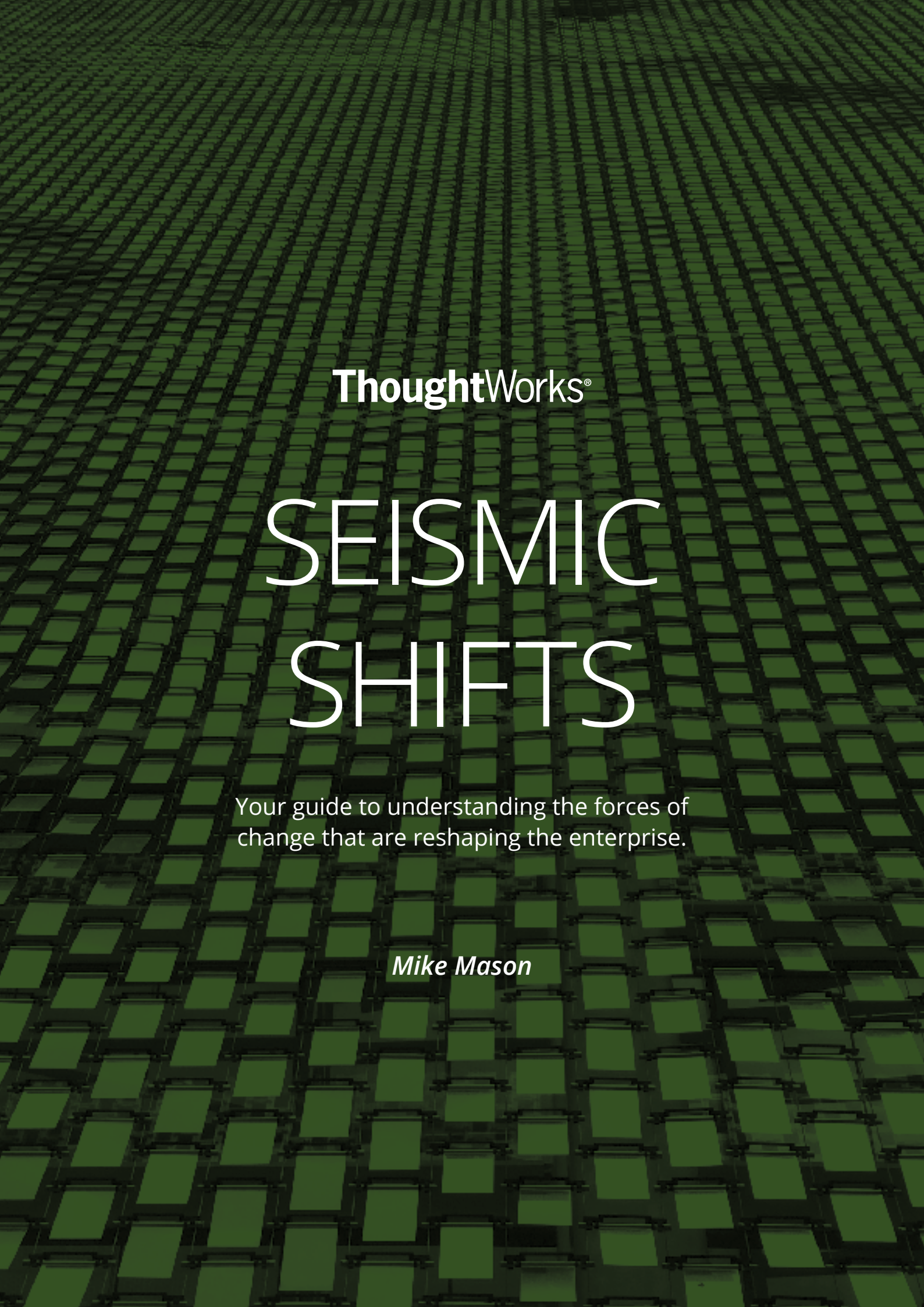
ThoughtWorks®
SEISMIC
SHIFTS
Your guide to understanding the forces of change that are reshaping the enterprise.
Mike Mason

# INTRODUCTION

Business, technology and society have become deeply intertwined, fueled by advances in tech. The implications are profound. Organizations must plan for the day when existing business models or products are obsolete.

