale?

The answer is the Exponential Organization.

You won't have much choice, because in many (and soon most) industries, that acceleration is already underway. Lately, I've begun to teach about what I call the 6Ds: Digitized, Deceptive, Disruptive, Dematerialize, Demonetize and Democratize.

Any technology that becomes *Digitized* (our first "D") enters a period of *Deceptive* growth. During the early period of exponentials, the doubling of small numbers (0.01, 0.02, 0.04, 0.08) all basically looks like zero. But once its hits the knee of the curve, you are only ten doublings away from 1,000x, twenty doublings get you to 1,000,000x, and thirty doublings get you a 1,000,000,000x increase.

Such a rapid rise describes the third D, *Disruptive*. And, as you shall see in the pages of this book, once a technology become disruptive it *Dematerializes*—which means that you no longer physically carry around a GPS, video camera or flashlight. All of them have dematerialized as apps onto your smartphone. And once that happens, the product or service *Demonetizes*. Thus, Uber is demonetizing taxi fleets and Craig's List demonetized the classified ads (taking down a flock of newspapers in the process).

The final step to all this is *Democratization*. Thirty years ago if you wanted to reach a billion people, you needed to be Coca-Cola or GE, with employees in one hundred countries. Today you can be a kid in a garage who uploads an app onto a few key platforms. Your ability to touch humanity has been democratized.

What Salim, along with Yuri van Geest and Mike Malone, has observed from the front lines—and what you will come to understand as you read this book—is that *no* current commercial, governmental or non-profit enterprise, as currently configured, can keep up with the pace that will be set by these 6Ds. To do so will require something radically new—a new vision of organization that is as technologically smart, adaptive and encompassing (not just of employees but of billions of people in vast social networks) as the new world in which it will operate—and ultimately transform.

That vision is the Exponential Organization.

Peter Diamandis
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Santa Monica, California
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INTRODUCTION

The Iridium Moment

In the late 1980s, in what was generally lauded as a forward-looking move to capture the nascent cell phone industry, Motorola Inc. spun out a company called Iridium. Motorola recognized—before anyone else—that while expensive mobile phone solutions were relatively easy to implement in urban centers thanks to their high population densities, there was no comparable solution for regions outside major cities, much less the countryside. A calculation convinced Motorola that the cost of cell phone towers—about $100,000 each, not including spectrum utilization limits and the not-inconsiderable expense of producing brick-sized handsets—meant that it would too expensive to blanket the vast majority of the landscape.

Soon enough, however, a more radical but also more profitable solution presented itself: a constellation of seventy-seven satellites (Iridium is number seventy-seven on the periodic table) that would cover the globe at low Earth orbit and provide mobile telephony for one price—*no matter the location*. And, Motorola concluded, if just a million people in various developed countries paid $3,000 for a satellite phone, plus a $5-per-minute usage fee, the satellite network would quickly become profitable.

Of course, we now know Iridium failed spectacularly, ultimately costing its investors $5 billion. In fact, the satellite system was doomed before it was even put in place, one of the most dramatic victims of technological innovation.

There were several reasons behind Iridium's failure. Even as the company was launching its satellites, the cost of installing cell phone towers was dropping, network speeds were increasing by orders of magnitude, and handsets were shrinking in both size and price. To be fair, Iridium was hardly alone in its misjudgment. Competitors Odyssey and Globalstar both made the same fundamental mistake. Ultimately, in fact, more than $10 billion in investor money was lost in a misplaced bet that the pace of technological change was too slow to keep up with market demand.

One reason for this debacle, according to Dan Colussy, who drove Iridium's buyout in 2000, was the company's refusal to update business assumptions. "The Iridium business plan was locked in place twelve years before the system became operational," he recalls. That's a

long time, long enough that it was almost impossible to predict where the state of the art in digital communications would be by the time the satellite system was at last in place. We thus label this an *Iridium Moment*—using linear tools and the trends of the past to predict an accelerating future.

Another Iridium Moment is the well-documented case of Eastman Kodak, which declared bankruptcy in 2012 after having invented, and then rejected, the digital camera. At around the same time Kodak was closing its doors, the startup Instagram, three years in business and with just thirteen employees, was bought by Facebook for $1 billion. (Ironically, this happened while Kodak still owned the patents for digital photography.)

Iridium's missteps and the epochal industry change from Kodak to Instagram were not isolated events. Competition for many of America's Fortune 500 companies is no longer coming from China and India. As Peter Diamandis has noted, today it's increasingly coming from two guys in a garage with a startup leveraging exponentially growing technologies. YouTube went from a startup funded by Chad Hurley's personal credit cards to being purchased by Google for $1.4 billion, all in less than eighteen months. Groupon leapt from conception to $6 billion in value in less than two years. Uber is valued at almost $17 billion, ten times its value of just two years ago. What we're witnessing is a new breed of organization that is scaling and generating value at a pace never before seen in business.

Welcome to the new world of the *Exponential Organization*, or ExO. It is a place where, as with Kodak, neither age nor size nor reputation nor even current sales guarantee that you will be around tomorrow. On the other hand, it is also a place where if you can build an organization that is sufficiently scalable, fast moving and smart, you may enjoy success—exponential success—to a degree never before possible. And all with a minimum of resources and time.

We have entered the age of the billion-dollar startup and soon, the trillion-dollar corporation, where the best companies and institutions will be moving at seemingly light speed. If you haven't transitioned into an Exponential Organization as well, it will not only seem as though your competition is racing away from you, but also, like Kodak, that you are sliding backwards at breakneck speed into oblivion.

In 2011, Babson's Olin Graduate School of Business predicted that in ten years, forty percent of existing Fortune 500 Companies would no longer survive. Richard Foster of Yale University estimates that the average lifespan of an S&P 500 company has decreased from sixty-seven years in the 1920s to fifteen years today. And that lifespan is going to get even shorter in the years to come as these giant corporations aren't just forced to compete with, but are annihilated—seemingly overnight—by a new breed of companies that harnesses the power of exponential technologies, from groupware and data mining to synthetic biology and robotics. And as the rise of Google portents, the founders of those new companies will become the leaders of the world's economy for the foreseeable future.

Doubling Down

For most of recorded history, a community's productivity was a function of its human power: men and women to hunt, gather and build, and children to assist. Double the number of hands gathering crops or bringing home meat and the community doubled its output.

