

“A crucial framework for the modern world of business.” –Eric Ries

SENSE & RESPOND

*How Successful
Organizations
Listen to Customers
and Create
New Products
Continuously*

JEFF GOTHELF & JOSH SEIDEN

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Introduction

A Two-Way Conversation with the Market

In 1975, a researcher named Steven Sasson, working in a lab at Eastman Kodak, built the first digital camera. It was a clunky machine, but Sasson's vision was clear. He saw the potential: in fifteen to twenty years, he told executives, the technology would be ready to compete against film. You could hardly blame executives for their skepticism, though: the contraption needed a tape drive to operate and took nearly thirty seconds to produce a tiny, low-resolution, black-and-white image. Still, Sasson and Kodak kept at it. Indeed, by 1989, they had created a commercially viable digital camera. But Kodak executives never got behind it. In the years that followed, digital photography blossomed, but Kodak did not—or could not—respond. Digital camera sales overtook film cameras by 2004. Kodak declared bankruptcy in 2012.¹

It's easy to see this story as a failure to innovate, and, of course, that's true in part. The lessons of *The Innovator's Dilemma* are obvious

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in this story: business leaders often miss the threat posed by disruptive technology until it's too late.

It would be a mistake, though, to think this story is only about innovation. It's about much more than that. We all now recognize that digital technology in its many forms is disrupting traditional businesses. Now we have to ask, What are we, as leaders, going to do about that problem? In other words, we sense the threat. Now we face a new question: How should we respond?

Borders, the bookstore chain, certainly sensed the threat. By 2006, Amazon.com had overtaken Borders in sales.² The large bricks-and-mortar retailer was struggling to respond. Borders was facing a handful of problems. Its superstore strategy, which offered an unrivaled selection of books and music to customers in the 1990s, was no longer enough to keep it ahead of its competitors: internet-based retailers could offer literally every book in print in the world, without having to support giant stores. If in-store selection was formerly its competitive advantage, that was no longer working. Borders would have to find something else. Perhaps it could compensate by building a robust online business? Yet its response to the threat of internet retailing seems, in retrospect, an obviously doomed strategy. From 2001 to 2008, Borders outsourced its internet business to Amazon.

Increasing the pressure, Amazon released its first Kindle e-reader in November 2007. The device, which was a hit from the day it was launched, opened a new front in the war on physical bookstores. Now it wasn't simply a battle between physical retail and e-commerce. Now consumers could download ebooks directly to their handheld devices. Two years later, Apple launched the iPad along with its own digital bookstore. In 2010, Barnes & Noble

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followed with NOOK, a product it had developed. Later that year, Borders announced a partnership with Kobo, a Canadian startup that had recently entered the e-reader space. But it was too little, too late. In 2011, Borders announced it was closing up shop for good.

Borders, it seems, didn't deny it had to respond to the digital threat. Unlike Kodak, it did respond. But Borders was never able to embrace and integrate digital capabilities and the operating methods that go with them. In other words, it just picked the wrong response.

Only the most stubborn leader would dismiss the threat posed by digital technology. Indeed, we take it as a truism that digital technology is here to stay. It has (for better and for worse) reshaped our world, and the world in which we do business. It has put mighty incumbents out of business and has created a generation of newly mighty companies.

But the economy has changed, too. It's not just the presence of technology. Instead, what has changed is the new things that people are doing as a result of technology. People now have remarkable new capabilities to communicate with one another—both directly and indirectly—and with the organizations that serve their interests. People can share personal messages with friends, groups, and strangers around the world. People can share their opinions of a merchant's products by posting online reviews. And the organizations serving these people's needs also can take advantage of these rich communication channels. They can see almost immediately how their products are performing online. What's selling? What are people saying about them? What features are working? What's not working?

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Savvy companies are taking advantage of this new communication capability. They continuously try new things in the market, testing and rapidly adjusting based on what they learn. In the mid-2000s, Spanish retailer Zara became well known for its so-called fast fashion approach, an approach made possible by digital technology. Zara produces as many as ten thousand designs annually, many of which live for a very short time. It produces the designs in small numbers, observes what works, rapidly communicates back to design centers, and adjusts based on what it has learned. Customers may not know that they're providing feedback, but they're voting with their wallets, and the company treats that information as its lifeblood.³

In a more purely digital realm, Google has become the dominant search engine in part because it has leveraged the power of running continuous small experiments to optimize its service. Some experts estimate that Google may run more than thirty thousand experiments a year to improve its search product. If you've used Google (and who hasn't?), then, in all likelihood, you've participated in many of these experiments.⁴

You can think of both the Zara story and the Google story as being about the same thing: companies engaging in what we call a *two-way conversation with the market*. Companies that formerly moved at an annual pace can try new things, learn from their customer interactions, and adjust their plans quickly. In response, customers see new offerings from companies, vote with their wallets, and express their feelings with their reviews, their tweets, their Facebook posts, and their YouTube videos. All this happens incredibly quickly. And the speed and richness of this conversation are putting fundamental pressure on businesses, governments, and other institutions: they must change the way they respond to the market, or go the way of Kodak, Borders, and a long list of others.

In this book, we talk about digital technology, but digital technology—software—is simply the enabler for this two-way conversation with the market, this new way of operating in the world. The real subject of this book is the way management must change to deal with this conversation.

The problem that many of us face is that most of our management techniques were created at a time when this two-way conversation didn't exist. Instead, our management tools were built for a completely different pace of operations—the pace of the past century's manufacturing economy. Operations in the manufacturing age were slower and more predictable. They rewarded a management approach based on planning, deliberation, and secrecy. The economies of scale in a manufacturing economy made it difficult to change plans in midstream, but there was less need to change plans in that era. Adjustments made on an annual basis were sufficient.

