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# Decisions *OVER* Decimals

Striking the Balance

between Intuition

and Information

WILEY

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## **Additional Praise for *Decisions Over Decimals: Striking the Balance between Intuition and Information***

“The authors have developed an innovative, practical framework for decision-making that is based on a synthesis of data analytics and experience-based intuition. Their approach is broadly applicable across industries, including health care.”

—**ELLIS M. ARJMAND**,  
Surgeon-in-Chief, Children's Hospital New Orleans

“The ability to make fast, yet informed decisions in a world where data is replicating so quickly is becoming an imperative skill-set for executives. The authors approach for Quantitative Intuition™ is a great balance of data and insights with experience. Readers will greatly benefit from learning this balance and using it to make better decisions (and actions).”

—**TRACI GUSHER**,  
Data, Analytics and AI Management Consultant

“Frank, Magnone, and Netzer have created a framework that systematically challenges human cognitive biases, providing a methodical approach that allows decision-makers to see meaningful patterns in a chaos of data. This book is a foundational guide to any executive on how to leverage the power of your System 1 intuition to make meaningful data driven business decisions at speed.”

—**TODD TRAUTZ**,  
Chief Innovation and Solutions Officer, Maru, author of *Feel, Behave, Think—The Pathway to Human Decision Making*

“High-stakes decision-making boils down to seeking truth and getting things ‘approximately right.’ Several quantitative-only methods run the risk of getting it ‘precisely wrong’ while offering a false sense of security. Techniques described in *Decisions Over Decimals* lead you to the truth and improve the odds of getting to balanced business decisions.”

**—ASIF HASAN,**  
Co-Founder, Quantiphi, Inc

*“Decisions Over Decimals* is an insightful and thought-provoking book for any new leader or established executive and their teams. Insights without Quantitative Intuition and interpretation are still just data on the page. Frank, Magnone, and Netzer do an amazing job at making the big data world a little smaller and clearer.”

**—TRACIE KAMBIES,**  
Founder and CEO of IQRush, Former Global Analytics Executive and  
Big 4 Consulting Partner

“The ambitious premise that human judgment in decision-making can be codified, taught, and honed is proven in *Decisions Over Decimals*. The authors articulate a process that right-sizes the Goldilocks compromise between data paralysis and gut feel—and do this credibly through their collective experience from companies ranging from startups to the most data-rich organizations.”

**—BRANT CRUZ,**  
Vice President, Platforms and Audiences Practice Leader, Chadwick  
Martin Bailey

*“Decisions Over Decimals* is an excellent reminder that as we navigate vast seas of information, we must bring our intuition along on the journey. This book is a must read for any insights and analytic professionals that want to enhance their ability to impact and influence decisions to drive action.”

**—THOMAS WALKER,**  
Senior Director, Global Consumer Insights

“The most important decisions are often the most uncertain and often on the razor's edge. Frank, Magnone, and Netzer masterfully provide a framework to make better decisions faster in a way that can be explained to your stakeholders.”

**—ALEX SHARPE,**  
Sharpe Management Consulting LLC



# Decisions Over Decimals

***Striking the Balance between Intuition and  
Information***

**CHRISTOPHER FRANK**

**PAUL MAGNONE**

**ODED NETZER**

**WILEY**

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This book is dedicated to our foundation and our future:

Rocco and Florence, Alberto and Grazia, Max and Drora

Michelle, Suzanne, and Susan

Alexander, Lauren, Luke, Eve, Talia, Ella, and Aviv

Cherish your past. Remain curious.  
Chart a bold future.





# Foreword

## *Striking the Balance between Intuition and Information*

— Christopher Frank, Paul Magnone, Oded Netzer

In February 2020 before the world as we knew it changed forever, I walked onto Columbia University's upper west side campus as a guest speaker to Chris, Paul, and Oded's executive seminar on Quantitative Intuition (QI)<sup>TM</sup>. Having worked closely with Paul for years in business and knowing of his work with Chris and Oded at Columbia, I was eager to engage as both a speaker and a student myself. The 45 business, government, and institutional leaders attending the session were diverse, formidable in their fields and an extremely talented group. So why did they come?

The saying “hindsight is 20/20” speaks to the wisdom of seeing things clearly in retrospect. But what if you could flip the switch to enhance your foresight materially?

*Decisions Over Decimals* is rooted in over 7 years of evolving QI coursework taught 4 times a year and the decades of collective experiences of the authors in varying fields. It offers both an enlightened understanding of how and why you think and process information a certain way, while giving you a repertoire of tools and techniques to fundamentally make more thoughtful, better choices.

This collaborative effort brings together each author's unique perspectives, valuable insights, and relatable experiences to you. The structure provides a clear end-to-end framework that taken in its parts, or as a whole, will up your strategic thinking and execution

One important tradeoff the authors DO NOT ask of their QI students and readers of this book is that better foresight comes at the expense of speed. Their goal is to accomplish the opposite -- how can you make more effective AND efficient decisions.

I see the byproduct of this dichotomy with my clients and business partners regularly. Being effective and efficient simultaneously often paralyzes organizations who desperately need both insights and speed. The breakthrough of *Decisions Over Decimals* is the holistic

approach that bridges data analysis with human insight for balanced decisions.

As an avid reader of business-oriented leadership and management books, *Decisions Over Decimals* complements any portfolio and is refreshingly action-oriented and pragmatic. I have applied the authors' approach to target large scale business opportunities, to shape board approvals, and to align stakeholders to play to win—It is comprehensive. It has thoughtful guardrails and exposes potential blind spots. It helps one to strike a better balance between intuition and information that often can be overweighted one way or the other.

In a world that comes at us each day with increasing velocity and exponential data availability, *Decisions Over Decimals* is a timely guide to give you greater comfort with uncertainty and clarity in the most important choices you make.

— **Thomas M. Galizia**  
Chief Commercial Officer, Alphabet Google at Deloitte  
Principal, Deloitte Consulting LLP



# Preface

What distinguishes a person who makes smart, confident data-driven decisions? It is not exceptional analytic skills. Instead, successful decision-makers balance data, experience, and intuition. They quickly sort through information, apply judgment, and are fierce interrogators of data to cultivate sharp insights. They know there is more to decision-making than just the data. They resist being intoxicated by information. Instead, they apply first-order principles to understand what the decision really is, why it must be taken, and to what end. They then seek the relevant data to help make that decision. In short, they make informed decisions with incomplete information.

This approach to fast decision-making taps into a different set of skills, requiring a change in mindset by combining information and intuition. We call this approach Quantitative Intuition (QI)<sup>TM</sup>. QI is the product of years of discovery about making effective and efficient decisions. For too long, the debate has been on the value, veracity, and variety of Big Data. This trend has shifted the problem from data exploration to data sifting. This book dives into this emerging method to reimagine making decisions with imperfect information. By sharing a set of rapid response tools to get to the core of any business challenge, QI enables the reader to quickly interrogate and integrate data to make quick, effective, and often bold decisions. QI emphasizes the need to break the allure that an abundance of data is a crystal ball to eliminate all uncertainty and lead to perfect decisions.

With so much information available, leaders often falsely expect the data to provide both the question and the answer. They focus on what nuggets of insights can be found in the data? rather than what is the essential question to solve? They think they're moving forward, but they're often just churning, working hard, but achieving little.

The authors of this book have worked in highly competitive, fast-paced industries where the temptation to simply drowning in data is immense. We have seen this from working for startups to the most iconic technology brands, from teaching at notable institutions to working with colleagues worldwide.

*Decisions Over Decimals* uniquely bridges theory and practice. Oded Netzer is the Vice Dean of Research and the Arthur J. Samberg Professor of Business at Columbia Business School and an affiliate of the Columbia University Data Science Institute; he also works at Amazon as an Amazon Scholar. Christopher Frank is at American Express and formerly at Microsoft, and Paul Magnone is at Google and previously at IBM and Deloitte Consulting. Chris and Paul are Adjunct Professors at Columbia Business School, and along with Oded, teach Quantitative Intuition™ at Columbia. Oded says:

If you were to describe me in one word, it would be *nerd*. If you want to use two words, it would be *data nerd*. I am the type of person who likes to stare at data and look for patterns and business applications. Sometimes I miss insights in the data, and sometimes I see patterns that are not there, and occasionally, I find some really interesting and useful nuggets. More seriously, what I do for a living is to preach what I practice when it comes to data-driven decision-making. I preach through teaching data-driven decision-making to undergraduate students, MBA students, data science graduate students, doctoral students, and executives in executive education programs. I practice in terms of my research and consulting work. My research focuses on one of the major business challenges of the data-rich environment: developing quantitative methods that leverage data to gain a deeper understanding of customer behavior and guide firms' decisions. Similarly, my consulting work with Fortune 500 companies and entrepreneurial startups, as well as my work at Amazon as an Amazon Scholar, focuses on making better decisions with data.

After graduating with an engineering degree, I started my love-hate relationship with data-driven decision-making. I began in consulting: talk about a place where quantitative meets intuition. Over a few years, I realized the tools consultants used to solve complex questions were too simplistic for the problems. That is what led me to the other side of research in academia. I did my M.S. in statistics and Ph.D. in Marketing Analytics at Stanford University. It would take me a good 15 minutes to explain what I was doing at a cocktail hour (needless to say the “data nerd” wasn't the life of the party!). Today, it is easier to describe my area of focus since *data science* has become a household term. I then traded the sun of California for the city life of New York. For the past 18 years, I have been at Columbia University teaching executives and executives-to-be. One of the key learnings for me from years of teaching data-driven decision-making was that people are often afraid of using data to make decisions because they erroneously believe that data-driven decisions are reserved for those who were top of their class in math in school. As we discuss in this book, this is a myth. There are many skills needed

to make data-driven decision but strong math skills is not one of them. I share in this book many of the learnings from the years of teaching, research, and work with companies about how to pour good amount of intuition and business acumen to convert numbers to effective business decision making.

Christopher is the Vice President of Amex Insights at American Express, leading the Global Advertising, Brand, and Communications research practice.

My background is in technology, startups, and consulting. I graduated from Stevens Institute of Technology with a Master of Science. I thrive in quantitative analysis, but quickly learned that was not enough. When I began my career, as an IT developer simply executing what the business needed. From there, I went into consulting. I applied the scientific method to tackle business problems using systematic observation, measurement, and the formulation, testing, and modification of hypotheses.

From consulting, I spent 10 years at Microsoft as Senior Director in the Corporate Marketing Research and Insights Group. When I started on the research team, we were eight people, and when I left, we were 103, reinforcing the increasing role of analytics in making decisions. While I am comfortable with numbers and quickly learned that the most valuable role I play is translating the numbers to business outcomes. I serve as the connector between analytics and strategy to create demand for the products and desire for the brand. My day-to-day focus is linking attitudes, behaviors, and outcomes with customers' needs, wants, and desires to fuel growth. I have developed a series of approaches to elevate the customer point of view, so it is influential at the highest levels to enable more thoughtful decisions. In the following pages, I share how to apply these practical techniques to everyday decision-making to help teams operate at a higher level, leading to greater impact.