We call the assimilation of technology into the fabric of the enterprise TECH@CORE™. And the phenomenon is spreading fast—from easily digitized industries such as finance, media and telecom into sectors such as manufacturing, automotive and transportation.

Every sector is investigating how TECH@CORE can drive productivity and profitability, enhance customer service, reduce time to market or develop new business models. Building tight strategic collaborations between technology and business enables you to pursue a wide range of opportunities (see Fig 1). That's why every business is becoming a technology business.

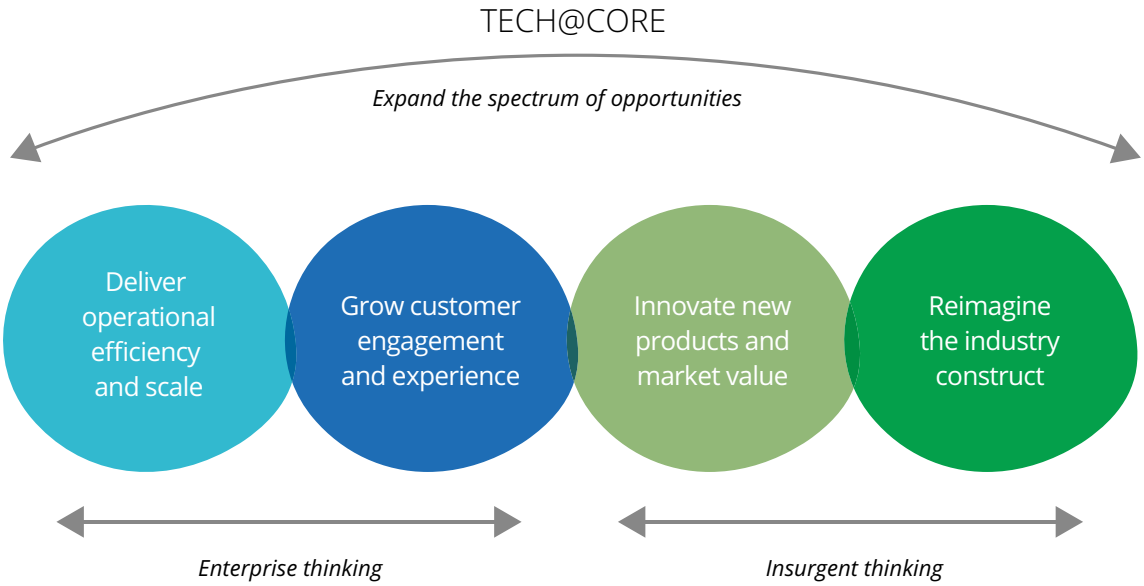


*Figure 1 - TECH@CORE enables a broad set of business opportunities*

Embracing TECH@CORE introduces fundamental change throughout an organization: it affects every internal process, as well as customer-facing activities, and interactions with partners. But we're only at the start of the digital revolution. Further dramatic change is on the horizon. A new wave of disruptive tech is starting to take hold in the enterprise. This is a time for courageous leaders—those that can understand the scale of change coming and plan for it, while simultaneously evolving their existing business and assets. For over two decades, ThoughtWorks has been at the forefront of helping organizations do exactly this.

This report breaks down the "Seismic Shifts" emerging in business and technology, to help you prepare for these changes. These shifts are:

ThoughtWorks' Seismic Shifts series will guide you through the tech-driven changes heading your way. We use our unique insights, gained from working alongside the world's leading organizations, to explains these shifts and why they matter to you. We will help you plot a path to success in a fast-changing world.

# Rise of the platforms

Platforms are becoming one of the most important concepts in business today. But it's a term that's overused, covering anything from data management tools or cloud services to enterprise resource planning. Executives think about business platforms when exposing select capabilities via product-inspired API's. And development teams think more in terms of building platforms, both for integration and improved developer experience. So how do you work out what platforms mean to you?

Companies such as Apple, Uber and Airbnb understood how platforms bring together consumers and providers to create new sources of value, and reshape their competitive landscape. Part of their success comes from finding a useful level of encapsulation and capabilities. Increasingly, "platform thinking" appears across the ecosystem.