That is no longer true. Imagine a website that is updated only once a year: it's an absurd scenario. When your customers can have a new version of your product in their hands every day, why would you wait a year to respond to feedback? Why would they tolerate that? Now imagine this scenario multiplied across all of your customers, partners, and workers—indeed all the players in our economy. Imagine this scenario applied to the software and policies that are used to operate your business, your supply chain, your distribution. This is the situation we face. Increasingly, the relationship with our partners is dominated by the two-way conversation that digital technology allows. In the face of this new pace and these new expectations, our management systems—built for the manufacturing economy that dominated in the past century—are worse than insufficient. They are failing badly. They are in need of an update.

The Two-Way Conversation Requires a Management Shift

Often, we fail to make a fundamental reassessment of the way we manage our business as a whole in the era of digital technology. Instead, the standard response within existing organizations has been to create a stand-alone or outsourced information technology (IT) capability.

This is a legacy not only of how we think about technology but also of how we think about and structure our organizations, a legacy we inherited from the very successful innovations of the past century: Henry Ford's assembly line, Taylor's scientific management principles, and the engineering model of organizations. This legacy of functional segregation in the name of efficiency makes sense in certain contexts, but unfortunately it doesn't work in the digital reality. The complexity of software systems, the challenge of predicting what the market wants, the pace of change within the market itself—all this stacks the odds against these stand-alone approaches.

When Borders outsourced its internet bookstore to Amazon, it did more than relinquish control of this channel to a competitor. It robbed itself of a crucial opportunity to have a two-way conversation with this emerging customer segment, to engage with this new type of customer behavior, to learn what the customer wanted, and to learn how to serve that customer online. Never mind that Borders didn't know how to run an e-commerce business in 2001; almost no one did back then. Indeed, you could argue that Amazon barely knew how to do it back then. Instead, from 2001 to 2008, Borders gave Amazon an opportunity to learn, on the Borders nickel, and with Borders customers, how to win—and all because it allowed

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Amazon to sit in the middle of a conversation Borders should have been having directly with its own customers.

The new playbook emerging from the technology industry gives us the ability to integrate this two-way conversation deep within the fabric of our organizations. Let's take a moment to look at this playbook and consider why it relevant to us.

Agile: A Playbook for the Information Age

The first people to seek out a new playbook were software engineers working in the 1980s and 1990s. A handful of frustrated and thoughtful practitioners looked at the software development process and asked why, at the time, it seemed difficult to create effective software systems. (Looking back on that moment, it's easy to see why there was so much frustration. A well-known study from that period—*The CHAOS Report (1994)*, by The Standish Group—found that 84 percent of IT projects either failed to deliver *any* results or were seriously impaired by cost and schedule overruns.) These practitioners concluded that the methods we had been using to make software until that point were based on the wrong model.

The software development models that were dominant at the time were based on the time-honored process models of the past century. But they were based on building things like cars and buildings. Things that had concrete and easily understood requirements. Things with stresses and loads and other properties that could be calculated with proven equations. Things that you could figure out in great detail prior to manufacturing, and then create plans that you could hand off to builders. Plans that didn't change after the assembly process started.

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Our group of frustrated practitioners realized the key difference in working with software: requirements always seemed to change after the project got started. For years, programmers fought this battle by fighting against requirements changes. But this group took a different approach. They asked, What if we embraced change? What if, for whatever reason, changing requirements are an inevitable part of the software development process, and what if we optimized our process for change?

If you've been close to the digital technology world, you'll recognize that question as the seed of what eventually grew into the *agile movement*. Once a kind of counterculture insurgency, agile is now mainstream and is on its way to becoming the dominant process model for software development.

Agile embraces change in a variety of ways, but at its core, it uses two techniques. First, it breaks the work into small batch sizes, and, second, it uses continuous market feedback to guide progress. So unlike an assembly line—where the customer doesn't see the car until the product is completely through the line—in an agile process, a small unit of software is made and presented to a user, feedback is collected, and, based on that feedback, the team decides what next steps to take. Perhaps the team continues as planned. Perhaps the team adjusts its priorities. Perhaps the team designs something new. The ability to create a continuous feedback cycle is the most important thing we gain as our economy moves from the manufacture of hard goods to the production of software and the delivery of services built on top of software. This feedback loop allows us to build learning into our daily operating rhythm.

The implications of this change in process are profound. Now teams are not working strictly to a preset plan. Instead, they use the feedback loop to learn their way forward. They can't promise that

they'll produce a Model T at a specific time. Instead, they decide what to build as they are in the process of building it.

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When you look at the methods that have been developed in the past twenty-five years in the software world, you'll see that many of the most influential ideas share the agile concept of a continuous feedback loop—this notion of a continuous conversation with the market—whether it's designers bringing the ideas of user-centered design, design thinking, and lean UX, entrepreneurs like Eric Ries and Steve Blank bringing lean startup and customer development, or technologists bringing lean and agile methods and DevOps practices.

More than that, though, we've seen the way these new methods for engaging the market have led to new leadership approaches. The authors of this book have worked in the technology industry for many years. We've watched and participated in the development of these methods, and we're excited to report on them to you. We've seen an entire industry form and a body of knowledge start to collect about working in ways that create a two-way conversation with the market, and we're excited to share what we've learned with you. As you'll see, we believe these methods apply far beyond technology's borders.

We've named this book *Sense and Respond* because we like the way this phrase describes the basic mechanism, the feedback loop, at the center of this approach. The most important themes that underpin the sense and respond approach can be found in these five key principles.