In time, humanity domesticated beasts of burden, including the horse and ox, and output increased further. But the equation was still linear. Double the beasts, double the output.

As market capitalism came into existence and the industrial age dawned, output took a huge leap. Now a single individual could operate machinery that did the work of 10 horses or 100 laborers. The speed of transport, and thus distribution, doubled, and then, for the first time in human history, tripled.

Increased output brought prosperity to many and, ultimately, a manifold jump in the standard of living. Starting at the end of the eighteenth century and continuing through the present—and largely the result of the intersection of the Industrial Revolution and the modern scientific research laboratory—mankind has witnessed a doubling of the human lifespan and a tripling of inflation-adjusted per capita net worth for every nation on Earth.

During this most recent phase of human productivity, the limiting factor to growth has shifted from the number of bodies (human or animal) to the number of machines and the capital expense deployed. Doubling the number of factories meant twice the output. Companies have

grown ever larger, and they now span the globe. With size has come increased global reach, the potential for sector domination and, ultimately, enduring and hugely lucrative success.

But such growth takes time and typically has required enormous capital investment. None of this comes cheap, and the complexity of large-scale hiring efforts and the difficulties of designing, building and delivering new equipment means that implementation timelines are still measured over the better part of a decade. On more than one occasion, CEOs and boards of directors have found themselves (as did Iridium) "betting the company" on a new direction requiring a huge capital investment measured in hundreds of millions or billions of dollars. Pharmaceutical companies, aerospace companies, automotive companies and energy companies routinely find themselves making investments whose returns might not be known for many years.

Although a workable system, it is far from an optimal one. Too much money and valuable talent is locked up in decade-long projects whose likelihood of success can't be measured almost until the moment they fail. All of which adds up to enormous waste, not least in terms of lost potential to pursue other ideas and opportunities that could benefit mankind.

This is neither a tenable nor an acceptable situation, especially when the challenges that face mankind in the twenty-first century will take every bit of the imagination and innovation we can muster.

There must be a better way to organize ourselves. We've learned how to scale technology; now it's time we learned how to scale organizations. This new age calls for a different solution to building new business, to improving rates of success and to solving the challenges that lie ahead.

That solution is the Exponential Organization.

Let's begin with a definition:

An Exponential Organization (ExO) is one whose impact (or output) is disproportionally large—at least 10x larger—compared to its peers because of the use of new organizational techniques that leverage accelerating technologies.

Rather than using armies of people or large physical plants, Exponential Organizations are built upon information technologies that take what was once physical in nature and dematerialize it into the digital, on-demand world.

Everywhere you look you see this digital transformation taking place: In 2012, ninety-three percent of US transactions were already digital; physical equipment companies like Nikon are seeing their cameras rapidly being supplanted by the cameras on smart phones; map and atlas makers were replaced by Magellan GPS systems, which themselves were replaced by smartphone sensors; and libraries of books and music have been turned into phone and e-reader apps. Similarly, retail stores in China are being replaced by the rise of e-commerce tech giant Alibaba, universities are being threatened by MOOCs such as edX and Coursera, and the Tesla S is more a computer with wheels than it is a car.

The sixty-year history of Moore's Law—basically, that the price/performance of computation will double about every eighteen months—has been well documented. And we've come a long way since 1971, when the original circuit board held just two hundred chips; today we have teraflops of computing operating within the same physical space.

That steady, extraordinary, and seemingly impossible pace led futurist Ray Kurzweil, who has studied this phenomenon for thirty years, to make four signature observations:

- First, the doubling pattern identified by Gordon Moore in integrated circuits applies to any information technology. Kurzweil calls this the Law of Accelerating Returns (LOAR) and shows that doubling patterns in computation extend all the way back to 1900, far earlier than Moore's original pronouncement.
- Second, the driver fueling this phenomenon is information. Once any domain, discipline, technology or industry becomes information-enabled and powered by information flows, its price/performance begins doubling annually.
- Third, once that doubling pattern starts, it doesn't stop. We use current computers to design faster computers, which then build faster computers, and so on.
- Finally, several key technologies today are now information-enabled and following the same trajectory. Those technologies include artificial intelligence (AI), robotics, biotech and bioinformatics, medicine, neuroscience, data science, 3D printing, nanotechnology and even aspects of energy.

Never in human history have we seen so many technologies moving at such a pace. And now that we are information-enabling everything around us, the effects of the Kurzweil's Law of Accelerating Returns are sure to be profound.

What's more, as these technologies intersect (e.g., using deep-learning AI algorithms to analyze cancer trials), the pace of innovation accelerates even further. Each intersection adds yet another multiplier to the equation.

Archimedes once said, "Give me a lever long enough, and I'll move the world." Simply put, mankind has never had a bigger lever.

Kurzweil's Law of Accelerating Returns and Moore's Law long ago broke from the confines of semiconductors and have utterly transformed human society over the last fifty years. Now, Exponential Organizations, the latest embodiment of acceleration in human culture and enterprise, are overhauling commerce and other aspects of modern life, and at scorching pace that will quickly leave the old world of "linear organizations" far behind. Those enterprises that don't jump aboard soon will be left on the ash heap of history, joining Iridium, Kodak, Polaroid, Philco, Blockbuster, Nokia and a host of other once-great, industry-dominant corporations unable to adapt to rapid technological change.

In the pages ahead, we will outline the key internal and external attributes of an Exponential Organization, including its design (or lack thereof), lines of communication, decision-making protocol, information infrastructure, management, philosophy and life cycle. We will explore how an ExO differs in terms of strategy, structure, culture, processes, operations, systems, people and key performance indicators. We will also discuss the crucial importance of a company having what we call a Massive Transformative Purpose (a term we will define in depth). We will then look at how to launch an ExO startup, how to adopt ExO practices in mid-cap companies and how to retrofit them to large organizations.

Our objective is to not make this a book of theory, but rather to present the reader with a how-to guide to the creation and maintenance of an Exponential Organization. We offer a hands-

on, prescriptive look at how to organize an enterprise able to compete in the face of today's accelerated pace of change.