*"Beyond technical platforms, to platforms for business innovation."*

Platforms have the power to transform organizations. That's why many industry watchers now believe that platform thinking is the key to future success. It's why so many organizations are deliberately and systematically building technical systems and business capabilities as the foundation for something bigger.

Business leaders have begun to realize that public and private clouds are merely technical delivery platforms and must be augmented with business-focused capability platforms, exactly like those built by industry pioneers.

Platforms that enable new business capabilities and foster innovation are created by combining technology and enterprise strategy. Today's leaders are no longer content with offering simple products or services: they understand that tomorrow's winners will be those with the most capable platforms.

### *What platforms do you have today?*

ThoughtWorks has seen our clients' teams become as much as 3x more productive simply by standardizing on a deployment platform such as Pivotal Cloud Foundry. This has enabled them to take the guesswork out of scaling and operating IT systems and allowed developers to focus on delivering business value.

When German e-tailer OTTO started thinking about platforms as the means to transform its business and reinvigorate its eCommerce strategy, it knew it there were no silver bullets. But it also recognized the need to change. The monolithic platform they were using lacked flexibility and speed.

OTTO began by reviewing its existing IT assets, considering which part of its infrastructure were meeting existing objectives, and which could form part of its new solution.

That type of review is essential in benchmarking where you are today and giving you an understanding of where change is needed. We have seen platform technology, especially on-premise cloud, evolve rapidly over the past two years. And we often encounter organizations that have hand crafted an internal 'platform' that fails to meet expectations.

A common pitfall is data. Many organizations struggle to unlock data assets and lack a coherent data strategy. Platform thinking around data is especially important in making that data available for advanced techniques such as machine learning and artificial intelligence.

Creating these platforms and ecosystems requires huge shifts in architectural rigor, infrastructural sophistication and organizational structure. You can't simply "install a platform" and assume that you're done. Using a platform—either internally or externally hosted—is not the end of the journey; it's the beginning. You need to be in charge of your platform strategy, not beholden to vendors who want to sell their entire product suite and lock you into their upgrade path.

But in a world that competes on platform, it's essential to put this groundwork in place today.

### *Make platforms your lens for innovation*

Today, many organizations have embraced the benefits of cloud and automation. They've been able to drive organizational agility further through embracing Continuous Delivery and DevOps. That's providing the foundation for a digital platform strategy, based on technical platforms such as OpenShift and AWS. At ThoughtWorks, we believe this delivers the opportunity to build business platforms which will become the nexus of innovation.

In partnership with our client, OTTO, ThoughtWorks created a more nimble eCommerce engine. We implemented Agile processes, architecture and technology to build an adjustable platform that meets OTTO's long term growth and business needs.

Upgrades were incremental. The launch of the new platform was not disruptive to the business. For millions of shoppers the re-engineering was invisible. For OTTO the gains are immense. Time to market for new features has been compressed from months to days.

We see platform thinking as the lens through which IT decision makers can seize the new opportunities for their business—whether that's the Internet of Things, autonomous vehicles or some other advanced tech.

## Evolving interactions

They way we interact with technology is changing. We're evolving from unnatural keyboard-and-screen or finger-on-glass interactions to true multi-modal interactions, with users moving fluidly between interaction styles based on their context or preferences.

*"We must evolve our thinking—and our capabilities—beyond the keyboard and the screen. Mixed reality will become the norm."*

Interaction through speech burst onto the scene with tools like Siri, Cortana and Hey, Google. These interfaces have reached into homes with devices like Amazon's Echo. Building conversational and natural language user interfaces presents new challenges but obvious benefits. The Echo in particular had to rethink many interactions because it initially omitted a screen, forcing all-verbal interaction.
The conversational trend is not just limited to voice. Messaging apps have come to dominate both phones and workplaces, and we're seeing conversations with other humans being supplemented by "intelligient" chatbots. As these platforms improve, they understand more conversational context, making interactions more lifelike and therefore more compelling.

These new forms of interaction challenge some of our notions about how we accomplish routine tasks in the post-digital world. If we want to book cinema tickets or a taxi, we don't need an app—our digital assistant can do it directly. We might alternatively rely on a system of intelligent, connected Internet of Things (IoT) devices to understand our behaviour and preferences, and automate routine tasks, such as ordering our morning latte, or replacing worn out gym shoes.