Create two-way conversations. Digital technology has given us the new ability to have two-way conversations with our

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markets and our customers. What does the market want? And by *market* here, we mean *people*. (When we talk about being user centered, customer centered, and human centered, we're referring to this idea.) Understanding the unexpressed and unmet needs of the people who are using our products, services, and technology is the key to unlocking value. In this ability is the key to success in the digital age: we don't have to predict what will work. Instead, we can listen, make a credible guess, get feedback in nearly real time, and adjust.

Focus on the outcomes. In the digital age, it's difficult, and sometimes impossible, to predict which product features are needed in the market. Yet often, we plan our features and manage our business cycles as if we know exactly what's going to work. We manage by specifying outputs—what we'll make. Instead, we need to focus on outcomes: management needs to declare the business outcomes they wish to achieve and then set up their teams to figure out how to get there. This means that we have to create the conditions in which teams can try different approaches, experiment, learn, and discover what works through trial and error.

Embrace continuous change and continuous processes. Modern digital development practices allow teams to make small changes in an ongoing way. This allows them to make the adjustments they need to make when they're using a sense and respond approach. But it also changes how we plan, because we're continuously learning and adjusting our plans as we go. And it changes how we budget, because we can no longer afford to make commitments a year in advance when we're learning every day. And it changes how we market,

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and sell, and . . . so much more. We have to move away from big-batch manufacturing processes and adopt small-batch, continuous processes.

Create collaboration. All great digital efforts are collaborations—between a creator and the audience. Between developers and operations people. Between designers and business stakeholders. You need to embrace collaboration deeply and break down walls where you find them. This means that we need to consider how we organize our teams, our departments, our programs, and our initiatives.

Create a learning culture. Sense and respond means embracing a way of working that is about continuous learning, which requires significant changes to process and organizational structures. This need to change, in turn, means we must build a learning culture, and that requires openness, humility, and permission to fail. It means supporting curiosity and collaboration. It means having a willingness to admit we don't really know the answer and an eagerness to go find it. Finally, it means embracing change and embracing the idea that software is a continuous, mutable medium.

Why This Book?

The management playbook that is emerging in the technology world has much to offer the larger business leadership community. This playbook enables organizations to engage in the two-way conversation with the market and to drive value from that conversation.

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The product teams in technology-centered companies tend to work in a continuous small-batch rhythm, creating small product updates, sensing the performance of the product, and responding continuously with adjustments. Some of these adjustments take the form of new software—but not always. Sometimes the adjustments are to business rules, or pricing, or marketing language, or support policies, or any of the many other variables that go into running a successful business. Regardless of the adjustment, though, the teams focus on creating outcomes, shun detailed feature road maps, and are guided by the continuous conversation with the market.

We wrote about these emerging principles in our first book, *Lean UX*, which describes a work system based on small, collaborative teams that deliver value rapidly and continuously. Though written for a technical audience, the book offers a state-of-the-art model for working with digital technology that applies to everyone. These new-model teams are the engine at the heart of business today.

As we traveled the world teaching these methods to practitioners, though, we kept hearing one constant theme. “We’d love to work this way,” they said, “but it’s so hard in this organization.” And as we dug deeper into their concerns, we saw a common pattern. The organizations in which they worked were not set up to support this new way of working.

Large organizations work in the opposite way: creating detailed plans and pushing them down to an execution factory—a staff of order takers. Large organizations tend to behave like a production line, outsourcing execution and isolating decision making within the higher levels. Instead of a conversation, these organizations are simply pushing “Play” on a prerecorded speech.

What You'll Find in This Book

Part I explains the sense and respond model: why it's so important, how it works, when to use it (and when not to), what obstacles you're likely to face, and how to overcome them.

Part II is our manager's guide to sense and respond. It explains how to adjust your teams and your planning processes to work in this way, how to experiment to unlock value, and how to structure your operations for continuous, predictable delivery. Our goal is not to teach every manager all the intricacies of each technique (there are lots of great books that focus on individual tactics) but instead to give managers an overview of the important techniques, explaining how they work together and why they are such important parts of the system.

The Power of Sense and Respond

As we've worked with organizations over the past few years to imagine, design, build, and launch new products and services that incorporate digital technology, we've seen the power of the sense and respond approach—and the necessity of building it in to your organization. We're seeing that leading organizations have started this evolution and are accelerating as a result. The small startup teams that have no legacy organizational baggage are adopting these techniques as the natural order of things, and they too are leaving their mark on the world. We think the ideas in this book—simple, practical ideas that don't require you to be a technologist—are critical for any manager, and that is why we're eager to share them with you.

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And, because we also use the sense and respond approach ourselves, we want to hear your feedback. So please, as you read, keep in mind that we too are open to a two-way conversation. So that you can continue your learning journey, we've created an online companion site to this book. You can find all the source material we reference in this book at <http://senseandrespond.co/links/>. If you want to get in touch with us directly, you can write to us at josh@joshuaseiden.com and jeff@jeffgothelf.com. Let us know what you think. Let us know how this approach works in your organization, for your team, and for your products and services. We'd love to hear from you.

1

Continuous Uncertainty

Everything's Changing, All the Time

It was Christmas 2012, and Facebook was more popular than ever before. What's more, smartphones and digital photography were more ubiquitous than ever before, and Facebook was far and away the most popular photo uploading destination. But with all these photo uploads came a new problem for the social networking site: people were reporting millions of photos as inappropriate. To review all these reported photos in a timely fashion would have taken thousands of people.

This story, first reported by NPR in 2015, caught the attention of mainstream readers.¹ But the tech world has heard stories like it before. Increasingly, it is the new normal for companies working in the digital space: companies launch software, the software has unpredictable effects, and companies struggle to respond. That's because the digital revolution has brought to the world of business two critical forces. The first is uncertainty: as our software systems get more complex, it becomes harder to predict what people will do with them. Savvy companies are adapting their processes to

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deal with this by harnessing the second force: continuous change. Unlike manufacturing products, digital products can be changed and updated rapidly. Organizations that apply the power of continuous change to products, services, and their businesses as a whole are able to adapt quickly in the face of uncertainty.