Although many of the ideas we will present may seem radically new, they have been around, *sub rosa*, for a decade or more. We first identified the ExO paradigm as a weak signal in 2009, and noticed over a two-year period that several new organizations were following a specific model. In 2011, futurist Paul Saffo suggested to Salim that he write this book, and we have been seriously researching the ExO model for the last three years. To do so, we:

- Reviewed sixty classic innovation management books by such authors as John Hagel, Clayton Christensen, Eric Ries, Gary Hamel, Jim Collins, W. Chan Kim, Reid Hoffman and Michael Cusomano.
- Interviewed C-level executives from several dozen Fortune 200 companies with our survey and frameworks.
- Interviewed or researched ninety top entrepreneurs and visionaries including Marc Andreessen, Steve Forbes, Chris Anderson, Michael Milken, Paul Saffo, Philip Rosedale, Arianna Huffington, Tim O'Reilly and Steve Jurvetson.
- Investigated the characteristics of the one hundred fastest growing and most successful startups across the world, including those that comprise the Unicorn Club (Aileen Lee's name for the billion-dollar market cap startup group), to tease out commonalities the companies used to scale.
- Reviewed presentations and gleaned key insights from core faculty members at Singularity University regarding the acceleration they are seeing at the edges of their fields and how that acceleration might impact organizational design.

We don't claim to have all the answers. But based upon our own experiences, both good and bad, we believe we can offer management teams critical insight into this era of hyper-accelerated innovation and competition, as well as into the new opportunities (and responsibilities) presented by this new world. If we can't guarantee you success, we can at least put you on the right playing field and show you the new rules of the game. These two advantages, plus your own initiative, offer good odds for a being a winner in the new world of Exponential Organizations.

CHAPTER ONE: – Illuminated by Information

While the original Iridium Moment caused enormous embarrassment for the satellite industry, you may be surprised to learn that there have been many similar but less-publicized Iridium moments in the mobile phone industry.

For example, because mobile phones in the early 80s were bulky and expensive to use, renowned consulting firm McKinsey & Company advised AT&T *not* to enter the mobile telephone business, predicting there would be fewer than one million cellular phones in use by 2000. In fact, by 2000, there were one hundred million mobile phones. Not only was McKinsey's prediction off by ninety-nine percent, its recommendation also resulted in AT&T missing out on one of the biggest business opportunities of modern times.

In 2009, yet another major market research firm, the Gartner Group, forecast that by 2012 Symbian would be the top operating system for mobile devices, with a thirty-nine percent market share and two hundred three million units shipped—a leadership position Gartner anticipated the company would hold through 2014. Gartner also predicted in the same report that Android would hold just a 14.5 percent market share.

The reality? Symbian shut its doors at the end of 2012 after shipping only 2.2 million units in Q4. Android, on the other hand, has overtaken even the Apple iPhone OS and today dominates the mobile world, with over one billion Android OS shipments just in 2014.

Venture capitalist Vinod Khosla conducted an insightful piece of research in which he reviewed predictions made by mobile phone industry analysts from 2000 to 2010. He studied major research firms such as Gartner, Forrester, McKinsey and Jupiter to see how they predicted the growth of the mobile phone industry in two-year increments over the course of that decade.

Khosla's research showed that in 2002 experts predicted, on average, sixteen percent year-to-year growth. In fact, by 2004, the industry had seen a one hundred percent increase. In 2004, their collective predictions called for an increase of fourteen percent; by 2006, growth had once again climbed one hundred percent. In 2006, the analysts estimated sales would increase just twelve percent—and they doubled again. Despite three previous—and notable—failures, in 2008 these very same experts forecast a measly ten percent growth, only to see the number double yet again—another one hundred percent leap. It is hard to imagine how anyone could be more wrong than to be off by 10x—and yet these were the mobile phone industry experts upon

whom corporations and governments worldwide relied for their long-term strategic planning. Nowhere does the phrase "missed by a country mile" seem more appropriate.

What makes this failure valuable for our purposes is that at each point of *exponential* growth in mobile phones over the last decade, the world's top prognosticators predicted largely *linear* change.

Khosla's research proved particularly compelling and valuable when he went on to show that such prediction errors weren't unique just to the mobile phone industry, but also to the oil industry and a host of other sectors. It seemed that the experts in almost every field *always* projected linearly, despite the evidence before their eyes.

Brough Turner, a noted entrepreneur in VOIP and mobile telephony, has been building companies in that industry since 1990. Having kept close track of industry predictions since the early 90s, he concurs with Khosla's analysis. In a recent interview with Salim, Turner noted that while the initial projections were always aggressive, the experts inevitably expected a tapering after the first eighteen to twenty-four months. Nonetheless, he said, the same rates of growth continued for twenty years. David Frigstad, CEO of research firm Frost & Sullivan, explains at least part of the problem thusly: "Predicting a technology when it's doubling is inherently tricky. If you miss one step, you're off by fifty percent!"

A final example should drive the point home. In 1990, the Human Genome Project was launched with the aim of fully sequencing a single human genome. Estimates called for the project to take fifteen years and cost about $6 billion. In 1997, however, halfway through the estimated time frame, just one percent of the human genome had been sequenced. Every expert labeled the project a failure, pointing out that at seven years for just one percent, it would take seven hundred years to finish the sequencing. Craig Venter, one of the principal researchers, received calls from friends and colleagues imploring him to stop the project and not embarrass himself further. "Save your career," he recalls them saying. "Return the money."

When Ray Kurzweil was asked his perspective, however, his view of the "impending disaster" was quite different. "One percent," he said. "That means we're halfway done." What Kurzweil got that no one else did was that the amount sequenced was doubling every year. One percent doubling seven times is one hundred percent. Kurzweil's math was correct, and in fact

the project was completed in 2001, early and under budget. The so-called experts had missed the end point by 696 years.

What is going on here? How can intelligent and well-read analysts, entrepreneurs and investors so consistently get things wrong? And not just a little wrong, but wrong by as much as ninety-nine percent?

If such predictions had been just a little bit off, it would be easy to dismiss them as based on bad data, or even simple incompetence. But no, mistakes this great are almost always due to a complete misinterpretation of the rules defining the nature of the marketplace. They come from relying on a paradigm that performed perfectly up until the moment it didn't, and that is suddenly, often inexplicably, out of date.

But if there is a new paradigm assuming a central role in the modern economy, one that will define how we live and work, what is it?

The answer lies within the anecdotes cited in the introduction to this book. Consider, for example, the Eastman Kodak story. Was its failure simply a case of a once-great company that had grown complacent and lost its innovative edge, as was suggested by the media at the time? Or was there something larger at work?