For organizations, this presents a challenge of how to project their brand, when their customers might never interact with them directly. How will you deliver a personal service when you don't see your customers directly?

*How will you deliver a personal service when you don't see your customers directly?*

How we interact with the world around us is also changing. Virtual reality (VR) and augmented reality (AR) are becoming common. Headsets such as the HTC Vive, Oculus Rift and Microsoft HoloLens provide entry into a high-definition immersive experience, without users needing to break the bank.

AR, VR and voice are just the start. Already companies such as Facebook are exploring the possibilities of thought-based interfaces; BMW is investigating holograms. As we move away from the notion that a computer is something with a screen and a keyboard, it's only natural that the way we interact with it will change.

## *Building new worlds*

Evolving interactions promise dramatic change, but it may not yet be clear which technologies are right for you. To plot your best course you need to understand the capabilities offered today by technologies such as voice recognition and chatbots, then match that with consumer demand for that service. Then, think about the capabilities that will be available tomorrow—VR and AR, digital assistants and advanced machine intelligence—and apply those to reimagine your existing products and services. Even better: invent new ones.

As always, it helps to understand where you are today, before trying to prepare for tomorrow. Audit the ways you currently interact with your customers: how does this match up to what you think you'll need tomorrow? You'll doubtless find there are gaps, so determine whether you will build, borrow or buy each capability. You may not need to hire 3D modeling experts but you'll definitely need to decide "what 3D worlds do I want to build? What business data and use-cases make sense?"

## *Time to get hands on*

We think that new forms of interaction open up endless possibilities for tomorrow's organization. But there's no easy way to predict what will work for you. That's why we believe in building R&D capability, exploring possibilities with our clients, and tapping into the grassroots enthusiasm of our tech communities to cover a broad range of areas in this space.

If you're not already exploring the possibilities of AR and VR, what are you waiting for? By experimenting with new headset technologies, or building capabilities in 3D modeling or interaction design, you can get a feel for what will work for you. You should, at the very least, be getting your technology partners to run workshops for you.

For instance, we've partnered with financial services provider Standard Chartered to explore how combining smart mirror systems digital assistants, such as Alexa, can help customers manage their finances.

# Humanity, augmented

Step into the street today and you'll appreciate the huge impact machine intelligence is having on the world around us. Autonomous vehicles are emblematic of the way machines are displacing humans in a number of ever more complex tasks.

Despite some alarmist predictions, this does not herald a jobless future. We envision a future where people and machines work together, each playing to their strengths, to achieve greater outcomes. We call this "Intelligent Empowerment".

Organizations won't replace workers, instead it will team them up with specialized machine intelligence. Algorithms will take on tasks that people formerly performed and weren't usually very good at or didn't enjoy doing. This will produce dramatic results: we could boost productivity by 30% in many industries, while cutting manufacturing labour costs by up to a third.

*"By collaborating, humans and machines deliver better outcomes.*

*Understand what the combination of human strengths like intuition and machines' abilities with data will do for productivity."*

For instance, ThoughtWorks is helping a client classify millions of legal documents, identifying which are contracts as well as the legal clauses that have changed between revisions of the contract. For human lawyers this is painstaking, slow work, but can be rapidly accelerated through machine learning.

People will use these tools to accomplish tasks quicker and more accurately, freeing them time to focus on areas requiring human ingenuity, intuition and experience. Additionally, we will solve their problems in new ways and allow people to do things they could never do before, opening up new opportunities.

### *Data comes first*

Data is at the core of these new intelligent systems. Your infrastructure will have to support storing large volumes of data and a scalable processing layer for different types of workload, from batch to more real-time and streaming needs.

We have seen many businesses invest in Big Data infrastructure without changing their organizational structure or building the skill-set required to fully leverage new Data Science and analytics applications.

We think you'll want to go beyond batch-oriented systems and traditional data warehousing techniques. You need to bring data thinking into the core of your system architecture.

Consider your organizational structure. Can existing silos really take your company to the next level? Applying intelligent solutions to a small problem might be enough to get you started, but you should really take a holistic approach that spans across the existing organizational structures to realize the full potential.