Older methods for dealing with uncertainty don't work in the digital age. Careful, detailed planning, for example, fails over and over. In 2013 the British Broadcasting Corporation shut down a decade-long attempt to build a new, organization-wide content management system. The project, called the Digital Media Initiative, was supposed to allow BBC staff to create, share, and manage digital content from their desktops. Despite the careful plans made by the project team and sponsors, after many years and close to £100 million, the project had delivered no value. Project managers complained that requirements kept changing, making it impossible for them to deliver. In other words, no matter how diligently they planned, the plans never worked. Conditions kept changing. The BBC project failed.

Every business leader you speak to can probably tell you similar stories of software-related projects and strategic initiatives that failed to deliver value, failed to deliver on budget, failed to deliver on time, or simply failed to deliver. Every year, our society wastes hundreds of billions of dollars on failed software efforts, mostly because we think we can use industrial-age management approaches on digital-age problems.

At the same time, software has become an ever more critical building block for every business of any significant size. At Goldman Sachs, for example, the largest single division in the firm is now technology, employing eight thousand—a full 25 percent—of the firm's thirty-two thousand employees.

Slowly but surely, we watch as the products and services around us are transformed by software. Apple's iPhone spelled doom for

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Nokia and RIM, two companies that were built on technological excellence but couldn't cope with the unpredictable change wrought by the software revolution. Amazon did the same to Borders and Barnes & Noble. Netflix did it to Blockbuster.

The software revolution is here, and we can't predict the ways it will play out. Customers use products in unpredictable ways. Competitors emerge where we least expect them. This new level of volatility and uncertainty is one of the side effects of the digital revolution. We need new ways to respond.

The team at Facebook could have simply hired more reviewers to deal with the deluge of “inappropriate” photos, but before it did, it started to look into the reported photos. That's when the Facebook team discovered something strange: most of the photos were not actually inappropriate. There were photos of people in ugly sweaters, people hanging out with their ex-boyfriends and ex-girlfriends, people in unflattering poses. The photos weren't inappropriate—no nudity, no harassment, no drug use, no hate speech. But Facebook's photo reporting tool didn't have an “ugly sweater” category, so if you didn't like a photo of yourself, you had little choice: you had to report it as something, and “inappropriate” seemed to be the best option.

This is uncertainty at work. Users come to a system with an idea of what they're trying to do. If they don't see an easy way to do it, they'll try to find a way. Just as a stream flows around obstacles, cutting unpredictable paths along the way, so will a group of users find the easiest, fastest ways to achieve their goal. If they can find a way to do it on your system, they will, even if it means doing something you hadn't predicted, like reporting an unflattering photo as inappropriate. And if they can't find a way to do what they want to do, they're likely to abandon your service in favor of something better.

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Facebook’s product team responded by trying to fix the reporting feature—and it used what we call a *sense and respond* approach to dealing with uncertainty. Because team members weren’t sure what was going on, they started to update the product in a way that would help them figure it out. First, they added a new step to the reporting process—a question that asked, “Why are you reporting this photo?” This open-ended question helped them learn that, in most cases, people were embarrassed by the photos they were reporting. Armed with this knowledge, the team updated the product again, this time asking people to contact the poster in these cases of embarrassing photos. This helped but didn’t solve the problem.

Then the Facebook team added a blank message box so that people could use the reporting feature to contact the poster directly. The team tested that. It was a little better. Then it added a default message in the message box. That was better still. The team members tried lots of different small changes, pushing these changes out to small segments of the user population. Each time, the changes attempted both to fix the problem and to get more information about the problem.

Eventually, by tweaking and trying and asking and measuring, the team was able to solve the problem. The reporting feature now has a category for embarrassing photos, directs users to contact the person who posted the photo, and prompts the poster with a carefully tested written message (which users can edit but rarely do).

Still, if you now go to Facebook and report a photo, there’s a good chance you’ll see something different from what we’ve described here. That’s because somewhere at Facebook, someone is probably looking at the numbers on this feature, spotting a problem, and running tests to improve the situation. This is sense and respond, and it’s a continuous process.

Facing Uncertainty

The uncertainties faced by the team at Facebook are the new normal. The tactics the team deployed are the emerging standard for how to respond. And even though the tactics can be thought of as simply a management approach (measure customer behavior, test solutions, scale what works), they rely on the ability to act, and act quickly. Until now, the common response in business and government has been to consider technology the domain of specialists and segregate it from core business operations. We know now that this approach doesn't work. The reason it doesn't work is that it reduces the business's capability to act.

In other words, we no longer have the luxury of ignoring technology—or leaving it to the technologists. Instead, we must all become adept at managing in the face of it—both the uncertainty it creates and opportunities it offers. The reality is this: assigning responsibility for software to your IT department is like assigning responsibility for breathing to an oxygen department.

Seeing the End of Assembly Line Management

To understand why we advocate changing the way we run our organizations, we need to take a step back and consider what's changed. Much of the management science that we take for granted was developed for the production of a certain kind of product. As production has changed—we're making different things in new ways from new materials—so too does our management approach need to change.

We all know the story of Henry Ford and the assembly line: by breaking down predictable, repetitive work into small, repeatable pieces, Ford was able to revolutionize manufacturing, establish the

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dominant position in the auto industry, and change the way businesses around the world thought about the production of material goods. This model created tremendous value and wealth and stands as the dominant model for the way we think about business.