Think back, if you are old enough to remember, to the days of film photography. Each photograph cost an incremental amount of money. The cost of the film, the cost of mailing or hand-delivering the film, the cost of processing that film—in the end, it all added up to about a dollar per photograph. Photography was based upon a scarcity model and we carefully conserved and managed our photos and film rolls to ensure no wasted shots.

With the shift to digital photography, something important—indeed something revolutionary—happened. The marginal cost of taking an extra photograph didn't just diminish, as it would with a linear improvement in the technology; instead, it essentially sank to *zero*. It didn't matter if you took five pictures or five hundred. The cost was the same. Eventually, even the storage of the photos themselves became all but free.

And that wasn't the only technological leap. Once you had these digital photographs, you could apply computations to them in the form of image recognition, artificial intelligence, social technologies, filtering, editing, and machine learning. Now anyone with minimal training could become a "darkroom wizard" like Edward Weston or Ansel Adams. You could also manipulate, move and copy a digital photograph infinitely more quickly and easily than a physical one—and

as such you became a publisher as well as a print and wire service. And all these things could be done with a camera that was a fraction the cost and size of the traditional analog versions it replaced.

In other words, what happened in the world of photography wasn't just a major improvement. It wasn't even just a single evolutionary leap. Eastman Kodak might have managed to stay competitive had that been the only challenge. But Kodak (and Polaroid, among other giants in the field) was hit by revolutionary technological change coming at it from multiple directions: cameras, film, processing, distribution, retailing, marketing, packaging, storage and, ultimately and most decisively, a radical change in the perceptions of the marketplace.

That is the very definition of a paradigm shift. There's an important and foundational lesson illustrated in each of these anecdotes, which is that an information-based environment delivers *fundamentally disruptive opportunities*.

There are thousands of similar disruptions taking place across the global economy, where just such a profound shift is occurring from a physical substrate to an information substrate. That is, at the heart of every one of these disruptions—these evolutionary leaps—can be found a fundamental change in the role of information: semiconductor chips assuming the role of image capture, display, storage and controller; the Internet transforming supply, distribution and retail channels; and social networks and groupware reorganizing institutions. Together, all indications are that we are shifting to an *information-based paradigm.*

In his book *The Singularity is Near: When Humans Transcend Biology*, Kurzweil identified a hugely important and fundamental property of technology: when you shift to an information-based environment, the pace of development jumps onto an exponential growth path and price/performance doubles every year or two.

As everyone in technology knows, this pace of change was first discovered and described in 1964 by Intel Corporation co-founder Gordon Moore. His discovery, immortalized as Moore's Law, has seen the doubling of price/performance in computing continue uninterrupted for a half-century. As noted in the Introduction, Kurzweil took Moore's Law several steps further, noting that *every* information-based paradigm operates in the same way, something he called the Law of Accelerating Returns (LOAR).

There is a growing recognition that the pace of change formerly seen in computing is now mapping into other technologies with the same effect. For example, the first human genome was sequenced in 2000 at a cost of $2.7 billion. Because of the underlying accelerations in computing, sensors and new measurement techniques, the cost of DNA sequencing has been moving at *five* times the pace of Moore's Law. In 2011, Dr. Moore had his own genome sequenced for $100,000. Today that very same sequencing costs about $1,000, a figure that is expected to drop to $100 by 2015, and to just a penny by 2020, when, in the words of Raymond McCauley, "It will soon be cheaper to sequence your genome…than it will be to flush your toilet."

We've seen a similar movement in robotics. Those twenty dollar toy helicopters all the kids are playing with? Five years ago that capability cost $700. Eight years ago it didn't even exist. As former astronaut Dan Barry says of a toy drone helicopter available on Amazon for seventeen dollars, "It has a gyro in it that space shuttle engineers would have spent $100 million to have thirty years ago."

And that's just biotech and robotics. We are also seeing plummeting costs across a host of other technologies, including the following:

Technology	**Cost (averages) for equivalent functionality**	**Scale**
3D printing	$40,000 (2007) to $100 (2014)	400x in 7 years
Industrial robots	$500,000 (2008) to $22,000 (2013)	23x in 5 years
Drones	$100,000 (2007) to $700 (2013)	142x in 6 years
Solar	$30 per KWh (1984) to $0.16 per KWh (2014)	200x in 20 years
Sensors (3D LIDAR sensor)	$20,000 (2009) to $79 (2014)	250x in 5 years
Biotech (DNA sequencing of one whole human DNA profile)	$10 million (2007) to $1,000 (2014)	10,000x in 2 years
Neurotech (BCI devices)	$4,000 (2006) to $90 (2011)	44x in 5 years
Medicine (full body scan)	$10,000 (2000) to $500 (2014)	20x in 14 years
Nanotech (graphene)	80 percent price drop in producing graphene between 2014 and 2020	Projected

In each of these domains, at least one aspect is being information-enabled, which then catapults it onto the bullet train of Moore's Law as the pace of development accelerates into a doubling pattern.

The physical world is still there, of course, but our relationship to it is changing fundamentally. Note that for many of us, our memories aren't in our heads anymore—they're buried in our smart phones. Via social networks, our relationships are increasingly digital, not analog, and our communication is nearly all-digital. We are rapidly changing the filter through which we deal with the world from a physical, materially based perspective to an information- and knowledge-based one.

And this is just beginning. Ten years ago we had five hundred million Internet-connected devices. Today there are about eight billion. In another decade there will be fifty billion, and two decades from now we'll have a trillion Internet-connected devices as we literally information-enable every aspect of the world in the Internet of Things. The Internet is now the world's nervous system, with our mobile devices serving as edge points and nodes on that network.

Think about that for a second: we'll be jumping from eight billion Internet-connected devices today to fifty billion by 2025, and to a trillion a mere decade later. We like to think that thirty or forty years into the Information Revolution we are well along in terms of its development. But according to this metric, we're just one percent of the way down the road. Not only is most of that growth still ahead of us, *all of it is*.

And *everything* is being disrupted in the process.

The magnitude of that disruption, especially in the consumer world, is only now becoming obvious. It started with certain products and industries, such as books (Amazon) and travel (Booking.com). Then classified ads (Craigslist) and auction sites (eBay) decimated the newspaper industry, which has been further disrupted in recent years by Twitter, the Huffington Post, Vice and Medium. More recently, entire industries—music, for example, thanks initially to Apple's iTunes—have been disrupted.