This requires rethinking not only how people are organized, but also your existing processes. With intelligent systems being able to provide data-driven insights and perform data gathering and processing tasks much more efficiently than humans, you need to consider what roles will require real human power in the future. While predictable and procedural activities of some jobs will be readily replaced by automation, this would free up staff to be creative, to use their insight and imagination to benefit the business.

Finally, what business priorities are your efforts addressing? Bring your Enterprise Architects along in this journey and make sure they understand the business problems you are trying to solve. It will not only help simplify your systems landscape and retire many legacy systems, but will also help modernize your overall architecture. Since this will take time and require changing technology and people's mindsets along the way, we believe taking an evolutionary approach to architecture can help offset the risks of trying to implement this in a Big Bang approach.

### *Enabling end-to-end optimization*

The move towards intelligent systems and machine learning in the enterprise will mean greater demand for data scientists. We think that's an important part of strategic planning today.

But the intelligent enterprise will not emerge fully formed. We think that many organizations will start in their supply chains. Indeed, we're already seeing large enterprises trying to apply holistic intelligence to their planning capabilities. A truly end-to-end planning system goes beyond the existing silos of production planning, material planning, demand planning, transportation planning and so on. It requires an approach that links those separate domains to drive a global optimal solution. It also requires a data platform that supports a responsive streaming architecture, enabling the system to go beyond daily or weekly batch processes into one that can react at the speed of business.

Our focus is on global optimization; not just optimizing individual plants or warehouses, but optimizing the entire producer-to-consumer supply chain for improved responsiveness and massively reduced costs.

## Security, privacy and transparency

A complex storyline is evolving across these interrelated and often conflicting themes. Security focuses on protecting systems from unauthorized attack and continues to be a hot topic, with system breaches playing out across the globe on a weekly basis. The privacy theme focuses on expectations of how organizations protect consumers' data, or data about them. Transparency is a related topic, where citizens and regulators are beginning to demand clarity around how an organization operates, and how and why decisions are made.

IT security is a headache for every organization. The complexity of today's IT systems combine with the volume and variety of attacks to create a perfect storm. Business leaders just can't get ahead of the curve.

*"A sea change is happening in security. Now it's everyone's problem."*

And the problem's getting worse. The move towards more rapid software releases and continuous delivery means hard pressed IT security teams are being overwhelmed. Meanwhile, consumer attitudes towards personal data are hardening. For instance, more than a fifth of companies that suffered data breaches in 2016 lost customers. Today's consumers expect personal data to be guarded closely—and they expect organizations to be transparent about how they'll use information.

As a result, security has to become "everyone's problem", so that everyone within the enterprise improves their understanding and management of risk.

That's easier said than done. One challenge of making security "everyone's problem" is that it can mean "no one is accountable". What it needs to mean is that secure behavior becomes the baseline. Beyond that, ownership for specialized capabilities, such as anomaly detection, need to be clearly delineated. Those "owners" must provide a clear articulation of their security responsibilities, so that others in the organization can access their knowledge.

Consumers are rightly concerned about how their data—and data about them—is used and are beginning to demand rigorous privacy guarantees from the organizations that hold it. Some companies, for example Apple, use privacy as a differentiator in their products. A recent CEO report highlighted that consumers prefer to engage with brands and products with which they feel 'safe'.

Consider how your brand is perceived in the market. Have your competitors already adopted a "privacy forward" stance or can you take the lead? How should your organization increase its focus on security and privacy for customer data?

### *You can't spend to win*

Start thinking about security, privacy and transparency as an interconnected set of concerns. The more customer data you collect, the more important it becomes to provide safeguards about how you store it—and how you'll use it. Do not assume that you can simply spend your way to a good outcome for any given problem in this area—in reality, you must build security awareness into the fabric of your organization. And make security something you consider during all aspects of product and service development.

You'll need security to be a priority. Ensure these concerns are represented at the highest levels of your organization. Remember that this is likely to be a massive cultural shift. In many cases, old ways of doing things simply won't work—relying on manual reviews, for example, doesn't make sense in an era when software can be released dozens of times every day.

It's not easy. Security, privacy and transparency expertise are highly sought. Many businesses are struggling to hire talented people.