This everyday application is where Paul Magnone contributes a unique voice.



While Oded and Chris approach decision-making from an analytic perspective, I come at it from building teams, structuring deals, and establishing strategic partnerships. Chris and I went to the same university, so we have a common foundation in the scientific method and approach to problem-solving. Currently, I work at Google, but if we go back in time, like Oded, I'm a recovering engineer. Yes, an engineering-only mindset is curable.

I spent my first 20 years after engineering school at IBM. About 10 years into it, after working with complex customers, I moved to the frontlines of the dot-com era working with venture capital firms and their portfolio companies in Silicon Valley, Europe, and Israel. After some time with the VCs, we realized we had all the resources to be creative, and I found myself in an entrepreneur-in-residence (or intrapreneur) role starting emerging IBM business units, developing a few patents, conducting business in over 30 countries, and driving acquisition integration of smaller software firms. So, a funny thing happens when you ask how do I reach a great decision and not just a good one; did I miss the turn? The difference between a good success and a billion-dollar business may be just a small handful of choices. How do you see the right alternative and make that choice? This is where coffee played a significant role because Chris and I would have virtual coffee on the weekends, and I'd say, "Chris, you do market research for a living. What am I missing? How am I not finding that needle in the haystack?" That was the genesis for the material in this book. It was the origin of marrying research with the frontline application.

From IBM entrepreneur-in-residence, I moved to a small telecom software firm at the forefront of 5G networking, then to a Deloitte Consulting Innovation group. Now I am at Google in the cloud business. I appreciate the academic view and helped form a lot of the strategic models in this book, but I also have experience working in the trenches, trying to understand what practical techniques will help sort out the blend of intuition and the quantitative—the head and the heart.

Bringing the head and the heart together is where leaders and teams struggle—striking the right balance so you can quickly move forward

with confidence. This is the focus of the book. We identify specific techniques to do that swiftly and effectively from working on the frontlines. There is a clear thread among Chris, Paul, and Oded. We landed on the notion of Quantitative Intuition from our collective experience, from teaching thousands of executives and managers-to-be, and from our interactions with global teams in highly matrixed, competitive industries.

There are many terrific books on decision-making. We are striving to add to the pantheon of knowledge by discussing how to strike a balance between data intelligence and human judgment. This book is written to share practical techniques to make smarter decisions. You do not need to have gone to math camp to read this book, but you will acquire the necessary counterpart to IQ: QI. This book teaches you that to be an effective decision-maker you should rely on data, but at the same time you must resist being intoxicated by information.

*Decisions Over Decimals* underscores how the process of decision-making can be streamlined. This book is intended as a career tool, not a single-use one. Readers should be able to come back repeatedly as they progress through their careers, shifting upwards and sideways. It's not industry or geography-specific, and the value of QI can extend well beyond the confines of the corporate world.

QI aims to raise awareness of the power of thinking beyond Big Data without neglecting it, and chasing the perfect decision while appreciating that such a thing can never really exist.



## Prologue: The Certainty Myth

We want to start by debunking two common myths. The first is the common view that you need to be a math savant to make decisions with data, which deters many people from using data for decision making. This is an erroneous belief. The reality is that making decisions with data is not a choice anymore, it's a necessity. Whether you were top of your class in math or not, you need to make data-driven decisions. However, having deep math skills is not a core requirement to be a great decision-maker. This is much like a race car driver who does not need to be a mechanical engineer but is a better driver given awareness of the underlying mechanics. Aptitude and depth in math are quite different from what is truly needed from a business leader—an appreciation for numbers and how they apply to your business.

The second myth is the illusion that, with the abundance of Big Data that surrounds us, we can finally get to the nirvana of making certain decisions—the perfect decision. The challenge in today's world is not the lack of information but the judgment to use it. This goes back to the first myth that you need to be a math whiz to make smart data-driven decisions. Rather, you need to balance the information with human judgment, experience, and intuition. These ingredients are at the heart of what we call Quantitative Intuition (QI)<sup>TM</sup>.

Consider the following scenario is quite familiar to many of us—the presentation has been going on and on. Slide after slide of numbers and figures. We are on slide number 25 and suddenly, you hear a sharp voice from the back of the room. One of the executives in the room raises her hand and announces, “Hold on, help me understand this, the revenue number at the bottom of this slide doesn't make sense, it doesn't match the production number you showed us before on slide 9.” What just happened? The executive did what good QI leaders do. She did not just evaluate the plethora of numbers at face value. She also avoided the temptation to simply look at the numbers in the table in front of her. She put the data in the context of her experience and the previously presented figures. Did she solve calculus equations or re-run the spreadsheets multiple times in her head to make this statement? Did she need to be top of her class in math to identify a gap in the pattern and a flaw in the plan? No,

possibly she used fifth-grade math by multiplying the unit sold found on slide 9 by the price of the product to arrive at a sales figure on slide 25. In fact, her gut probably told her that the sales figure on slide 25 seemed off, which sparked her interrogative mindset. This type of interrogative mindset and the ability to put the data in context make for a good quantitative intuition-oriented leader. It is the ability to correlate your gut intuition with the data, put the data in the context of the business environment, and ask precise questions.

## Quantitative Intuition (QI)<sup>™</sup>

The list of examples of corporate and public policy failures is as long as history itself. It includes Coca-Cola introducing the New Coke formulation and walking back its launch a few months later, NASA's decision to launch the *Challenger* space shuttle on an unusually cold night in Florida, or Juicero, a company that briefly made and sold high-end Wi-Fi-connected juice machines for \$700 before disappearing. What is common to all of these examples, which we discuss in detail later in the book, is that the problem was not in the lack of data or the data itself, but rather in the judgment employed in converting the information to sound decision-making. As data becomes more ubiquitous, and as our temptation to draw grand conclusions from it becomes more difficult to resist, it's critical that we chalk up case studies like these as invaluable lessons to learn. *Decisions Over Decimals* describes the Quantitative Intuition techniques to allow for better navigation through problem exploration to reach a sound decision more effectively.

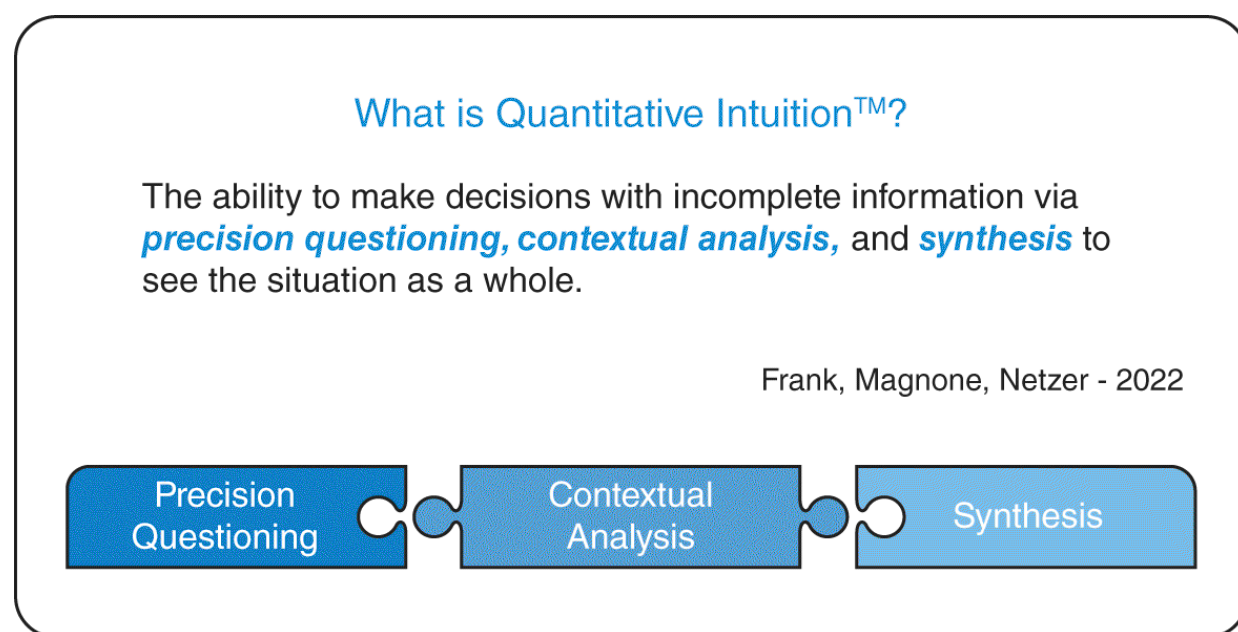
Quantitative analysis is valued because it tends to be considered unambiguous. Numbers are a universal language that everyone speaks more or less uniformly. Humans tend not only to be terrified of failure but also of the unknown, so if we're given data that can be feasibly interpreted as solid, we tend to jump to two conclusions: first, that it will save us from failure, and second, that it will provide certainty. Both are categorically wrong.

Data and numbers tend to provide the comfortable feeling of accuracy and certainty, but they rarely tell us the full story. Numbers alone can never provide a perfect solution or answer, and they will never immunize decision-makers from faltering. At the other end of the analytics spectrum, intuition—which is difficult to measure—often receives a poor reputation for being subjective and susceptible to biases and manipulations. And yet, intuition is visceral and grounded in understanding fundamental beliefs, which in corporate terms is business acumen. The inner voice that you may work to ignore may be a guidepost along the way to a better decision if it is well contrasted and combined with the data.

Quantitative intuition (QI)—the combination of data and analytics with intuition—might sound like an oxymoron at first, but it is actually the key to effective decision-making.

Simply put, QI is the ability to make decisions with incomplete information via precision questioning, contextual analysis, and synthesis to see the situation as a whole (see [Figure P.1](#)).

Quantitative thinking balanced with intuition is the necessary mix to make decisions in the data-driven world we all live in. QI equips us to be more confident when making decisions in the face of uncertainty. By striking the right balance between data intelligence and human judgment, QI helps us navigate between risk and certainty.



**[FIGURE P.1](#) Quantitative Intuition definition**

We live in a world of Big Data, yet we are always seeking more data, often questioning the data we have and feel frustrated by inaction. By allowing ever more data and analysis to drown out our human judgment, we neglect a powerful combination that can lead to a comprehensive view of a decision to be made. No amount of purely quantitative information will provide certainty and the answers needed to run an organization, grow a business, or lead a team. Combining quantitative information with intuition—human judgment developed through experience and close observation—is indispensable. *Decisions Over Decimals* busts the Big Data myth by

putting forward a set of QI techniques that teach you to bridge the gap between analytics and intuition.

So, what is intuition? In the context of decision-making, intuition is human judgment developed through experience and observation. *Intuition* can be further defined with reference to three distinct features: it is a *subconscious process*, it involves *parallel thinking* (holistic, rather than sequential or analytical thinking), and it involves *your “gut” as well as your brain*. These three features are worth looking at more closely.