Now, in 2014, we are hard-pressed to identify *any* industry that hasn't been fundamentally disrupted. And not just businesses, but jobs as well. As David Rose, a leading angel investor and founder of Gust, says, "Every single job function we can identify is being fundamentally transformed." Even "old" industries such as construction are in the throes of disruption. Mike

Halsall, a construction company executive, told us that significant disruptions to his industry include:

- Increased collaboration (making an opaque industry more transparent and substantially more efficient)
- Ever-more sophisticated design software and visualization
- 3D printing

Halsall estimates that the sum of these disruptions could reduce the number of people working in construction by more than twenty-five percent within ten years. (The construction industry, by the way, represents a $4.7 trillion industry annually.)

In the corporate travel industry, Russ Howell, EVP of Global Technology at BCD Travel notes that fifty percent ransactions at telephony based call centers moved to the internet in less than a decade. Furthermore, he expects fifty percent of those to move to mobile smartphones within three years.

A Racing Pulse

As this new information-based paradigm causes the very metabolism of the world to heat up, we're increasingly feeling its macroeconomic impact. For example, the cheapest 3D printers now cost only $100, which means that within five years or so most of us will be able to afford 3D printers to fabricate toys, cutlery, tools and fittings—essentially anything we're able to dream up. The implications of this "printing revolution" are almost unfathomable.

So are the potential repercussions. Consider that, for all of its advances over the past few decades, China's economy is still fundamentally based on the manufacturing and assembly of cheap plastic parts. This means that within a decade, the Chinese economy could be under serious threat from 3D printing technology. And that's just one industry. (Next, consider the ripple effect if an economically distressed China decides to call its overseas debt.)

Historically, disruptive breakthroughs always occur when disparate fields cross. Consider for example how combining water power with the textile loom helped launch the Industrial

Revolution. Today, we are essentially cross-connecting *all* innovative new fields. And not just new fields: similar collisions are also occurring in age-old disciplines as well, from art and biology to chemistry and economics. It's no wonder that Larry Keeley, founder of Doblin Group, a noted innovation strategy consulting firm, says, "I have never, in thirty-two years, seen anything like the pace of change we're seeing today."

Even industries that were once thought impervious to technology are being affected via second-order impacts of information. For example, in January 2013 Santiago Bilinkis, a renowned entrepreneur in Argentina, noticed that Buenos Aires car wash operators had seen their revenues drop fifty percent over the previous decade. Given Argentina's growing middle class, a steady increase in the sales of luxury cars and a population that takes pride in showcasing clean cars, the fall in revenue made no sense. Bilinkis spent three months researching the situation, checking whether there were more car washes on the market (there weren't) or if new water conservation rules had been introduced (they hadn't). After eliminating all the possibilities, he stumbled upon the answer: Thanks to increased computing power and data, weather forecasters had become fifty percent more accurate in their predictions during that period. When drivers know it's going to rain, they skip the car wash, resulting in fewer visits. Thus have computational improvements in weather forecasting delivered a body blow to an industry as seemingly immune to technology advances as Buenos Aires car wash operators.

To fully comprehend the sheer acceleration we're seeing, recall the $10 billion in investment that was lost on Iridium and other satellite efforts in the 90s. Today, twenty years later, a new breed of satellite companies—Skybox, Planet Labs, Nanosatisfi and Satellogic—are all launching nanosatellites (which are, essentially, the size of a shoebox). The cost per launch is about $100,000 per satellite—a fraction of the $1 billion Iridium incurred per launch for its constellation. More important, by launching a cluster of nanosatellites operating in a coordinated, meshed configuration, the capability of these new satellites blows away what the previous generation could do.

For example, Planet Labs already has thirty-one satellites in orbit and plans to launch another one hundred during 2014. Satellogic, operating out of Argentina, has already launched its first three satellites and will soon be able to provide *real-time video anywhere on earth to a*

one-meter resolution. Emiliano Kargieman, the founder of Satellogic, estimates the total cost of launching his fleet will be less than $200 million. All-told, this new breed of satellite companies is operating at one-ten-thousandth the cost and delivering about 100x better performance than twenty years ago—a millionfold increase. Now that's an Iridium Moment.

Chapter 2 – A Tale of Two Companies

In one of the most iconic moments in modern business history, Steve Jobs rocked the world in January 2007 with his announcement of the Apple iPhone, which debuted six months later.

Literally everything in high tech changed that day—indeed, you might even call it a Singularity—as all existing strategies in consumer electronics were instantly rendered obsolete. At that moment, the entire future of the digital world had to be reconsidered.

Two months later, Finnish mobile phone giant Nokia spent a staggering $8.1 billion to buy Navteq, a navigation and road-mapping company. Nokia pursued Navteq because the latter dominated the in-road traffic sensor industry. Nokia concluded that control of those sensors would enable it to dominate mapping and mobile and online local information—assets that would act as a defensive barrier against the increasing market predations of Google and Apple.

The stratospheric price tag represented Navteq's near-monopoly of the road sensor industry. In Europe alone, Navteq's sensors covered approximately a quarter-million miles in thirty-five major cities across thirteen countries. Nokia was convinced that global, Navteq-powered, real-time traffic monitoring would enable it to both compete with Google's growing presence in real-time data and fend off Apple's revolutionary new product.

That was the theory, at least. Unfortunately for Nokia, a small Israeli company called Waze was founded around the same time.

Instead of making a massive capital investment in in-road sensor hardware, the founders of Waze chose instead to crowdsource location information by leveraging the GPS sensors on its users' phones—the new world of smartphones just announced at Apple by Steve Jobs—to capture traffic information. Within two years, Waze was gathering traffic data from as many sources as Navteq had road sensors, and within four years it had ten times as many sources. What's more, the cost of adding each new source was essentially zero, not to mention that Waze's users regularly upgraded their phones—and thus Waze's information base. In contrast, the Navteq system cost a fortune to upgrade.

Nokia made a gigantic defensive bet in acquiring an asset in the hopes of making an end-run around the iPhone. It was the kind of move that is celebrated in business—if it succeeds, that

is. But because Nokia didn't understand the larger, exponential implications of Leveraged Assets (see Chapter Three), the effort failed spectacularly. By June 2012, Nokia's market valuation had tumbled from $140 billion to $8.2 billion—pretty much what it spent to acquire Navteq. Not only had the world's largest mobile phone company lost its lead but because it had also lost the capital needed to claw its way back, it also likely lost its role as a leading industry player forever.