Our early introduction to personal computer technology and software offered little evidence that computers and software were different from cars—or from any of the other modern engineered products we create with an assembly line approach. Certainly the laptops and phones and other high-tech devices we buy are made on assembly lines—very advanced assembly lines to be sure, but assembly lines nevertheless. And the first software programs consumers purchased seemed to be like any other product. We walked into the computer store, picked up a big shrink-wrapped box of Microsoft Office or Lotus 1-2-3, and took it home to install it. These products certainly appeared to be “manufactured” products, even if the software developers of the time suspected that something was different.

But with the first wave of internet companies in the late 1990s, we began to see a new kind of software distribution model emerge: software as a service (SaaS). In this model, we didn’t install software on our local computers. Instead, the software ran on a company’s server, and we consumed it over the web, in our browsers. One of the values that SaaS companies promised was that you’d never need to go to the store or install a software update again; the latest version of the software would always be available to you, because it would always be running on the company’s servers.

Escaping the Manufacturing Mindset

This shift may seem like a small process change, but it’s hard to overstate how significant a paradigm shift it represents. Why? It’s because the manufacturing process—the process of copying soft-

ware onto floppy disks or CDs or DVDs—is no longer part of the software distribution process. And by removing this one step, we’ve enabled a fundamentally new model.

In this new model, the conversation with customers changes: you no longer have to convince them to buy a new version. You just push it to your server. You no longer have to convince them to install an upgrade; they see it when they log on.

The new model changes the economic incentives, too. In industries that are built around mass manufacturing, the high cost of launching new products is defrayed by the efficiency of the assembly line, so the natural incentive is to set up your production lines once and then crank out as many units as possible. Automakers created a well-known annual “model year” product cycle to take advantage of this while still meeting the market’s need for new products. This annual rhythm is so ingrained in us it almost appears to be a natural phenomenon, but it’s not: it’s a strategy based on the way products are produced.

Consider this stunning fact: Amazon releases new software to the world every 11.6 seconds.² This is possible because of a set of techniques called *continuous deployment*. Basically, continuous deployment allows software developers to keep systems in a constant state of readiness and to make incremental changes to those systems in an ongoing way. Amazon is one of the leaders here, but it’s becoming routine for large companies to release software daily, and, for many companies, we see releases multiple times a day.

What does this mean for managers? We think it’s not an exaggeration to say that it changes everything. In the digital world, there is no longer any “manufacturing.” In a world with a manufacturing step, the cost of change is high; every time you make a change to the product, you need to go through manufacturing again, and that incurs costs. So there’s an incentive to limit how often we change our

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manufactured goods. Without that process step, though, we remove that constraint. Instead, the constraints on change exist elsewhere in the system—how much change a customer can tolerate, for instance, or how much change we can make without reducing quality or increasing other costs. But as industry leaders like Amazon are demonstrating, these constraints are much less restrictive than we might imagine. In practice, it is now possible to present new features, capabilities, and services to our customers and our internal staff on a continuous basis and at a remarkably rapid pace.

Finding Value in Uncertainty

Why does Amazon release software so often? It's not only because it can do it. No, instead, releasing software frequently is only one element in the sense and respond approach. This approach to work involves rapid cycles of *sensing* what the market needs and *responding* rapidly. As you saw in the Facebook story, this approach allows teams to make sense of complexity, reduce uncertainty, and find solutions that work.

Let's look at some of the benefits of working this way.

Delivering Services

The first generation of consumer software changed how we work. Spreadsheets and word processors created a boom in personal productivity. But first-generation software was also inflexible. This meant that when organizations tried to deliver services through software, the result was often terrible. Inefficient. Confusing. Hard to use.

Picture yourself calling a call center, perhaps to talk about your phone bill. How many times have you heard the call-center operator

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struggling with her computer system? In the past, business processes and customer behavior often had to adapt to the way the software worked, because the rate at which we could change software was slow. We once overheard a group of industrial plastics executives comparing benchmarks on their customer-service process. They were talking about how many orders each business processed each day. The average seemed to be about thirty orders a day. Then one executive spoke up: “We used to process about thirty a day. Then we installed a new order-taking system. We’re doing about two a day now.”

With our new ability to change software on a continuous basis, businesses have a new ability to deliver customer services that are based on, mediated by, or simply supported with software. Software, which can be inflexible, is only now living up to its potential to be “soft,” and this process flexibility gives us new overall flexibility when it comes to delivering services to the market. Whereas formerly we’d roll out a service and be stuck with it, now we can roll it out and adjust it until it works properly. And if we need to change a policy or process, we can adjust the software that supports it nearly as easily.

Reducing Risk

If you’ve followed the news, you’ve heard about massive technology projects that fail. A recent headline on CIO.com was blunt: “Enterprise software project success remains elusive.”³ Industry analysts at The Standish Group, who study technology project outcomes, have been benchmarking the industry for years. Their most recent study puts IT failure rates at around 70 percent, a number that is better than the more than 80 percent failure rates of the 1990s, but still.

In Massachusetts, for example, the state government spent more than nineteen years and more than \$75 million on a system

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to connect the state's courthouses to one another. It was supposed to take five years. After nineteen years, though, most observers consider the project unfinished and useless: a very expensive failure.

Sense and respond methods can help this. Traditional IT projects tend to take a “big bang” approach, in which the software is not released to users until it is finished. This means that it's hard to tell whether the team building the system is on the right track until the end of the project. In contrast, an agile approach, which is at the heart of sense and respond, would address this problem by releasing small pieces of the system frequently and would do so from the earliest days of the project. This reduces the risk that the software team is off course, because it creates transparency. It becomes easy to see what the team is doing, because it's sharing its work continuously.