Intuition is primarily a subconscious process. Even if you use your conscious mind to formulate the problem or rationalize the result of intuitive judgment, intuition occurs without having to apply mental effort.

This distinction is elaborated in Nobel laureate Daniel Kahneman's seminal book *Thinking, Fast and Slow*, in which the Israeli-American psychologist and economist introduces the concepts of System 1 and System 2 thinking to describe the different ways the brain forms thoughts.

System 1 is rapid, automatic, and unconscious; it kicks in when we pull our hand away from a hot stove or step out of the street as we see a car racing toward us. System 1 is probably at work right now if you're a competent reader. You are making connections and associations without even realizing it.

System 2 is much slower, rational, and effortful. We rely on this system when we have to recall a series of numbers from memory or read a particularly technical passage of text. What's 45 multiplied by 97? Your system 2 just got to work.

Intuition falls squarely into the domain of System 1 thinking. It tells us the answer to something before we even know we know the answer. It gets us to the top of the stairs, both literal and metaphorical, before we even become aware of moving our legs.

The second characteristic of intuition is that it is parallel rather than sequential. When we employ intuition, we see a problem holistically, and simultaneously considering all of its features and components. Synapses fire furiously so that we can appreciate the whole picture swiftly, much like a talented chess player looking multiple moves



ahead to map out the future consequences. In the context of decision-making, analysts are trained to think systematically and sequentially about the steps of data analysis. On the other hand, decision-makers are often required to, and benefit from, consuming and synthesizing different pieces of information in parallel to arrive at a decision.

Finally, intuition involves your “gut” as well as your brain. Of course, that's not physiologically accurate—our stomachs can't think—but when we say “use your gut,” we are talking about human judgment that feels visceral and instinctive.

One famous case study that demonstrates all three of these characteristics vividly, but particularly the last, is featured in Malcolm Gladwell's best-selling book *Blink*. Gladwell recalls a researcher, Gary Klein, telling him a story of a team of firefighters being called to a burning house. The fire in the house appears to be coming from the kitchen, but when the crew tries to extinguish it with their water hoses, it continues to rage. After spending a few minutes in the burning house and observing the situation, the lead fireman tells everyone to evacuate the house immediately. Just seconds after they do so, the floor collapses. They likely would have been killed almost instantly if anyone had still been inside.

After the drama, it emerged that the source of the fire had not been in the kitchen but in the basement. But when asked what had triggered him to make the snap decision and urgently order everyone outside, the lead fireman was unable to give a real answer. He'd had no concrete information to inform a rational decision, but something had told him what had to be done. He purportedly felt it in his gut. He just sort of knew.

Something in this fire scene was different and surprising, which led the fireman to call the heroic shot to evacuate the house. Extensive questioning later revealed that the fireman had responded to subconscious clues and cues. Without knowing it at the time, he had noticed that the fire was unusually quiet and that the floor was much hotter than it should have been if the fire really had been in the kitchen. It was a combination of the “gut” and the brain, parallel thinking, that involved the eye observing the fires, the ears listening to the level of noise, and the sensation of heat that was much stronger than the fire he could see with his eyes. Data based on hundreds of

other fires might have indicated that it was most likely to have started in the kitchen—because that's where fires in the vast majority of cases do start—but if the fireman hadn't heeded his intuition, events would have taken a far more tragic turn that day.

In life-or-death situations, intuition often takes over. Our System 1 dominates out of necessity—call it a primal instinct that humans have cultivated over millennia. But under different circumstances, as managers and decision-makers in corporations, we rarely find ourselves in scenarios where decisions need to be made in seconds and with such high stakes. It is in those scenarios that we have the luxury of drawing on both intuition and quantitative knowledge and allowing one to make up for the shortcomings of the other.

Perhaps this seems too isolated and the circumstances unique. Most of us do not deal with life or death situations. How often would any of us sense there is an issue that quickly? Daily. You notice when there is a pause in the conversation with a colleague, and with no additional data, you begin to ask yourself questions to corroborate that intuitive spike. However, with family and friends, a shift in discussion topic or a delay in a response at the dinner table—or even in a text chat thread—begins to activate your intuition. For that signal to not become disruptive, you are best served correlating with facts and looking for the key to the new puzzle you were just presented—again this is QI.

Being able to combine qualitative thinking and intuition means possessing the ability to make confident decisions with incomplete information while counterbalancing our fear of failure. It means transforming different pieces of information into a decision by adopting a parallel view of all issues that matter, rather than just considering each piece of information separately and sequentially. Furthermore, it means enhancing our business acumen with the ability to spot patterns while also challenging how much value we are willing to attribute to those patterns and the data. We challenge patterns by asking the right questions: precise questions that are relevant and specific.

For many years, we have been teaching classes and programs on Quantitative Intuition™ at Columbia University, in Executive Education, and in custom private sessions for Fortune 500 companies. As part of the programs, we have asked executives to

identify the aspect of decision-making they think represents the biggest gap in their organizations when it comes to making smarter data-driven decisions. We give them the options of the five steps of decision-making:

1. Defining the problem
2. Data discovery
3. Data analysis
4. Insights or delivery
5. Implementation

While each step involves both quantitative and intuitive elements, you can think of steps 1, 4, and 5 as the more intuitive steps (*I* in *QI*) involving leadership and management skills. Steps 2 and 3 can be thought of as the more quantitative steps (*Q* in *QI*) requiring mostly analytic skills. Across hundreds of business executives we surveyed, it became very clear that leaders find a much bigger gap in the intuition steps than in the quantitative steps. While some leaders pointed out that their organizations suffered from a lack of reliable data, the most common gaps were identifying the problems and converting the analysis to insights and actions. Now think about where we get the most help from external sources regarding data-driven decision-making. There is an abundance of companies selling us data and the newest, shiniest three-letter acronym analytic tools. We get very little help defining the problem, generating insights, and converting these insights to actions. *Decisions over Decimals* is intended to bridge this gap.

This insight crystallized and focused our theory that business decision-making often neglects powerful skills and tools. Like many of the failed business examples we previously mentioned, decision-makers may feel confident or are hesitant, nervous, or conflicted when it comes to applying and acting on intuition.

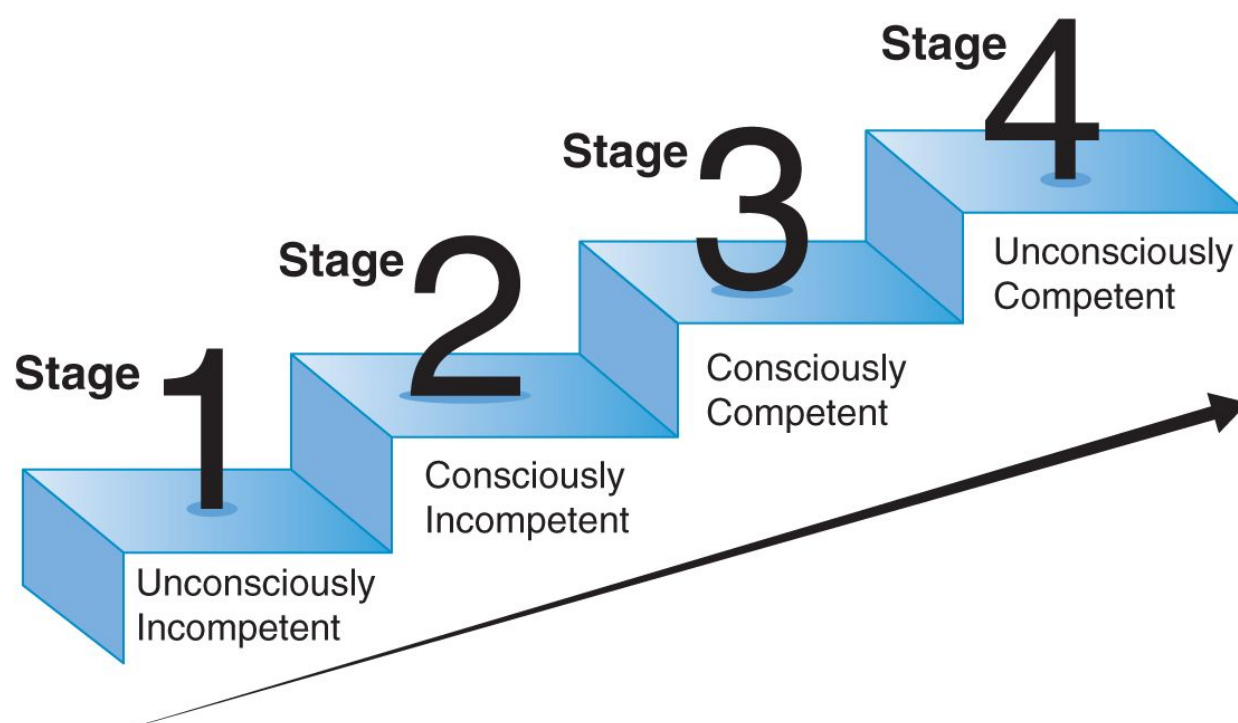
To that end, this book will help you to develop both sides of the coin, the quantitative and the intuitive, and integrate Quantitative Intuition into your team's ways of working. It will serve as an aid when you're faced with small decisions that must be made briskly, but also when

you're faced with weighty decisions with the potential to have a major impact on business, lives, and livelihoods.

It is clear that quantitative skills can be taught. After all, we have been taught quantitative skills from a very young age, since kindergarten, if not earlier. But one of the questions we are sometimes asked is: "Can one really teach intuition? Isn't intuition something you're born with, something that, by definition, you either have or you don't?" The theory of learning suggests that many intuitive skills like walking, riding a bike, or driving can be taught. It is simply a matter of re-application. In his book *The Empathic Communicator*,<sup>1</sup> William Howell suggests that there are two important dimensions to learning: conciseness and competence. These two dimensions create the four stages of learning (see [Figure P.2](#)).

At the lowest level of learning, we are so clueless that we are *unconsciously incompetent*. We don't even know what we don't know. Then, in the next stage of learning, we are *consciously incompetent*. For example, we buy a book like *Decisions Over Decimals*, watch a TED talk, or attend an online course and we start realizing the limits of our knowledge. For example, we learn that there is something called Quantitative Intuition, but we don't know yet exactly what it is. Then as we progress reading through the first few chapters of the book, we not only understand what QI is, but we also start to learn a few new skills that we jot down to try at work. We are transitioning to the third stage of learning. We are *consciously competent*. We are ready to start implementing the new skills we have learned, but it requires effort. It requires System 2 thinking, consciously and carefully thinking about what we do. Think about a toddler who is just starting to walk. They need to put all their cognitive capacity toward taking the next step without falling. If you are an experienced driver, think about your first few days driving. You were probably very proud of yourself for being able to competently maneuver the four-wheeled metal box. Still, you had to dedicate your full attention to operating the car while paying attention to the road conditions and the other cars on the road. You probably couldn't even fit into your cognitive capacity a conversation with your fellow passenger while driving. You were consciously competent at driving. At the highest level of learning, the nirvana of learning, you get to the fourth and final stage. You are *unconsciously competent*. This stage is often referred to as

habit or second nature. You have exercised the skill so frequently that it became like second nature, it became intuitive. You have just learned intuition. Think about walking, driving, or riding a bike. These activities that you had to learn at some point in time became intuitive through re-application. Think about our leader from the example at the start of this prologue who compared figures across slides. At the start, it was difficult, she had to pay close attention to do this, but now we know that she does it in almost every presentation; we learn to almost expect it from her. As you learn the different QI skills and tools throughout this book and start exercising them, these skills will also become intuitive for you.