### *Build in security from the ground up*

Security needs to be built into every piece of software right from the outset. That's why we encourage our developers—and our clients—to incorporate techniques such as threat modeling into each phase of the software lifecycle, from product ideation to story writing, development and deployment.

Organizations can improve their security posture by ensuring the software development is part of an overarching enterprise security strategy. We're increasingly seeing that security is no longer treated as a separate, distinct task. It has to inform activities at all levels throughout the organization.

## Rise of the robots

The robots are coming: self-driving cars may lead the headlines, but vast amounts of human work will be displaced by machines. We commonly think of "blue collar" jobs such as truck drivers, fast food workers and so on. Industries such as transportation, logistics and agriculture are obvious examples of where robots can easily displace human workers.

> *"Robots mean you can improve productivity in any business process that currently has a physical, human touch point."*

But it's not just low-skilled jobs that will be affected. The type of tasks that computers can do better than humans is changing fast. For instance, computers are now outperforming humans at games, such as Go or Texas Hold'em poker. So the combination of AI and robotics opens the door to far more complex human roles being displaced—robotic surgeons or airline pilots are easily imaginable.

Of course, we've had robots and automation for more than 40 years. But there are several converging trends that put us on the cusp of dramatic changes. For instance, the proliferation of sensors we're starting to see makes a new level of autonomy possible, to the extent that it's now feasible to safely use robots side-by-side with humans on the most delicate of tasks. Today's software allows for automation to be self training and adaptive, that makes it much cheaper and easier to program and manage machines.

## *Physical touch points are an opportunity*

For today's business exec, it's important to appreciate the scale of opportunity that robotics can bring. Anywhere that you currently have a physical, human touch point in your business processes, there's a chance to improve productivity—through greater speed, accuracy or length of continuous operation.

Take a hospital ward. We all know the problems of hospital acquired infections: the large congregation of people, with immune systems that may be compromised through illness, increases the chances of transmitting nasty bugs. Human cleaners can only do so much. But robotic cleaners, such as the one made by Xenex, can make a huge difference. Xenex uses powerful UV beams to destroy bacteria. It's best done without people present, and a five-minute session has been shown to reduce superbugs by 53% compared to conventional cleaning.

Such changes do not happen easily. Increased automation is dependent on timely, accurate data. For the enterprise, this means that old methods of systems integration—EDI and so on—need to change.

## *Time to solve integration issues*

How quickly this robotic future arrives remains uncertain. There are many questions to be answered. For instance, despite widespread coverage of drone delivery systems—whether that's for pizza, home shopping, or medical supplies—the big issue of economics has yet to be settled. What are the cost implications of a one-to-one drone delivery service, compared to a well-routed truck?

We believe that almost every organization has some activity where robots can help. But in order to uncover those opportunities, it pays to be prepared. Systems integration, data management and data integrity will become the foundation for successful robotic deployments.

We're already working with some customers to understand where we can enable them to unlock business value by applying automation. We're also partnering with robotic providers, such as Xenex, so that we can learn about potential roadblocks or unexpected opportunities.

# It's time to start exploring

The Seismic Shifts highlighted in this report are important story lines playing out today in the world of technology-enabled business, and each one is worthy of consideration and response. But what's also interesting is how the Shifts overlap, how the story lines support each other, and how specific issues look different through the lens of each of the different Shifts.

Humanity, Augmented requires significant data in order for machine intelligence to augment human beings, but we must also bear in mind the security and privacy implications of gathering and storing such a data set. When we think about Evolving Interactions, it's exciting to think about speech and gesture interfaces, but those will only work when supported by Machine Learning that can intelligently interpret a user's intent.

At ThoughtWorks we have always been intrigued by the interaction of technology and business trends. We encourage you to be curious, too. Rather than trying to decide which Seismic Shift is most important to you, ask "how can we use each of these lenses to consider technology as it affects our organization?"

**Keep ahead of these fast-moving developments, by registering for updates at**

***thoughtworks.com/seismic-shifts***

# MIKE MASON

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Mike has been with ThoughtWorks for more than a decade, as a developer, a tech lead, architect and Head of Technology. He serves the Office of the CTO to set the company's technical direction and strategy. Mike has worked with senior IT decision makers at some of the world's leading companies, helping them build highly performing tech teams.

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