In June 2013 Google acquired Waze for $1.1 billion. At that time, the company had no infrastructure, no hardware and no more than one hundred employees. What it did have, however, was fifty million users. More precisely, Waze had fifty million "human traffic sensors," double those of just a year before. That number has probably doubled again since then, to one hundred million location sensors globally.

Nokia followed the old linear rules and bought physical infrastructure (remember Iridium?), hoping it would prove to be a competitive barrier. It was, of course, but only for in-road sensor users, not against information-enabled mobile phone application designers. In contrast, Waze leapfrogged the world of physical sensors simply by piggybacking on its users' smart phones.

In a real-time epilogue to the Nokia/Navteq story, as we write this, Microsoft has acquired Nokia's cell phone device business and patent portfolio for $7.2 billion, or about $1 billion less than Nokia paid for Navteq. Just as Nokia has fallen far from its early lead in the cell phone industry, Microsoft has struggled to gain share for its Windows Phone software.

Microsoft's stated rationale for the Nokia deal is to accelerate its share and profits in phones; to create a first-rate Microsoft phone experience for users; to prevent Google and Apple from foreclosing app innovation, integration, distribution and economics; and to avail itself of an outsized financial opportunity fueled by growth in the smartphone industry. Time will tell how this scenario plays out, and whether Nokia's acquisition is a case of linear, exponential or just an intellectual property land grab.

The story of Waze versus Navteq is important, and relevant to this book, not just because of who won and who lost, but also because of the fundamental difference in the two companies' approaches to *ownership*. Nokia spent enormous resources to purchase and own billions of

dollars in physical assets, while Waze simply accessed information already available on user-owned technology.

The former is a classic example of linear thinking, the latter of exponential thinking. While Nokia's linear strategy was dependent on the speed of physical installation, Waze benefited from the exponentially faster speed at which information can be accessed and shared.

* * * *

From time immemorial, human beings have worked to own "stuff" and then trade access to it. This behavior started in tribes, was adopted by clans, and then later spread to nations, empires, and most recently, global markets, making possible ever-larger human institutions. Value has always been generated by owning more land, more equipment, more machinery, more people. Ownership was the perfect strategy for managing scarce resources and ensuring a relatively predictable, stable environment.

The more you had—that is, the more value you "owned"—the wealthier and more powerful you were. To manage that asset, of course, you needed people. Lots of them. If a plot of land was twice as big, you needed twice as many people to farm or protect it. Luckily, our span of control didn't reach very far across the landscape, so this was a perfectly workable arrangement.

Once we reached a critical mass of people needed to manage or protect our owned assets, we created hierarchies—in every tribe or village, there was an implicit or explicit hierarchical order to the power structure. The bigger the tribe, the bigger the hierarchy. Then, beginning in the Middle Ages but fully taking hold with the Industrial Revolution and rise of the modern corporation, that local, hierarchical thinking was mapped onto companies and into governmental structures, a design that with only limited modification has held ever since.

Today, we still manage and measure ourselves on this linear scale. That is: x amount of work takes y amount of resources, 2x needs 2y, and so on of ever-greater *arithmetic* magnitude.

Automation, mass production, robotics and even virtualization with computers altered the slope of this line, but it still remained linear. If one concrete mixer truck replaces one hundred laborers hand-mixing concrete, two trucks replace two hundred laborers. Similarly, much of society is also measured on this basis: the number of doctors per 100,000 patients, class size per

teacher, GDP and energy per capita. Labor is paid hourly, as are legal fees, and housing is priced by the square foot.

In business, the way we build most products and services continues to mirror this linear, incremental, sequential thinking. Thus, the classic way to build a product, be it a giant airliner or a thumbnail-sized microprocessor, is through a template stage-gate process called New Product Development, or NPD, which includes the following steps:

1. Idea generation
2. Idea screening
3. Concept development and testing
4. Business analysis
5. Beta and market testing
6. Technical implementation
7. Commercialization
8. New product pricing

So codified is this process into the DNA of modern business there is even a designated industry association for it, called the Product Development and Management Association (PDMA).

You might think that while this old-fashioned linear approach is still widespread among mature industries, it has long been abandoned in the world of hot new technologies. You would be wrong. The linear process remains pervasive across the world economy, taking on different names in its different iterations. In software, for example, it's been called the *waterfall approach*. And while new development methods, like Agile, have cropped up to short-circuit this approach and parallelize some of the steps, the basic paradigm is still linear and incremental. Whether you are making locomotives or iPhone apps, linear product development remains the predominant name of the game.

When you think linearly, when your operations are linear, and when your measures of performance and success are linear, you cannot help but end up with a linear organization, one that sees the world through a linear lens—as did even multi-billion-dollar, technologically cutting-edge Nokia. Such an organization cannot help but have many of the following characteristics:

- Top-down and hierarchical in its organization
- Driven by financial outcomes
- Linear, sequential thinking
- Innovation primarily from within
- Strategic planning largely an extrapolation from the past
- Risk intolerance
- Process inflexibility
- Large number of employees
- Controls own assets
- Strongly invested in status quo

As noted business author John Hagel said: "Our organizations are set up to withstand change from the outside," rather than to embrace those changes even when they are useful. Aerospace engineer Burt Rutan's corollary to this is, "Defend and don't question."

Not surprisingly, given all of these characteristics, linear organizations will rarely disrupt their own products or services. They haven't the tools, the attitude or the perspective to do so. What they will do, and what they are built to do, is to keep getting bigger in order to take advantage of economies of scale. *Scale*—but linear scale—is the raison d'être of the linear organization. John Seely Brown calls this "scalable efficiency" and maintains that it is the paradigm that drives most corporate strategy and corporate architectures. Clayton Christensen immortalized this type of thinking in his business classic, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fall*.

Most large organizations use what is called a *matrix structure*. Product management, marketing and sales are often aligned vertically, and support functions such as legal, HR, finance and IT are usually horizontal. So the person handling legal for a product has two reporting lines, one to the head of product, who has revenue accountability, and the other to the head of legal, whose job it is to ensure consistency across numerous products. This is great for command and control, but it's terrible for accountability, speed and risk tolerance. Every time you try to do something, you have to get authorization from all the muckety-mucks in HR, legal, accounting and so on, which takes time.

Another major issue Salim has observed with matrix structures is that, over time, power accrues to the horizontals. Often, HR or legal have no incentive to say yes, so their default answer becomes no (which is why HR is often referred to as "inhuman resources"). It's not that HR people are bad people. But, over time, their incentives end up at cross-purposes with those of product managers.