**FIGURE P.2 Dimensions and stages of learning**

Broadly, the book is divided into three parts:

The first part, *Precision Questioning* ([Chapters 1–3](#)), is devoted to assessing the situation, effectively framing an issue, and identifying the question we seek to ask and subsequently answer. We believe that the most intelligent person in the room is not the one with the right answers but the one with the smart questions. Questions expose, reflect, and test assumptions transforming the data-driven journey from problems to actions. We provide you with several tools to help you focus on the essential questions.

The second part of the book focuses on *Contextual Analysis* ([Chapters 4–6](#)), developing intuition and exercising the ability to move confidently from data, through analyses, to business problems and decisions—challenging and interrogating the data and analyses, but only when it is relevant to the problem and decision at hand. We introduce the Fermi estimation methods and teach you to develop “numbers intuition” through approximation and back-of-the-envelope calculations. You will learn how to become a fierce, intuitive interrogator of data. How to put data and analysis in the context of your business and the decision at hand.

The book's final part ([Chapters 7–10](#)) centers on *Synthesis* by transforming analyses to insights, insights to actions, and actions to outcomes. While traditional data analysis techniques promote a systematic approach of summarizing data to inform actions, this essential section encourages parallel thinking to synthesize the data and insights to enable agile decision-making. It also illuminates the importance of effective communication to inspire action.

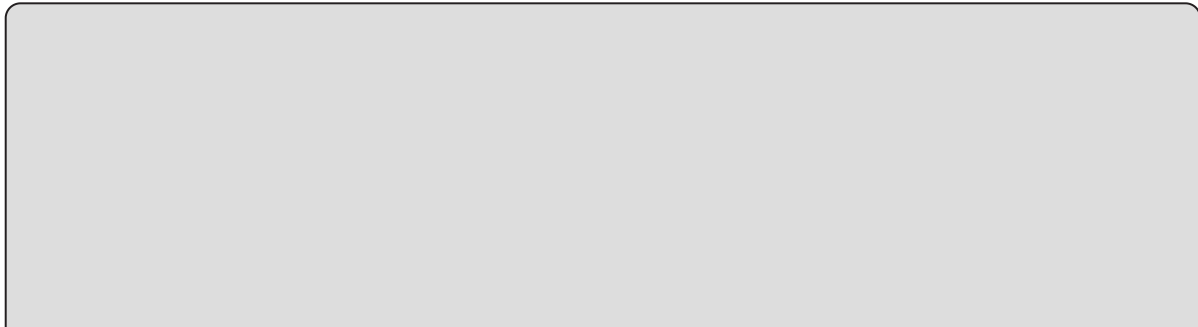
Across the three pillars of the QI approach—Precision Questioning, Contextual Analysis, and Synthesis—we first teach how to decode data and analytics, understand their limitations and values, and scrutinize and question them in the most effective way.

This book is a handbook on Quantitative Intuition. *Quantitative and Intuition* sounds like an oxymoron, but as you dive into the chapters, you will not only appreciate that it's possible to combine data insights with intuition, but in fact it is the best way to make smart decisions.

## Why Quantitative Intuition™

While we have promoted the value of intuition and listening to your “gut,” do not mistake our message to suggest that you should fully rely on your intuition and abandon the data. The main reason to combine intuition with data is that intuition alone can steer us wrong due to a host of biases. Biases in decisions can creep in both because one does consult data when making decisions and often looks at the data through a biased lens, and because one ignores data and relies solely on intuition.

Management and business writers love reciting stories of advice that were thought of as canny at the time of its delivery but later turned out to be wildly misguided. American astronomer Clifford Stoll is regularly mocked for a 1995 article he penned for *Newsweek* calling the internet a “trendy and oversold community.” We relish that IBM chairman Thomas Watson famously forecasted that the world would be able to accommodate “maybe five computers.” And even Albert Einstein's 1932 observation that there's not “the slightest indication” that nuclear energy will ever be obtainable is still regularly met with chuckles of incredulity. But the truth is that we've all suffered the same fate at one point or another, albeit perhaps not in relation to a concept that revolutionized the world in quite such a dramatic way. One such famous example of a statement that was found to be vastly erroneous in light of history was a Yale professor's comment to the founder of FedEx, Fred Smith, when he proposed the idea of FedEx as a student in college (see the call-out box, “In Order to Earn Better than a ‘C’ the Idea Must be Feasible”). So why do such intelligent and experienced individuals make such erroneous predictions? The main reason is that people suffer from biases that can steer them wrong. As a subpopulation of society, leaders often suffer from similar, and in some cases even more pronounced, biases.





## **“IN ORDER TO EARN BETTER THAN A ‘C’ THE IDEA MUST BE FEASIBLE”**

In August 1944, Fred Smith was born into a wealthy family in a small Mississippi town called Marks. When Fred was just four years old, his father passed away. The family was devastated; the elder Smith had been just 54 years old, but his life had already spanned an exceptionally successful career. In his five and a half decades on the planet, he'd displayed exquisite business acumen and remarkable entrepreneurial spirit, which would feed a posthumous legacy for many years to come.

In 1925, after receiving a used truck as a gift from a previous employer, Fred's father had launched a highway coach service that was renamed the Dixie Greyhound Lines when the Greyhound Corporation bought a controlling stake in it in 1931. Later, Smith invested in—and became president of—a fledgling and later wildly successful restaurant line called Toddle House, which specialized in takeout breakfast but served food around the clock.

Despite the Smith family's wealth, Fred's childhood wasn't easy. Not only did he lose one of his parents at a tender age, but he was also born with a condition called Calve-Perthes Disease, a congenital defect that temporarily interrupts the blood supply to the hip joint. For much of the first decade of his life, Fred was dependent on braces and crutches to walk, which significantly inhibited his self-confidence and ambition despite efforts from his well-meaning mother and uncles.

Fortunately, as he got older, things changed for the better. By his teenage years, Fred's health had improved dramatically until he grew out of the disease entirely. He started playing sports, and his academic prowess helped him excel at school, eventually earning him a spot at Yale University where he started studying in 1962.

Yale embodied a world of opportunity for Fred. He became a member of—and eventually presided over—the Delta Kappa Epsilon fraternity, through which he befriended the brother of future U.S. President George W. Bush. He also developed a friendship with John Kerry, who would later serve as U.S. Senator



and Secretary of State. Either of these acquaintances could have been life-altering for Fred, but it was a seemingly innocuous term paper that he wrote for his economics class that ended up defining his life like nothing else that happened at Yale.

Perhaps he was inspired by the indelible mark his father had left on the logistics sector, or perhaps it was something else entirely, but in the paper, Fred argued for the need for a reliable overnight delivery service for goods in the dawning age of information. At the time, packages were transported with the excess capacity at the bottom of commercial airplanes. Typically, people want to fly during the day. Business packages are often sent at the end of the workday with the expectation of arriving in the morning at their destination. Fred's idea was to create a special airline to deliver packages. He was wildly enthusiastic about the concept and it showed in his writing, but his professor did not share his eagerness. "The concept is interesting and well-formed," the professor concluded. "But in order to earn better than a 'C', the idea must be feasible."

Fred graduated in 1966 and enlisted in the Marines with a bachelor's degree in hand. He was sent to Vietnam, where he found himself receiving an education of an entirely different kind. "As a platoon leader in Vietnam, I was in charge of a group of youngsters who had come from very different backgrounds than I had. You know, blue-collar backgrounds: steelworkers, truck drivers, gas station folks," he told a reporter in 1998. "The experience gave me a very different perspective than most people who end up in senior management positions on what people who wear blue collars think about and the way they react to things, and what you should do to try to be fair to those folks."

After two tours of duty, Fred left Vietnam and headed to Little Rock, Arkansas, where his stepfather had bought an ailing company that modified aircraft and revamped engines. All the while, his mind would intermittently return to that economics paper he'd penned at Yale and the overnight delivery idea that had germinated and formed the basis of it. One day, while struggling to source parts for a particular aircraft engine he made a decision. The only way to determine whether it was really ever going to be worth more than a 'C' was to give it a shot.

He developed an integrated air and ground delivery system plan according to which packages from all over the U.S. would be flown to a central hub, where they would be sorted and then distributed along specific routes or “spokes” as he called them. The actual travel would take place at night. The packages would be delivered to sizable airports in major cities and then a fleet of trucks would transport them to their final destination, however remote. Fred still had a few million dollars in the bank that he had inherited from his late father. Coupled with fierce determination, he put it to work. Federal Express, better known as FedEx, began operating in April 1971.

In 2021, as the company turned 50, its market capitalization was hovering around \$80 billion. To the professor, the idea for FedEx might've been no better than a ‘C’, but in Fred's case, it paid off. By April 2021, his estimated personal net worth had surpassed \$6.5 billion.

In conducting research for this book, we were unable to track down the professor who offered Fred that dispirited feedback all those years ago. If we had been able to—and if, of course, we'd found that person to still be alive—we would have told her or him two things in the spirit of kindness and compassion.

First, we would have said, “You're not alone.” History is painted with erroneous predictions and statements that did not stand the test of time.

The second thing we would have said is “Thank you!” The FedEx story is a beautifully evocative, even cinematic, demonstration of how biases in real life affect the way we make decisions.