This transparency is key because it enables a feedback loop. Is the software working? Is it meeting user needs? Is it creating the outcomes the business seeks? Why wait until the end of the project to find out?

Optimizing for Value

Imagine for a moment that you're an executive at Amazon. You run a huge e-commerce business, and you make money when people buy things from you. To buy things from you, people must complete the checkout process on your website. Thus, it is in your interest to optimize the checkout flow so that people can navigate through it with great success. You don't want to confuse people. You don't want to distract people. You want them to move through the flow until they complete the transaction.

One technique that Amazon and similar companies use to optimize the process very quickly is to release different versions of

a portion of their website—for example, the checkout flow—and route incoming traffic to the variant versions, comparing the performance of the versions. This is the scientific method in action. It's called *A/B testing*, and it's become a standard technique in the online world. For example, this technique was what the team at Facebook used to test its solutions to the photo-reporting problem. Companies like Amazon perform many tests every day in an ongoing effort to optimize their flows. And even though it may not seem that these optimizations could be very valuable, in fact the opposite is true. In one well-known case, a large online retailer unlocked \$300 million in annual sales by changing the wording on *one button* in the checkout flow.⁴

In 2012, the Obama campaign used this technique on nearly everything it launched on its campaign website. In one case, the team was trying to optimize the donation page. Team members tried many variations before they decided to try adding a simple quote from the president to the page. Compared with the page without the quote, this page generated an 11.6 percent increase in donations. That may not seem like much, but given its volume, that simple change increased donations by millions of dollars over the life of the campaign.⁵

This approach to optimization is enabled by two important factors. First, you need the technical infrastructure in place to run these tests, gather the results, and route the results quickly to the right people. More important is the second factor: management attitude. Managers need to be able to admit that they don't have all the answers, and they must be willing, in the right circumstances, to submit their ideas to testing in the marketplace. This new management mindset is only the first of the important management innovations we need to adopt if businesses are going to succeed in the digital age.

Recognizing Emergent Value

To understand what we call “emergent value,” we need to step back and consider the nature of the products and services that technology is now making possible.

In the early days of the computer revolution, when the first personal computers were coming onto the market, people talked about the “killer app”—an application that would be so useful and so compelling that it would drive large-scale purchase of these machines. It is common wisdom to claim that the spreadsheet—VisiCalc first, and then Lotus 1-2-3—was the driving force behind most early purchases of PCs. For others, the killer app was the word processor. But in either case, the uses that these programs enabled were similar: one person, sitting at one computer, interacting with the software and unlocking more productivity by means of a more efficient tool.

Think now about the killer app of our contemporary age. Imagine for a moment a computer without internet connectivity. Or even worse, imagine your smartphone in airplane mode. Without connectivity, our devices are nearly useless—they lose most of their value. This is because increasingly, our technology systems are connecting us to services and, more important, to *other people* on the internet. We use Twitter and Facebook to share news and information. We use Amazon to shop. We use Uber to summon service providers. We use Google Maps and Waze to navigate, with real-time traffic information collected by other users of the system. Our “apps” are no longer stand-alone programs running on our personal computers.

And it’s not just that our users are doing new things with this connected technology. Businesses are increasingly delivering their core services through connected technology. Simple Bank, for example, is a bank that is available only through software, even though there are real humans operating the business behind the scenes. Weight

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Watchers now supplements its traditional channels by allowing clients to connect to a weight-loss coach through a smartphone app.

Designing and building these new kinds of systems require a different management approach. When you start to connect apps into larger communication systems, you start to see an explosion in the level of complexity and therefore the level of uncertainty. It is difficult to predict how groups of people will use systems and, as a result, what parts of the system they will find valuable.

Consider the hashtag. This ubiquitous means of tagging content and conversations on the internet emerged from Twitter users in 2007 as a way to track their conversations with one another. This feature wasn't planned or introduced by Twitter. Rather, users of the system started to tag their conversations with keywords, which they set off by means of a leading “#” (hash) symbol. This method proved popular with users, because they could agree on a tag and then use the regular Twitter search feature to find all the tweets with that tag. In other words, it added value, and its use spread. It wasn't until two years later, in 2009, that Twitter responded by building features into the system that specifically supported the hashtag. Twitter automatically hyperlinked all tags, and clicking on that link returned a search result for that tag.⁶ Now Twitter has turned the hashtag into a revenue-generating product: you can buy ads that use specific hashtags to target audiences.

The hashtag story is an example of a company responding (albeit slowly) to unpredicted user behavior in a way that captures and creates value. In this story you see the connection between user value and business value. When we can understand the things that users want to do, we have the basis for serving customer needs, thus creating business value.

But companies that are not prepared to take advantage of unpredicted user behavior run into big problems. In the BBC Digital Media Initiative example we mentioned earlier, technology managers

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complained that one reason for the project's failure was that internal users continually changed the system requirements. You hear this frequently in the technology world—and people make this claim as a way of pointing fingers, either at users for being fickle or at technologists for not being responsive to change. The reality is more subtle. Although careful study and analysis of user needs is important and valuable, it's not always enough. Often, requirements *cannot* be known in advance, and once a system is in use, new needs are discovered, creating new requirements.

Again, this is uncertainty at work. As the hashtag story illustrates, if businesses are open to uncertainty, they can find new ideas in the unpredicted user behaviors that emerge from uncertain situations. If they can respond appropriately, this phenomenon—emergent behavior—becomes emergent value. On the other hand, when businesses try to predict the future and reject the emergent reality, the gap between plans and reality is likely to lead to disappointment, finger-pointing, delay, and project failure.

Responding appropriately is not easy, though. It requires managers to adopt a new mindset and to be willing to adjust plans in response to new information. This new mindset embraces continuous change and uncertainty, seeks market feedback, and is willing to look within that feedback for opportunities to create new value. In short, it requires leaders to say, “I don't know the answer. Let's go find out together.”