Over the last few decades, the race to capture economies of scale has resulted in an explosion of large globalized corporations. At the same time, the pressure for higher and higher margins has led to offshoring, international expansion and mega-mergers in the name of cutting costs, increasing revenues and improving the bottom line.

But each of these changes comes at great cost, because the flip side of size is flexibility. However hard they try, large companies with extensive facilities filled with tens of thousands of employees scattered around the world are challenged to operate nimbly in a fast-moving world. In his analysis of exponential disruption, Hagel also notes: "One of the key issues in an exponential world…is that whatever understanding you have today is going to rapidly become obsolete, and so you have to continue to refresh your education about the technologies and about the organizational capabilities. That's going to be very challenging." Rapid or disruptive change is something that large, matrixed organizations find extremely difficult. Indeed, those who have attempted it have found that the organization's "immune system" is liable to respond to the perceived threat with an attack. Gabriel Baldinucci, Chief Strategy Officer at Singularity University and a former principal at Virgin Group's US venture arm, has observed that there are two levels of immune responses. The first is to defend the core business because it's the status quo; the second is to defend yourself as an individual because there's more ROI for you than for the organization.

What makes traditional companies highly efficient at expansion and growth as long as market conditions remain unchanged is also what makes them extremely vulnerable to disruption. As Peter Thiel said, "Globalization is moving from one to N copying existing products. That was the 20th century. Now in the 21st century we move into a world where zero to one and creating new products will increasingly be a priority for companies due to the rise of different exponential technologies."

Whatever else they may be, big companies aren't stupid. They know about this structural weakness and many are striving to fix it. For example, one of Larry Page's first steps upon

becoming CEO of Google in April 2011 was to strip management layers and flatten the organization. Similar programs have been implemented at Haier, in China, and other large organizations. While some of these fixes have proven successful, in the longer term, such flattening is merely a stopgap, because the total number of employees—the financial weight and resistance to change—rarely diminishes.

Of course, not all industries are "going lean." One industry headed in the opposite direction is pharmaceuticals—to what we believe will be the industry's regret. Once the low-hanging fruit of blockbuster drugs began winding down around 2012, instead of breaking into smaller, more flexible units, Big Pharma chose instead to pursue the consolidations and mergers that seemed to make Wall Street happy. We believe that increased size will reduce the flexibility of pharmaceutical companies even further, thus increasing their exposure to disruption.

One exemplar of that pending disruption is teenager Jack Andraka, who at the age of fourteen single-handedly developed an early-stage detection test for pancreatic cancer that costs just three cents. His approach is 26,000 times cheaper, 400 times more sensitive, and 126 times faster than today's diagnostics. Big Pharma has no idea how to deal with Jack, who is one of many wunderkinds emerging globally, all of them with the potential to disrupt great companies and long-established industries. The Jacks of the world bring exponential thinking to our linear world—and nothing is going to stop them.

Getting back to the Navteq versus Waze story, one thing we hope to make clear is that traditional linear thinking doesn't work in an exponential world. Simply put, it cannot compete. Salim saw this firsthand at Yahoo in 2007, which despite its web bona fides, operated within a classic linear matrix organizational structure. Every time a new product was launched or an old one modified, the team behind it had to jump through several clearance hoops—branding, legal, privacy and PR, etc.—each step taking days or weeks, which meant that by the time anything finally landed in the consumer Internet space, it was usually too late: some startup or another had already gotten traction. Salim's conclusion about one root cause of Yahoo's troubles is that its organizational structure is antithetical to the industry.

Yahoo is hardly alone. Even the mighty Google struggles with this. It took two years and enormous effort to get Google+ out the door. Even though the product is brilliantly crafted, by the time of its launch in the summer of 2011, Facebook had an almost insurmountable lead.

As we saw in Chapter One, this pace of change isn't going to slow down anytime soon. In fact, Moore's Law all but guarantees that it will continue to speed up—and speed up exponentially—for at least several decades. And given the cross impact into other technologies, if the last fifteen years has seen enormous disruption in the business world, the next fifteen will make that disruption seem tame by comparison.

Internet companies have changed the way we advertise and market. They have transformed the world of newspapers and publishing. And they have profoundly changed the way we communicate and interact with one another.

One reason for that change is that the cost of distributing a product or service, particularly if can be converted almost entirely to information, has dropped almost to zero. It used to require millions of dollars in servers and software to launch a software company. Thanks to Amazon Web Services (AWS), it now costs just a tiny fraction of that amount. Similar stories can be found in every department in every industry of the modern economy.

History and common sense make clear that you cannot radically transform every part of an organization—and accelerate the underlying clock of that enterprise to hyper-speed—without fundamentally changing the nature of that organization. Which is why, over the last few years, a new organizational scheme congruent with these changes has begun to emerge. We call it the Exponential Organization precisely because it represents the structure best suited to address the accelerated, non-linear, web-driven pace of modern life. And while even cutting-edge traditional companies can only achieve arithmetic outputs per input, an ExO achieves geometric outputs per input by riding the doubling-exponential pattern of information-based technologies.

To achieve this scalability, new ExO organizations such as Waze are turning the traditional organization inside out. Rather than owning assets or workforces and incrementally

seeing a return on those assets, ExOs leverage external resources to achieve their objectives. For example, they maintain a very small core of employees and facilities, allowing enormous flexibility as margins soar. They enlist their customers and leverage offline and online communities in everything from product design to application development. They float atop the existing and emerging infrastructure rather than trying to own it. And they grow at incredible rates precisely because they aren't dedicated to owning their market, but rather to *enlisting* it to their purposes. A great example is Medium, which is disrupting the magazine business by relying on its users to provide long-form articles.

It is our belief that ExOs will overwhelm traditional linear organizations in most industries because they take better advantage of the information-based externalities inaccessible to older structures, a feat that will empower them to grow faster—shockingly faster—than their linear counterparts, and then accelerate from there.

It's hard to pin down exactly when this new organizational form emerged. Various aspects of ExOs have been around for decades, but it is only over the last few years that they have really started to matter. If we had to pick an official ExO origin date, it would be March 2006, when Amazon launched Amazon Web Services and created the low-cost "Cloud" for medium and small businesses. From that date on, the cost of running a data center moved from a fixed CAPEX (Capital Expenditure) cost to a variable cost. Today, it is almost impossible to find a single startup that doesn't use AWS.