*Heuristics* can generally be defined as rules of thumb or shortcuts that the human brain uses to draw conclusions or make decisions about something. These heuristics are at the heart of Kahneman's System 1 thinking that we discussed earlier. They allow us to move on with our lives and fit everything we need to do within the 24 hours we have each day. Sometimes these heuristics are entirely adequate and serve as a perfectly good conduit to get us to where we need to be, but other times they lead us entirely astray and cause us to make decisions and judgments that turn out to be flawed. Biases are

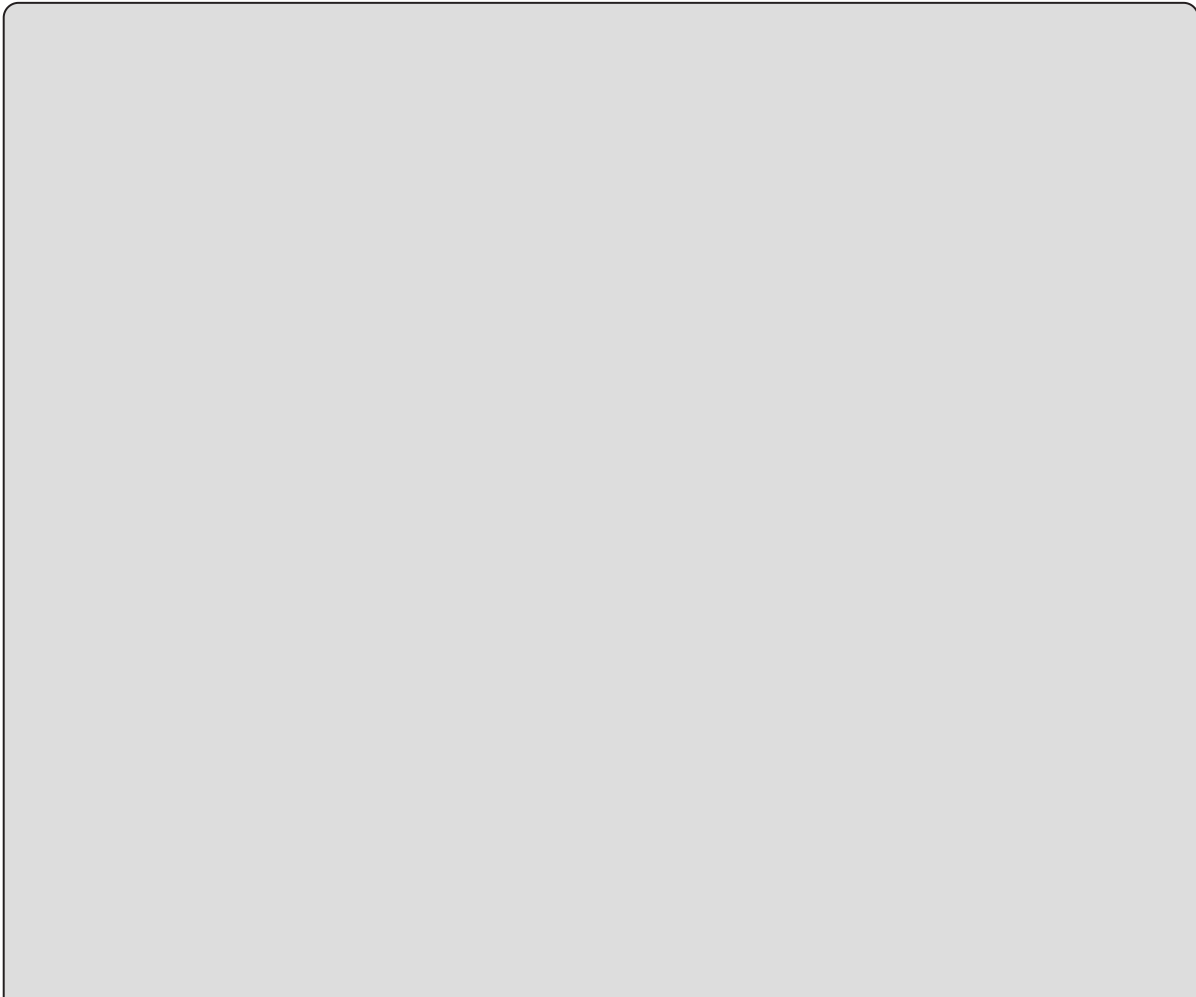
particularly important to understand in the context of intuition. Their existence certainly doesn't make intuition any less valuable as a component of good decision-making, but it is critical to be aware of biases that may arise from intuitive decision-making. Understanding biases and knowing how to navigate them is the first step in attempting to avoid them.

The beauty of the human race—what makes life interesting and worth enduring—is that individuals are not robots. We all have opinions that are shaped by factors we're not aware of, by preconceptions we don't know we have, and by beliefs we don't know we hold. The decisions we make will always be affected by bias. But to be the most effective decision-makers, to be able to foster and develop our quantitative intuition, we must be aware of the presence of biases and the impact they having on us in order to check them, control them and minimize them wherever possible.

Many books have been written about biases in decision-making. Our objective here is not to survey this literature, but rather to highlight when and how those biases can affect our intuitive mind as well as our quantitative thinking. When working purely based on intuition, some biases can become more prevalent because we do not have data to prove our intuition wrong. On the other hand, a different set of biases can arise when looking at data from a biased perspective.

## Biases from Working Intuitively

Probably the most prevalent bias that prevents decision-makers from consulting data is *overconfidence*. Overconfidence is a particularly powerful source of illusion and it is therefore extremely important to be aware of it when relying on intuition as a tool for making decisions. The cruel nature of overconfidence is that it is hard to identify, purely because we often don't know what we don't know. Or in other words, we're so confident that we know the answer to something that we don't even entertain the idea that we might be mistaken. This is a recipe for disaster when it comes to data-driven decision-making as overconfidence in our erroneous conclusions prevents us from seeking the possibly correct answer in the data. In fact, and this might seem surprising, as leaders and experts in a given field tend to be more prone to the overconfidence bias than nonexperts precisely because they think of themselves as likely to be correct.



## OVERCONFIDENCE, OPTIMISM, AND THE \$700 JUICER

In theory, Doug Evans could well have been on to something. In 2013, when he launched Juicero, a company that made and sold high-end Wi-Fi-connected juicers, there were certainly reasons to believe that his venture would be a roaring success.

Healthy, wealthy Americans were eager for tasty new ways of sustaining their nutrition-conscious lifestyles. Juicing was all the rage; Chicago-based Information Resources Inc. (IRI) estimated the refrigerated juice and juice drinks category at more than \$6.6 billion by May 2013. The juice drink smoothie segment outpaced the overall category with growth just shy of 32% for \$701 million.<sup>4</sup> The data clearly indicated a rising thirst for fresh juice.

Large organizations were also making moves, notably with Evolution Fresh, acquired by Starbucks in November 2011. As stated in *QSR*<sup>5</sup> magazine, “Starbucks is so bullish on juice that it is building a high-tech juicery that will quadruple production and distribution capacity to take part in what it calls the ‘\$3.4 billion and growing cold-crafted juice category.’”

The investor community seemed sold on the idea too: Evans managed to raise \$120 million to get Juicero off the ground, attracting plenty of positive media coverage in the process.

But not long after launching, cracks started to appear. After an initial mini-surge, demand started to look lackluster, and Evans and his team were forced to slash the machine's price from an initial \$700 to just \$400. And then there were the journalists who suddenly seemed to have changed their minds too. The bandwagon perspective had shifted.

Juicero machines worked by squeezing small pouches of pre-chopped produce, each making a modest-sized glass of juice. But when a story published by Bloomberg pointed out that two reasonably strong hands clenching the pouches firmly could achieve exactly the same result and in a shorter time, Juicero went viral for all the wrong reasons.

The company was called out on social media for epitomizing Silicon Valley's chronic excess and obsession for creating solutions to problems that simply don't exist. In September 2017, the company announced that it was shutting down, consigning Evans to a long list of entrepreneurs who couldn't generate business results that matched their ambition.

The quantitative market research might have indicated appetite, and perhaps there was no obvious competitor. Evans may even have created some conservative sales projections that suggested his business model would likely be sustainable, but did he ask himself all the salient questions? Would Evans himself have splashed \$700 on a machine that takes three minutes to squeeze a small pouch of fruit and vegetables into a small glass? Would it have bothered him as a customer if he had found out that he could have made the juice in less time with his own hands? Any member of the Juicero team or their investors, listening to their intuitive voice for an honest assessment of these fundamental questions, could have foreseen why Juicero would fail. They were overconfident and overly optimistic about riding a couple of trendy waves and thinking they could squeeze \$700 from the customer's pockets for it.

Overconfidence's bedfellow, if you will, is the *optimism bias*. Many studies have shown that when entrepreneurs are asked to estimate the chance of their business succeeding, they're likely to predict a much higher likelihood of their business' success than if they're asked more generally about the chance of a business just like theirs doing well.<sup>2</sup> Indeed, because of their strong conviction in their idea, entrepreneurs often tend to overly rely on intuition and neglect data points that hint at risk to their idea (see call-out box “Overconfidence, Optimism, and the \$700 Juicer”).

Another bias that tends to appear when decision-makers rely mostly on their intuition and the available information is the *availability bias*. In short, that availability bias suggests that people use the most available information to make a judgment. Humans tend to think an event is more likely to occur if it's easily imaginable or if a specific example of a similar event occurring is easy to recall. For example, if

100 individuals were to be divided into two groups, with members of the first group asked to estimate the annual number of murders in Detroit and members of the second asked to estimate the annual number of murders in Michigan, the mean estimate in the first group is very likely to be higher than the second even though murders in Detroit (the capital of Michigan) would necessarily only represent a subset of overall murders in the entire state of Michigan. Why? Because people are more likely to recall headlines and news bulletins about murders in Detroit than in Michigan.<sup>3</sup> Such headlines are likely to be more striking and that's where the availability bias comes in. Similarly, populations regularly overestimate the number of yearly deaths due to shark attacks because the ones we hear about are so dramatic or remarkable that they're hard to forget, and the ease of imagining such events thanks to movies like *Jaws*.

But bringing in data is not always a cure for biases. The data itself may spark its own unique set of biases.



## Biases from Working with Data

When looking at data, sometimes we see things that aren't there; we recognize patterns that don't exist and, at the same time, we entirely miss patterns that are there. One widely cited example of this comes from an experiment created more than two decades ago by two academics to test the idea of *Selective Attention*.<sup>6</sup> Study participants were asked to watch a video in which two teams, wearing black and white shirts, are shown passing a basketball. Participants in the study were tasked with paying close attention and counting how many times the players in the white shirts passed the ball between them. About halfway through the short video, somebody in a large gorilla costume walks straight into the middle of the game, stands still, pounds their chest for a few seconds and then leaves again.

When participants were questioned about their observations afterward, many could correctly say how many times the players passed the ball, but fewer than half of all the participants said that they noticed the interrupting ape. And even after being told what had happened, the majority claimed that there's no way they could have missed such a noticeable thing. This is a great example of how focusing on specific aspects of data may distract you from seeing other things in the data, even if it is literally a gorilla in your data.

The context in which a decision is made introduces us to another set of relevant biases. The *anchoring bias* dictates that humans tend to overvalue the first piece of information that's provided to them when compared to subsequent data points. Think of the impact of anchors in salary negotiations, for example. The sheer power of anchoring can be quite striking, as demonstrated through an experiment that was conducted while teaching MBA students. In the study, students in an MBA class were asked to bid on a good bottle of wine, but before opening the auction, students were asked to write down on a piece of paper the last two digits of their social security number. Despite the fact that these students are, for the most part, highly intelligent and consider themselves to be largely rational, and although they would scoff at the idea that their social security number is in any way related to how much they're willing to bid on wine, time after time the experiment revealed a surprising result. Students for whom the last two digits of their social security numbers are above 50 tend to bid



more than those whose numbers were below 50. Entirely random numbers that students were asked to write down before making a bid impact the choices they made even if they were acutely aware of the fact that these numbers have nothing to do with the decision or its outcome.