Adapting to a Complex Context

For the typical twentieth-century leader, “I don't know” was a taboo. To admit uncertainty—to oneself or others—was seen as a sign of weakness. This mindset remains common in many organizations,

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and it is especially a problem when it comes to seeking emergent value in *complex adaptive systems*: systems with lots of components that behave and interact in such a way as to make prediction impossible. In our context, they are systems in which it's impossible to predict accurately how people will interact with them and what features users will embrace.

Writing in *Harvard Business Review*, David Snowden and Mary E. Boone describe how these systems are different from the mechanical systems of the industrial age.

It's like the difference between, say, a Ferrari and the Brazilian rainforest. Ferraris are complicated machines, but an expert mechanic can take one apart and reassemble it without changing a thing. The car is static, and the whole is the sum of its parts. The rainforest, on the other hand, is in constant flux—a species becomes extinct, weather patterns change, an agricultural project reroutes a water source—and the whole is far more than the sum of its parts. This is the realm of “unknown unknowns,” and it is the domain to which much of contemporary business has shifted.⁷

Without embracing uncertainty, you can't capitalize on the value that emerges from these systems. This is why many organizations are moving toward the continuous, small, rapid, experiment-and-adjust cycle that is at the heart of the sense and respond approach. By making small, continuous changes and measuring the results, teams have discovered in practice exactly the method that complexity theorists recommend for dealing with these complex contexts.

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Comparing the Old Model Versus Sense and Respond

When the digital revolution began, bringing with it new levels of complexity and uncertainty, most businesses tried to manage it using the industrial-age techniques that had worked well until then. We thought of software as just a type of Ferrari, to use Snowden and Boone's analogy. We didn't change the methods we used to make it, and we certainly didn't consider changing the way we ran our businesses to accommodate its impact.

As we've grown more sophisticated about software, though, we've learned better how to manage it. Our approaches—the agile methods that have become ubiquitous—have allowed us to treat software more like a rainforest. Our software management process is more like forestry than engineering.

Now we're ready to take the next step. As we realize the increasing reliance we place on software systems and the deep ways that the digital revolution has connected our businesses to the rest of the world through those systems, we must now begin to manage our businesses with the techniques we apply to software. In other words, where we once managed software in the same way we ran our businesses, now we need to manage our businesses in the same way we manage our software.

Understanding the Continuous Rhythm of Self-Directed Teams

In order to operate in this new, continuous rhythm, teams must be free to act. They must be free to experiment and learn. This means that teams need to be given greater decision-making authority. The assembly line approach of the industrial era sought to separate thinking (the realm of management) from doing (the realm of the worker). It tried to turn workers into assembly line machines. But

people are not machines—and the process of sensing market need and responding quickly is not as conducive to similar thought- and decision-minimizing approaches. Decisions that can be made in a top-down, hierarchical manner and with predictable, measured work flow are fewer in this new world. Instead, many more decisions need to be made from the bottom up, by the people with the expertise to work with the material and with access to the most recent information. These people are the ones closest to the market, and not closest to the top of the organization.

For example, let's consider Etsy, a ten-year-old e-commerce startup based in New York. Etsy is a marketplace where buyers can purchase handcrafted goods from more than a million independent sellers; think of it as the world's largest online crafts fair. Etsy is famous for its culture of continuous experimentation. Etsy continuously tests and optimizes the design of its website and mobile apps through the A/B testing process we described earlier. It develops multiple versions of a feature, releases the various versions of that feature for a short period to a small (but carefully selected) number of users, and then monitors the results. Its sophisticated systems allow Etsy to roll back designs that are not successful, and roll out successful changes beyond the original test group. And all this happens very quickly. Using continuous deployment techniques—many of which it invented—Etsy is able to make many small changes to its website in an ongoing way, typically at a rate of forty to fifty times each day. Etsy is also famous for its decentralized culture. Each team, acting within strategic guidelines, is free to experiment, learn, and adjust.

Etsy is a software-only startup of about eight hundred people, with revenues of about \$275 million per year on total merchandise sales of about \$2 billion.⁸ So even though its use of these techniques is impressive, it's a digital-native company. What about a more traditional industry?

Running an Auto Company Like a Software Company

Since we've been talking about Henry Ford's assembly lines, let's look at the auto industry, which is steadily being revolutionized by digital technology.

In March 2015, Tesla Motors, upstart producer of electric cars, announced that it would be solving one of its biggest obstacles to success, a problem it calls "range-anxiety": the fear that an electric car will run out of power somewhere, with no charging station within range. Elon Musk, founder of the company, promised to announce a new feature that would solve this significant need.

For about a week, the press and curious observers buzzed: How would Tesla solve the problem? Then, at a press conference, Musk revealed the solution, a new feature called "range assurance." The feature would monitor energy use and driving conditions in real time (how fast were you going? what was the weather like? was the road flat or hilly?) to continuously predict remaining range. At the same time, the feature would monitor the location of the nearest charging station. With this capability, when you reached the point of needing a charge, the car would alert you and guide you to the most appropriate charging station. You'd never run out of power, Musk said, unless you did it on purpose.

Perhaps feeling that this seemed like a small win for future models, reporters asked when this capability would be available. Musk's reply? Every current owner would receive the update shortly after the press conference—an update to their current cars—via software that would be distributed via the internet and installed in Teslas over Wi-Fi.

Moments after the press conference was over, *Consumer Reports* responded over Twitter:

Biggest takeaway from @TeslaMotors announcement is the reminder that cars can be made to improve over time, like other electronic devices.⁹

In other words, in the same way that we now update our smartphones and our computers, we are starting to see self-updating cars. And other traditional manufactured good are likely to be next.