We have even found a simple metric that helps to identify and distinguish emerging Exponential Organizations: *a minimum 10x improvement in output over four to five years*.

The following table shows some ExOs and their minimum 10x benchmarks:

ExO	**Sector**	**Performance Improvement over Peers**
Tesla	Automotive	30x more market cap per employee
Airbnb	Hotels	90x more listings per employee
GitHub	Software	109x more repositories per employee
Local Motors	Automotive	1000x cheaper to produce new car model

		5-22x faster process for a car to produce (depending on vehicle)
Quirky	Consumer goods	10x faster product development (29 days vs 300 days)
Google Ventures	Investment	2.5x more investments in early stage startups 35x faster through design process
Valve	Gaming	30x more market cap per employee
ING Direct Canada	Banking	7x more customers per employee, 4x more deposits per customer

Look again at Waze. By harnessing information on its users' phones, Waze currently has one hundred times the traffic movement signals that Navteq/Nokia acquired by buying the physical sensors buried in roads. Even though Waze was just a tiny startup company with just a few dozen employees, it quickly ran down and overtook the linear Nokia, despite its thousands of employees. Nokia thought it dominated the mobile phone world—and while it once had, within the new paradigm it didn't stand a chance.

Two key factors enabled Waze to succeed, and those two factors hold true for all next-generation ExO companies:

- *Access resources you don't own*. In Waze's case, the company made use of the GPS readings already on its users' smartphones.
- *Information is your greatest asset.* More reliably than any other asset, information has the potential to double regularly. Rather than simply assembling assets, the key to success is accessing valuable caches of existing information. Andrew Rasiej, chairman of the New York Tech Meetup, said it best: "I think of Waze as a civics app. It's collecting information about the movement of cars and people in public places. What else could you do with that data?"

Taking Rasiej's observation a step further, the real, fundamental question of our exponential age is: *What else can be information-enabled?*

The key outcome when you access resources and information-enable them is that your marginal costs drop to zero. Quite possibly the granddaddy of information-based ExOs is Google, which doesn't own the web pages it scans. Its revenue model, the butt of many jokes ten years ago, has enabled Google to become a $400 billion company, a milestone it reached by essentially manipulating textual (and now video) information. LinkedIn and Facebook together are worth over $200 billion, and that's just as a result of digitizing our relationships—that is, turning them into information. It is our belief that most great new enterprises in the years to come will either build their businesses off new sources of information or by converting previously analog environments into information. And that environment increasingly includes hardware (sensors, 3D printers/scanners, biotech, etc.): As noted earlier, the Tesla S, which has just seventeen different moving parts in its drivetrain, can be thought of as computer masquerading as a supremely capable luxury car, one that it updates itself every week via a software download.

This search for new sources of information that can underpin new companies and businesses is at the heart of the revolution often labeled Big Data. By combining vast stores of data with powerful new analytical tools, there is an opportunity to see the world in a new way—and to turn the resulting information into new business opportunities.

Sources of this Big Data are emerging everywhere. For example, we mentioned the three separate initiatives for low Earth orbit (LEO) satellite systems that within a few years will deliver real-time video and images anywhere on the planet. Despite the inevitable privacy and security concerns bound to arise with the launch of LEO satellite systems, there is no doubt that scores, even hundreds, of new businesses will emerge from access to this massive new information source.

For instance, what if you could count the number of cars in any or all Sears or Walmart parking lots throughout the country? Or predict natural calamities like tsunamis and typhoons, as well as their impact? Or measure the increasing wattage along the Amazon River at night? Or track every container ship, in real time, around the world? Soon you can—either via nanosatellites or global Internet access initiatives such a Google's Project Loon and Facebook's drones strategies.

Even closer down this road is the Google autonomous automobile. The key navigational technology it uses is light radar, also known as *lidar*. Each car has a spinning lidar unit on its

roof that creates a live 3D map of its surroundings to a range of about one hundred meters. As it moves, a Google car collects almost a gigabyte of data per second and creates a 3D image of its surroundings to within a one-centimeter resolution. It can even compare two images to get a perfect before-and-after analysis. If you move a plant off your front porch, if you leave a window open or if your teenager sneaks out of his or her bedroom at night, Google will know.

This is not just static information. It is also *dynamic* information—data that registers the natural world not simply as it is, but as it changes. Mountains (petabytes) of data can be analytically sliced and diced to discover previously unknown truths about the world around us—truths that will result in opportunities currently unimaginable.

As outlined earlier, traditional organizational structures, designed over the last few hundred years to hierarchically manage physical assets or people, are rapidly becoming obsolete. To compete in our rapidly changing world, we need a new kind of organization, one that is not only able manage this change, but also thrives on it.

We opened Chapter One with a discussion of what we refer to as the Iridium Moment. By ironic coincidence, the extinction of the dinosaurs was revealed by an iridium layer in rock formations; this time around, the destructive agent is an Information Comet. What if we are having another, collective Iridium Moment? One that doesn't just involve a single giant corporation that has failed to recognize the revolutionary nature of the technological change taking place around it, but a whole *species*—indeed the dominant species—of large corporations in the modern economy. What if they are all facing the same fate as Iridium?

That question, and the quest for a strategy that both established and new companies can use to survive and thrive in this new world will be the subject of the rest of this book. Exponential Organizations have the capability to adapt to this new world of deep and ubiquitous information and convert it to competitive advantage. The ExO, in fact, is the appropriate commercial response to our new exponential world.

We'll next take a closer look at this remarkable new organizational form: how it works, how it is organized, how it scales its operations and why it will succeed in a transformed marketplace when other, established organizational schemes won't. Most of all, we will explore why, if we are to succeed in business, the Exponential Organization is our destiny.

Key Takeaways

- Our organizational structures have evolved to manage scarcity. The concept of ownership works well for scarcity, but accessing or sharing works better in an abundant, information-based world.
- While the information-based world is now moving exponentially, our organizational structures are still very linear (especially large ones).
- We've learned how to scale technology; now it's time to scale the organization.
- Matrix structures don't work in an exponential, information-based world.
- ExOs have learned how to organize around an information-based world.

David S. Rose, author of the best-selling book *Angel Investing: The Gust Guide to Making Money and Having Fun Investing in Startups*, sums it up more dramatically:

"Any company designed for success in the 20th century is doomed to failure in the 21st."