Now take the anchoring bias to a business meeting environment, say a meeting around projections for next year's operation. The meeting starts and someone throws into the air their projection for next year's sales. At this point, all numbers are likely to be anchored toward the number that was voiced, whether it was right or wrong. Even those who think the number mentioned is way too high or way too low will likely anchor their new estimate toward that number. Even worse, if the first number thrown into the air comes from a leader, the anchoring bias is likely to be stronger. But leaders are often the first to speak in any business meeting, making the likely anchoring more pronounced in practice. We have two practical pieces of advice to mitigate the anchoring effect in business settings. First, if the meeting is around a specific number, at the start of the meeting, ask every person in the room to write down on a piece of paper their estimate for the number. That way, when the discussion starts and people are susceptible to other anchors, they will at least be also anchored toward their initial estimate. Second, if you are the leader in such a meeting, speak last to avoid anchoring others to your views.

An important bias that is particularly troubling when people look at data is the *confirmation bias*. Confirmation bias means that we tend to overweight and overvalue information and data that explicitly supports our initial opinion or belief about something. As we discuss later in the book, becoming a fierce interrogator of data, asking questions such as “What data am I not seeing?” or “Who delivered the data and why?” can help identify instances of confirmation bias.

Other biases related to looking at data include *conservatism bias*, which presents itself in people tending to favor older information and undervaluing new data points, and *information bias*, which describes the tendency to seek new information even if it is not directly relevant to the decision that we're trying to make. We revisit that last bias again and again over the following chapters of this book as we seek to underscore why certainty—and the perfect decision—is entirely unattainable.

# Notes

1. Howell, William Smiley. *The Empathic Communicator*. Wadsworth Publishing Company, 1982.
2. Salamouris, Ioannis S. "How Overconfidence Influences Entrepreneurship." *Journal of Innovation and Entrepreneurship*, 2013, 2(1): 1–6.
3. Kahneman, Daniel, and Shane Frederick. "Representativeness Revisited: Attribute Substitution in Intuitive Judgment." *Heuristics and Biases: The Psychology of Intuitive Judgment*, 49 (2002): 81.
4. "2013 State of the Industry: Juice & Juice Drinks." *Beverage Industry*, July 10, 2013.
5. "The Great Juice Rush of 2013." *QSR*, March 2013.
6. Chabris, Christopher F., and Daniel J. Simons. "The Invisible Gorilla: And Other Ways Our Intuitions Deceive Us." *Harmony*, 2010.



# CHAPTER 1

## Asking Powerful Questions

*The important thing is not to stop questioning.*

— **Albert Einstein**

Eighteen months. That is the age, according to psychologists, at which children start to seek information. At the age of about 36 months, this fledgling curiosity translates into verbal questions. The questions can seem countless and random, darting from one topic to the next seemingly indiscriminately. Why does it rain? What is the moon made of? How do birds fly? Where did the dog go? When can we go to the park?

By the age of three, we are naturally wired to ask what are known as the 5Ws and H questions: what, when, where, who, why, and how. These are open-ended questions, meaning that they must be answered with more information than just a simple “yes” or “no.” The 5Ws and H are information-seeking questions that spark new ideas and inspire conversation. When a child isn't satisfied with a response to a question, they simply keep asking.

How do adults, respond to a child's 5Ws and H questions may help that child's development and accelerate new ways of thinking. Countering a child's question with another question could motivate them to think critically. Responding to the question, for example, of where did the dog go, by saying “Where do you think the dog could be found...?” could stimulate new answers, spark a fresh perspective, or encourage a different exchange.

As children get older, their questions increase in frequency and complexity, indicating growth in their analytical skills. As they mature and develop, they will start to question everything in their daily lives. Anyone who interacts with teenagers regularly may have experienced this greater degree of questioning.

But this insatiable curiosity to learn by questioning often takes a pivot when a child starts grade school. Slowly, the focus of education shifts from asking questions to having answers. A new habit begins to take root as children are asked to raise their hands if they know

the answer. This mindset—the expectation to deliver an answer rather than ask more questions—only deepens as young people continue their education journey.

By the time we start working, it is instilled in us that we need to have answers. In the work environment, the value of questioning is frequently, largely, and wrongly overlooked. Answers are championed; solutions are expected; more questions are implicitly discouraged. Consider performance reviews. Leaders rarely allocate much time to highlighting how someone challenges the status quo, opens a new line of thinking, or stimulates a different dialogue. Instead, they focus on outcomes. Yes, results matter, but could those results have been more significant and achieved with less risk through a more intelligent allocation of resources or with a more creative strategy? Too often, we neglect the fact that top performers are the ones who ask questions and activate critical thinking that can expose weaknesses in a strategy or reveal an alternate path.

The path back to our young, inquisitive self is short. In fact, it depends on asking ourselves one question that links our professional and personal lives: How do we grow? This question underpins every project, every request, every meeting, and even where we choose to work and live. It is rarely asked as directly as this, but the answer to this underlying question is what shapes our careers and lives. We grow through questioning. Understanding this point creates the scaffolding that helps determine how to increase personal satisfaction or the company's market share, grow our customer base, help increase product usage, or drive renewals. If you seek growth, you need to stimulate critical thinking. For that, you need powerful questions.

# Road to Powerful Questioning

While we are wired from a young age to ask questions, we are rarely taught to develop the skill of questioning effectively. Too often in business, we overlook the importance of questioning. We fail to appreciate questioning as an integral skill necessary for doing our jobs. We don't invest enough time and energy in training ourselves and others to be effective inquisitors.

The foundation of Quantitative Intuition (QI)<sup>™</sup> is learning to become a fierce interrogator. The first pillar of QI is precision questioning. In this chapter, we discuss a practical approach to probing an issue by asking a string of questions to rapidly explore a topic while at the same time building and extending your partnership with your stakeholders. When done well, it is a dance, with each partner contributing to the exchange, reading the tempo, adjusting their responses, and supporting the other, resulting in a smooth, fluid movement.

On the surface, you know how to recognize and ask a question. A *question*, according to the Oxford English Dictionary, is a sentence expressed to elicit information. Taking this one step further, a question may lead to a hypothesis that you test to ascertain whether that hypothesis is true or needs to be refined. Applying the scientific method leads to a question-hypothesis-learning loop that yields new data to analyze. It is a continuous learning cycle. When you get new information, you ask additional questions that may spark new hypotheses that you then test and refine. This cycle enables you to drill down to the root cause and arrive at a conclusion.

Is this the process you use when you take on an assignment at work? Too often, we omit the learning cycle. Instead, the data-decision journey is viewed as a one-way street. What is expected is an actionable recommendation supported by compelling conclusions with relevant data, a straight line from point A to B. This is viewed as the most efficient route and the iterative question-hypothesis-learning loop is neglected.

# Precision Questioning

The oldest and still the most powerful tactic for fostering critical thinking is the Socratic method, developed over 2,400 years ago by Socrates, one of the founders of Western philosophy. The Socratic method uses thought-provoking question-and-answer probing to promote learning. It focuses on generating more questions than answers, where the answers are not a stopping point but the beginning of further analysis. Managers can use this model in a modern-day organization to create a dialogue among colleagues, clients, or stakeholders. The method is used to find a productive path forward and guide data discovery through a series of steps. These steps include examining an issue, questioning the outcome, and finding true knowledge by applying different types of questions.

One modern-day version of the Socratic method is *precision questioning* and *precision answering* (PQ/PA), which became popular in Silicon Valley. This method was created by Dennis Matthies and Monica Worline, Stanford University educators who taught at the Center for Teaching and Learning. Precision questioning provides its practitioners with a highly structured, one-question/one-answer discussion format to help them solve problems or conduct deep analysis.

The way PQ/PA works is that one participant asks a question, and the respondent answers it. The questioner uses that answer to ask a follow-up question, and so on, until the respondent finally says, “I don't know.” The idea is to answer as many questions as possible before finally reaching the point where the respondent cannot answer the question. The process pushes critical thinking to a deeper level and can elicit new information or analysis.

For example, in our experience, analysts often know more than they are sharing in a typical presentation. They may exclude information not out of an unwillingness to be helpful, but because they over-index on accuracy. By training and inclination, analysts often focus their attention on the specific, the rational, and the explicable. By asking questions, PQ/PA encourages them and other team members to think more broadly.

The authors of this book have had the opportunity to learn about PQ/PA first-hand from Matthies. By its nature, it is direct, rapid-fire, and pointed. The call-and-response model is designed to uncover weaknesses in thinking. Precision questioning holds to the ideal of gathering information quickly. When drilling into a topic, the questioner strives to avoid personalization, so the questions are not seen as personal. However, depending on the problem being investigated or the questioner's skill, the method might be alienating in some company cultures. To counter this effect, leaders must foster a more open environment.

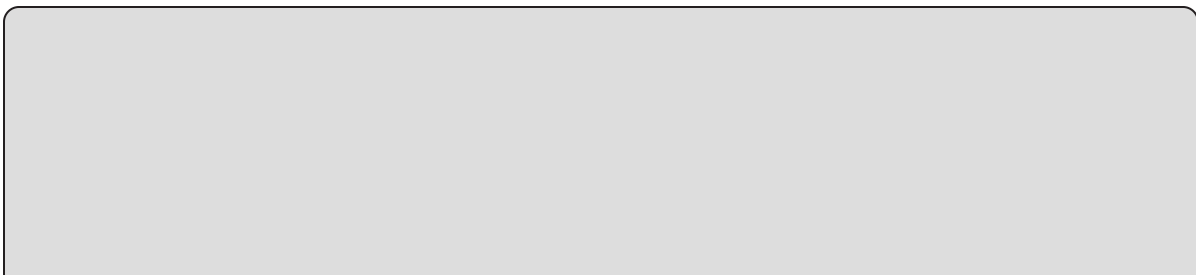
To reap the greatest benefits of PQ/PA, leaders should embrace the opportunity to pivot from interrogation to integration. The best leaders do this by fostering a collaborative learning environment where people have the trust to speak openly, share their ideas, and challenge the status quo. The hallmarks of a successful meeting are open-mindedness, patience, and mutual respect. As a data-driven leader, your role is to serve as a coach to unlock and integrate the intrinsic knowledge and awareness of each person on your team. This is effectively done through questions.