Changing More Than Products

We take for granted that products are becoming more sophisticated every day, so perhaps it's not surprising that Tesla cars are becoming more sophisticated. But this example is not simply about a smarter product; other dimensions of the auto industry are changing as well. These cars don't need to go to a dealership or a mechanic for an upgrade—Tesla can send out the upgrade over the wireless internet—so the process of maintenance is changed. Tesla also monitors a car's use over time, so it knows when the car needs service.

So software is changing our products—in this case the car—and it's changing the maintenance process. Anything else? Yes—it's also changing the basic release cycle of the auto industry. No longer do you need to buy next year's model to take advantage of the latest features. Instead, manufacturers can release new features whenever they are ready.

Building Hardware Products as If They're Software Products

One extreme example of this new ability to release products quickly comes to us from Chinese phone maker Xiaomi. Founded in 2010, Xiaomi releases phones in small batches—100,000 every Tuesday—and each batch sells out quickly. More impressive is this: Xiaomi continuously updates its products in response to user feedback collected on online forums. So an idea that a customer suggests can go from forum to product manager to engineer to release in a matter of days. Once again, this is a company engaging in a two-way conversation with customers.

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This ability to release small batches of product with the most recent, most desirable features gives Xiaomi a huge competitive advantage. It gets immediate feedback on what the market wants, instead of having to guess. In the manufacturing world, guessing wrong can be very expensive if it results in filling a warehouse with inventory that no one wants to buy. Because digital technology allows the company to both collect feedback and produce phones in small batches, it limits the risk of producing unneeded inventory. If you've been involved in retail, you know the challenges involved in forecasting production, and the cost of guessing wrong. By using tactics taken from the digital world, Xiaomi is able to limit the uncertainty of long-term forecasts, produce small batches of products, and create a high degree of certainty that it's making exactly the product the customer wants—in other words, that the product will sell.

Learning New Roles, New Methods, New Activities

In each of these cases, from Etsy to Tesla to Xiaomi, we see teams that are using the real-time capability that digital technology provides to have a two-way conversation with the market—to sense and respond. They sense which customers need attention and service. Based on what they sense, they decide which features to release or what business processes to adjust. The data they collect is powerful, but it's also disruptive: it has the effect of trumping plans, road maps, and schedules. When you have real-time information about an engine that requires service, aren't you going to prioritize that data over a planned service schedule? When you discover a market need, such as range anxiety, that is a serious problem for your customers, why would you wait until next year to solve the problem when you can fix it tomorrow?

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On the other hand, you also have new problems now. How can you build a marketing campaign around exciting new features if you don't know when those features are coming—or even what features are coming in the first place? How can you write contracts for your customers if you're not sure what you will deliver to them? How can you coordinate the activity of multiple teams if you don't have a plan?

The answer is that you need to change the way all of the parts of the business operate, and what you think of as a “plan.” It's not enough to change the way you make your products and then leave the rest of the business to operate as if those changes weren't happening. The BBC tried to do this on its Digital Media Initiative project. That project needed to get non-software managers involved in the project as active participants rather than simply treat them as passive consumers. It needed the insight from those managers and other users in order to understand what users needed from the system. But, for whatever reason, managers declined to get involved in a meaningful way. In doing so, they starved the project of the oxygen it needed to survive—the feedback from the internal users—and contributed to the failure of the initiative. In order to create the kind of continuous conversation required to be successful in the digital world, we must understand that it will change the way people interact across the organization.

This means that we need to consider and change how our teams operate. We need to change how we conceive of, create, and market our products and services. We need to change the way we engage with our customers, stakeholders, and users during these processes.

These changes extend far beyond the work of software engineers and designers. The product managers have had to completely rethink the way they plan out their road maps and budgets. They have had to adjust their approach to coordination and planning.

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Marketers and salespeople have had to adapt their approaches. They have had to change their sales models and their contracts with vendors. And of course, senior managers and executive leaders are faced with a tidal wave of bottom-up planning that challenges their expectations, their mandate, and their authority. In organizations that have been able to adjust their approaches to take advantage of this energy, we're seeing a smooth transition to the postindustrial age. But for organizations that continue to impose industrial-age centralized, top-down planning, we see a great deal of struggle. The gears, if you will, are grinding.

Adopting the Continuous Mindset: More Than Just Listening to the Customer

We're seeing many organizations that are in this gear-grinding state. Their technology teams are moving (perhaps tentatively) into the continuous rhythm and adopting the continuous mindset that makes it possible—but organizations are having trouble integrating these teams into the rest of the business. This is because the rest of the business doesn't yet have a model for moving to this new rhythm.

For years, companies have talked about the need to “listen to the customer.” But listening alone is not enough. With digital technology beginning to power every element of business, we are going to see organizations facing the problem of managing uncertainty across many frontiers. Technology teams and theorists have converged on a way to handle this problem: use agile methods, frequent small experiments, deep collaboration between roles inside and outside businesses, and a continuous mindset. Sense and respond integrates these ideas and helps organizations listen and respond with great speed and flexibility. This goes beyond listening to customers. This is a continuous two-way conversation.

Sense and Respond Takeaways for Managers

- ✓ Because of the digital revolution, businesses face new levels of complexity and uncertainty.
- ✓ The industrial-age approach to managing uncertainty was to make detailed plans. Because software systems are complex, that approach does not work. Detailed plans break down in the face of reality.
- ✓ The best way to deal with uncertainty is to adopt a continuous, small-batch approach that is oriented toward learning your way forward.
- ✓ This approach, pioneered in the software world, is increasingly relevant across the business because many operations are tied in some way to software.