# The Power of Precision Questions

Questioning is a skill. Like other skills such as active listening, time management, or collaboration, it takes training, practice, and application to become proficient. The journey begins with an appreciation for different types of questions. Questions can be broadly classified into four categories:

- **Factual Questions:** This type of question has straightforward answers based on facts or awareness. These questions can be open or closed. The answers to questions are based on facts but may require an explanation.
- **Convergent Questions:** These are close-ended questions with a finite set of answers. Typically, these questions have one correct answer. The most basic convergent question can be answered with a “yes” or “no.” For example, consider Spiderman from Marvel Comics. How did Spiderman get his powers? The answer is clear and specific. He was bitten by a radioactive spider.
- **Divergent Questions:** These are open-ended questions that encourage many answers. These questions can best be understood as exploratory—as means for analyzing a situation, problem, or complexity in greater detail and then predicting different outcomes. Frequently the goal is to stimulate creative thought or to expand the conversation. For example, if every petrol station installed multiple fast electric charging stations, how would that change the demand curve for electric vehicles? If you could “fill-up” your electric car by simply swapping out batteries versus recharging the batteries, how would that change consumers' range anxiety about electric vehicles? (see call-out box Divergent Questions for a sample of divergence questions)



## DIVERGENT QUESTIONS

1. Go/No Go: Why are we talking about this now?
2. Clarification: What is the meaning?
3. Assumptions: What are your assumptions?
4. Foundational: How do we know this to be true?
5. Action: What could be done? What should be done?
6. Cause: What is the context? Why did this happen?
7. Effect: What will be the impact or outcome?

- **Evaluative Questions:** This type of question requires deeper levels of thinking. The questions can be open or closed. Evaluative questions elicit analysis at multiple levels and from different perspectives to arrive at newly synthesized information or conclusions. For example, what are the similarities and differences between... ?

# Building an Inquisitive Team

One of the best LinkedIn profiles starts with “I am insatiably curious.” What would it take to build a team of insatiably curious, truly inquisitive people? A team that has a thirst for learning? Building an inquisitive culture involves a combination of what and how. The what is a combination of the types of questions previously outlined, and the how is the environment you create. Great leaders create great cultures. There are three basic steps to building an inquisitive culture:

1. Start with an open-ended question.
2. Respond, don't react. Embrace silence.
3. Ask a stream of questions.

## Step 1: Start with an Open-Ended Question.

Having a good arsenal of questions at one's disposal is a must for any leader, but the one staple of any leader is the open-ended question. Asking open-ended questions is like adjusting the lens of a camera, opening the aperture to create a wider field of view. This wider field sets a tone of receptivity, signaling that you are open to new information, in learning mode, and ready for a dialogue not a monologue.

Here are three practical open-ended ways to start a conversation:

1. Help me understand...
2. Have you considered...?
3. What surprised you?

The simplicity of starting with one of these three-word statements belies their power. We call these multiplier questions as they are designed to increase the dialogue. Open-ended questions also serve as a relief valve, reducing the tension of having the correct answer.

“Help me understand” enables you to take a posture of learning and humility. It communicates that I don't know what I don't know. I am

hungry to learn.

“Have you considered” puts the power in the other person's hands. It equips them to discuss their assumptions and caveats and share any trade-offs they may have made. A variation of this, beneficial when providing feedback, is “you may want to consider.” Again, it is up to them to decide whether they want to take action or explore further. You are empowering them.

“What surprised you?” is an open-ended question designed to reduce bias. The word *surprise* is a bias killer. We all have biases—preconceived notions. Some are conscious and others are unconscious. The latter is often called “implicit biases,” which the Kirwan Institute at Ohio State University defines as “the attitudes or stereotypes that affect our understanding, decisions, and actions in an unconscious manner.”

Without being aware of their influence, implicit biases affect how we interpret and tell a data story. The brain is wired to connect new information to past interpretations to learn quickly. These mental processes naturally introduce bias as we interpret new information. An analyst, as someone who is expected to interpret data rationally and logically, may be hesitant to share data they cannot explain. They may be tempted to label an unexplained result as an outlier and disregard it or relegate it to an appendix. As the leader, you may miss a rich data point or a potential winning solution by not knowing about these outliers. When you ask, “What surprised you?” you are giving your colleagues permission to share what they did not expect to see, what might fall outside of their logical lens. “What surprised you?” creates a trusting, inviting space for an open discussion.

In our experience, asking your analyst the powerful question of “What surprised you?” often leads to two additional beneficial outcomes. First, it releases the analyst from the need to describe their hard work and chronologically go through all of the analysis that they have performed over the past few weeks. It cuts straight to the chase to the interesting findings. Second, by their definition, surprises are likely to be patterns that are not easily explained. Identifying these surprises may help you quickly identify problems with the analysis. What may be a surprise for the analyst who may

not be aware of the context may be easily explained by the context-aware leader.

## **Step 2: Respond, Don't React. Embrace Silence.**

You may have heard the term active listening. It involves paying close attention to words and nonverbal actions and providing feedback to improve mutual understanding. But have you ever stopped to consider passive listening? Passive listening also involves listening closely to the speaker but without reacting. Instead, passive listening leaves space for silence. By combining both of these modes, we achieve what we call *effective listening*.

Effective listening focuses on two elements of the communication process: silence and responding versus reacting. To create a learning environment built on trust, you need to listen. Listening begins with silence. Because it creates a void, silence may cause some discomfort, but it is an effective way to enhance learning. During the silence, the speaker will fill the void, often revealing more information; hence you learn more. Silence signals that you are fully engaged; you are listening intently, considering what is being shared so you can respond in a meaningful way.

The difference between responding and reacting lies in the level of consideration. Reactions tend to be instinctual, spontaneous impulses driven by emotion without considering the result. Reactions often come without a filter, without much thought or analysis, and without taking time to consider possible implications. Even if a reaction isn't intense or negative, it disrupts communication. For example, a listener may feel the need to share a related story. The intent is positive—to show understanding—but the unintended consequence is to redirect the speaker's attention toward the listener. The listener has shifted the conversation and taken control of the discussion.

Contrast this with responding. A response is thoughtful, logical, and informed. Responding uses your head and your heart to consider the outcomes of a reply before speaking. Responding is thoughtful; it involves taking time and using silence to process new information. Responding is also proactive, using intuition and experience to consider what is optimal for you, for others in the meeting, and for

the desired outcome. You can then engage in a way that is accretive to the result you're trying to achieve. In many situations, work or personal, responding versus reacting will yield richer results. You should joyfully embrace it, not only when someone is presenting an idea or information but also when someone asks a question.

### **Step 3: Ask a Stream of Questions.**

One of the most powerful response techniques is the ability to ask questions. Questions frame the issue, remove ambiguity, expose gaps, reduce risk, give permission to engage, enable dialogue, uncover opportunities, and help to pressure-test logic. Questions that are informed, thoughtful, and relevant advance learning. Varying the questions sustains engagement and fosters creative thinking. The goal of asking questions is not to achieve a single right answer but to accumulate and expand knowledge through the questioning process.

Returning to our camera lens analogy, open-ended questioning provides a wide-angle lens. It enables you to capture the broader picture and take in crucial background elements, allowing you to explore the scene with an unrestricted view rather than through a narrower analytical lens.

Of course, this wide view also creates distortion. Open-ended questions provide much more real estate to work with, but ultimately, we need a sharper picture to make smarter decisions. To quote the famous photojournalist Robert Capa, “If your photographs aren't good enough, you're not close enough.” Questions also allow you to narrow the lens, to get closer. By asking a stream of questions and using the different types, you can focus the data picture.

Start with the basics. Your ability to focus starts with developing comfort with the four types of questions—factual, convergent, divergent, and evaluative. This is the question library that equips you with the capacity to ask a stream of questions.

As your progress with the discussion, the secret to asking questions is to be precise. Your questions are still open-ended but focus on particular aspects of an outcome you are looking to achieve. Start to transition from a broad question—How do we increase sales?—to more precise questions—What specific promotion has had the

highest response among older millennials? Did your analysis uncover any variations by gender? Were there surprises in the sales data from a geographic view? How would your conclusion change if you were the competitor? As you consider the new information shared, are you clear on how it relates to the original problem or the outcome you are working toward?

# The Smartest Person in the Room

The smartest person in the room is not the one with an answer, but the person asking the best questions. That is the irony. If you seek bolder recommendations, ask better questions. Answers come from the discovery journey. Ask a stream of questions, develop the skill to pivot, dive deep, and come back up. Questioning is analogous to pulling threads on a sweater. Some loose threads will just come out; others, if pulled, can unravel the whole sweater. Questioning enables you to quickly pull threads to see which are superfluous, which are integral, and consequential.

Questioning is a skill worthy of your time to practice and master. It starts with understanding the taxonomy of questions. By being aware of the different types of questions and tapping into their power, you will arrive at better decisions. You will be able to influence strategy by building new connections.

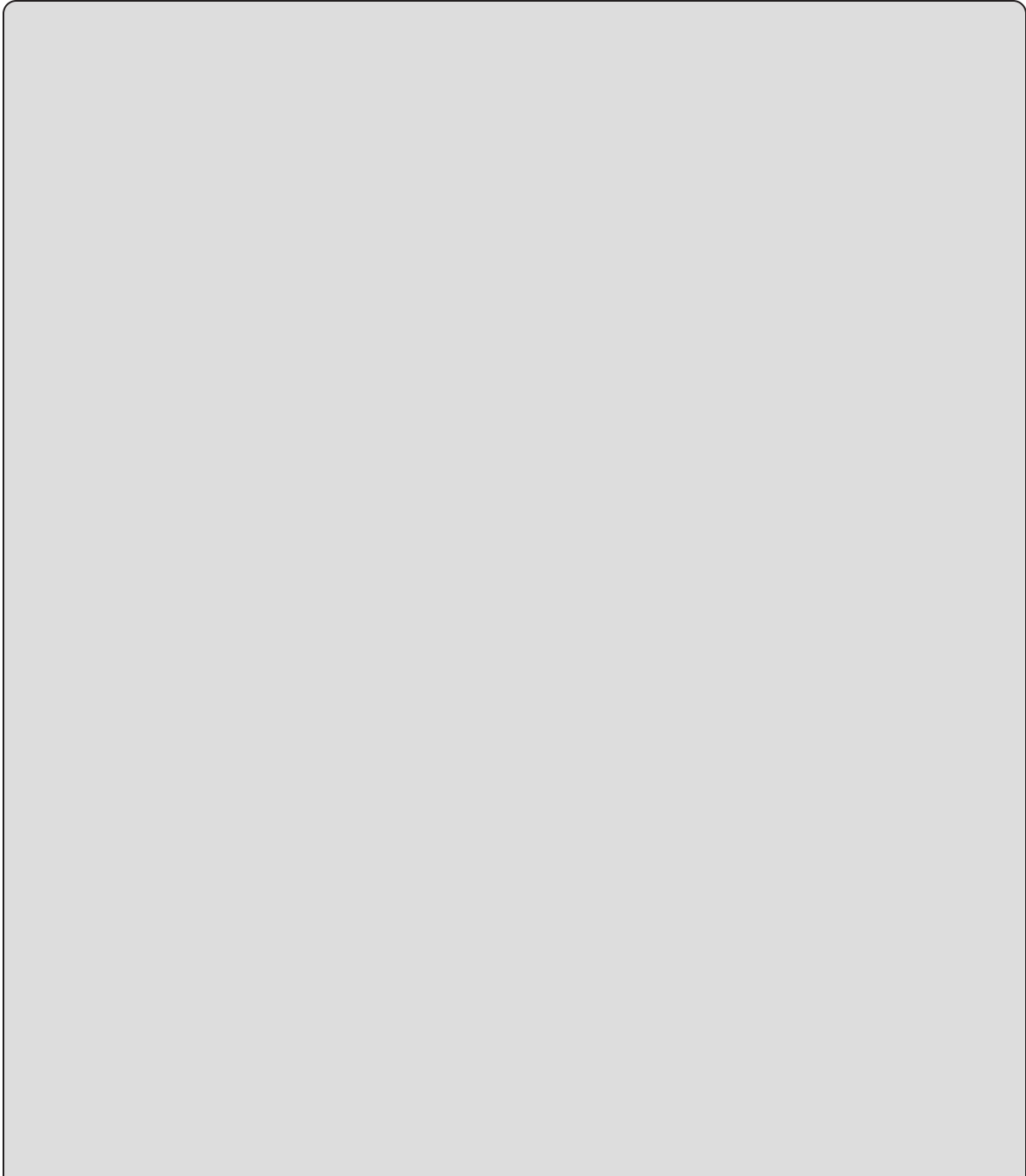
Becoming a robust questioner is also about creating a cooperative process to elicit new learning through a series of questions. Questioning helps your team make inferences and connections about data and open up viewpoints or analysis that is not apparent. This exploration mindset encourages trial and iteration; unexpected solutions originate from the discussion, not data. As a leader, you should strive to create a learning environment that fosters the question-learning loop.

Building a team of questioners is the path to winning, to achieving the robust growth many companies seek. Modeling and embedding this critical competency in your team's culture will enable team members to quickly navigate the data decision journey to arrive at new answers sparking more ambitious agendas. Your analysts will be better critical thinkers, strengthening creativity, collaboration, and communication across the team. When this kind of interaction is encouraged, you have a robust, healthy, productive culture.

Knowing all this is just the beginning. Now it's time to ask yourself, as a leader, do you reward critical thinking? Is critical thinking part of your leadership behavior? Do you offer training in questioning and critical thinking?



Since all work and no play is boring, we thought we would share how you can effectively use questions in nonwork environments to get to know people at a different level. One of the best-known question sets is the Proust Questionnaire. It is thoughtful, fun, and concise. The Proust Questionnaire was popularized by Marcel Proust, the French novelist, who believed that, in answering these questions, an individual reveals his or her true nature.

A large, empty rectangular box with rounded corners, intended for the Proust Questionnaire. The box is light gray and occupies the lower half of the page.

# THE PROUST QUESTIONNAIRE

Questions Made Famous by Marcel Proust

1. What is your idea of perfect happiness?
2. What is your greatest fear?
3. What is the trait you most deplore in yourself?
4. What is the trait you most deplore in others?
5. Which living person do you most admire?
6. What is your greatest extravagance?
7. What is your current state of mind?
8. What do you consider the most overrated virtue?
9. On what occasion do you lie?
10. What do you most dislike about your appearance?
11. Which living person do you most despise?
12. What is the quality you most like in a man?
13. What is the quality you most like in a woman?
14. Which words or phrases do you most overuse?
15. What or who is the greatest love of your life?
16. When and where were you happiest?
17. Which talent would you most like to have?
18. If you could change one thing about yourself, what would it be?
19. What do you consider your greatest achievement?
20. If you were to die and come back as a person or a thing, what would it be?
21. Where would you most like to live?
22. What is your most treasured possession?

23. What do you regard as the lowest depth of misery?
24. What is your favorite occupation?
25. What is your most marked characteristic?
26. What do you most value in your friends?
27. Who are your favorite writers?
28. Who is your favorite hero in fiction?
29. Which historical figure do you most identify with?
30. Who are your heroes in real life?
31. What are your favorite names?
32. What is it that you most dislike?
33. What is your greatest regret?
34. How would you like to die?
35. What is your motto?

## Key Learnings - Chapter 1

- The smartest person in the room is not the one with an answer, but the person asking the best questions.
- Build an inquisitive team by encouraging asking a series of open-ended questions.
- Respond rather than react to questions.
- Incorporate the following questions to advance the conversation: “Can you help me understand?”, “Have you considered...?”, and “What surprised you?”
- Develop comfort with the four types of questions—factual, convergent, divergent, and evaluative. Practice asking them on a regular basis.



## CHAPTER 2

### Framing the Problem

*If I had an hour to solve a problem, I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions.*

— **Albert Einstein**

In the previous chapter, we emphasized the power of asking questions. In this chapter, we build on this notion by introducing a deceptively simple yet extremely powerful question: What do I wish I knew to make the best decision? This question generates a sequence of statements we refer to as IWIK™, “*I wish I knew*.” IWIKs will enable you to quickly focus on the essential question and prioritize your efforts to make efficient and effective decisions.

It's often impossible to tell why decision-making seems to take forever. An ancient parable that likely dates back to the era of the Buddha, around 500 BCE, tells the tale of a group of blind men who encounter an elephant for the first time. As they approach the animal, each man stretches out his hands and comes into contact with a different part of its hulking body. The man who touches the elephant's tail asserts that an elephant must be a long skinny animal, not unlike a snake, but the man who touches the side disagrees vehemently. An elephant, he concludes, must be a large flat animal that stretches up into the sky like some kind of living wall. Others have different opinions entirely. The man who touches the ear has reason to believe that an elephant is flat and soft, like an eel. And why wouldn't he think that? He's basing his argument on real evidence that he has felt with his own fingers.

Of course, the meaning of the parable is that humans tend to claim they know the absolute truth about something without appreciating the whole picture. They rely heavily on their own subjective experience to draw generalized conclusions, and they ignore other people's limited subjective experience, even though combining their own experience with that of others would produce the most comprehensive and objectively accurate picture of something.

This story repeats itself every day in our teams and at work. Replace the elephant with data in this parable, and it shines a light on many issues in data-driven decision-making.

Imagine you work in the marketing department of ACME SNOW, a manufacturer of snow-removal products. An email comes into your inbox celebrating the 8% sales growth of ACME's snow products in Europe. You are aware of the recent innovations in the scratch-free snow brush and scraper and therefore conclude that, clearly, the innovations are paying off. What you don't realize, though, is that if you had woken up on the morning of February 4, 2012, in Rome, you would have stepped into a foot, or about 30 centimeters, of snow.

Out of sheer necessity, Rome's Civil Protection Agency purchased 4,000 shovels so its citizens could clear the streets before a nighttime freeze. As someone looking at only the 8% data, you may have been convinced the Europe division was on a wild growth trajectory. If you had taken the time to ask your colleagues what they were

seeing, you would have learned that Gaspé, a leading Canadian competitor, saw a 12% increase in snow removal products in Italy. Your conclusion would therefore have been very different. Indeed, the growth that ACME SNOW recorded was four percentage points below its competitor's growth.

This story reflects something that occurs daily in business. People consider data without taking the time to ask for context. Data without context is dangerous; it leads to wrong conclusions and poor decisions. To put data in context, you must always triangulate it by looking at it in absolute terms, over time, and relative to what's going on elsewhere.

The reason we're elaborating on the importance of context, the big picture, partial information, and growth in context is that it amplifies the importance of the first step of making any sort of good decision: that first step is to ask ourselves one straightforward but extremely powerful question: What do I wish I knew to make the best decision possible? In the case of the blind men and the elephant, some answers to that question might include responses like this: I wish I knew how many other people have impressions of what an elephant is and looks like; I wish I knew more about how their impressions are different from, or similar to.

## IWIK™: A Tool for Reasoning

IWIK, as we'll henceforth refer to the formula “I wish I knew,” has a particular goal: to identify the core fundamental issue that needs to be solved. IWIK accelerates your team's thinking to establish awareness of what you know and what knowledge is necessary to make an informed decision. By focusing on what matters, IWIK speeds up the decision-making process.

Agile decision-making is grounded in how you think, not how hard you work. Either through repetition or observation, we have all developed habits that undermine our ability to solve a problem. We jump into solution mode, accepting what is asked of us at face value, often confusing activity with impact. In our rush toward a solution, we neglect to frame the problem. We need to understand this crucial insight: *The quality of your decision is directly proportional to the effort invested in framing the problem.* The frame enables you to narrow what you need to solve.

IWIK is a tool—a thinking technique, if you will—that's designed to help you frame the problem. It clarifies priorities, uncovers the essential information needed, quickly identifies knowledge gaps, defines assumptions, and reveals biases that might threaten to influence, slow, or shape a decision.

So how does it work? Let's assume you work at a large company and are challenged to grow your business's streaming service. Instead of jumping directly into analyzing viewer data, it may be more productive to first answer the following questions:

1. Can we grow revenue by adding incremental premium content?
2. Are we looking for bottom-line revenue or top-line subscriber growth?
3. Do we want to attract a different target customer, for example, GenZ?
4. Do we have an attrition issue?
5. Is our marketing, product offering, or media budget superior to competitors?
6. Are we interested in educating people about the service or completing the sale?
7. Do we have an awareness issue or a value proposition challenge?

While the request to increase growth might seem obvious at first, there are different ways of tackling it, and how you do so will lead you down very particular paths all the way from building the business case to shaping your recommendation to the size of the budget request, and the ultimate success of the company.

Interestingly, if you talk to various colleagues and they all define growth differently, you have just uncovered the root cause: lack of alignment. By doing this upfront, you save yourself time and effort, and set up the company for success.

Without pausing to truly understand the questions behind the question, you might well find yourself swirling. By applying IWIK, you'll quickly understand and appreciate the essential issue that your stakeholders or clients want to answer.

IWIK is a technique to unpack what is at the root of an issue, also known as the *first cause* or *first principle*, which Aristotle defined as “the first basis from which a thing



is known.” IWIK uses first principle's reasoning to deconstruct a problem to its core. Once you understand the components of a decision, you can quickly start to solve it. IWIK ensures your data discovery, analysis, and effort are proportional and directed to what is needed.

First principle's reasoning is an especially smart approach to decision-making, as teams desire to move faster, reduce rework, and navigate complexities.

# The IWIK™ Process

IWIK is a simple but powerful technique that acts as a catalyst to bring clarity to an issue. We begin by asking “What do you wish you knew?” The output is a series of statements, all beginning with the reply “I wish I knew... .” The IWIK statements your colleagues or clients provide, reveal a deep understanding of their actual needs. IWIK goes beyond stating objectives to gathering a visceral understanding of essential needs. It is a fresh and unexpected way to learn what your colleagues really need to decide.

There are four parts to the IWIK process:

1. Ask
2. Brainstorm
3. Capture
4. Deliberate

Let's explore each in order.

## **Ask: Getting the Right People to Think about the Right Questions**

The IWIK process begins as soon as you're asked to tackle an issue that requires conducting analysis, drawing conclusions, and making recommendations.

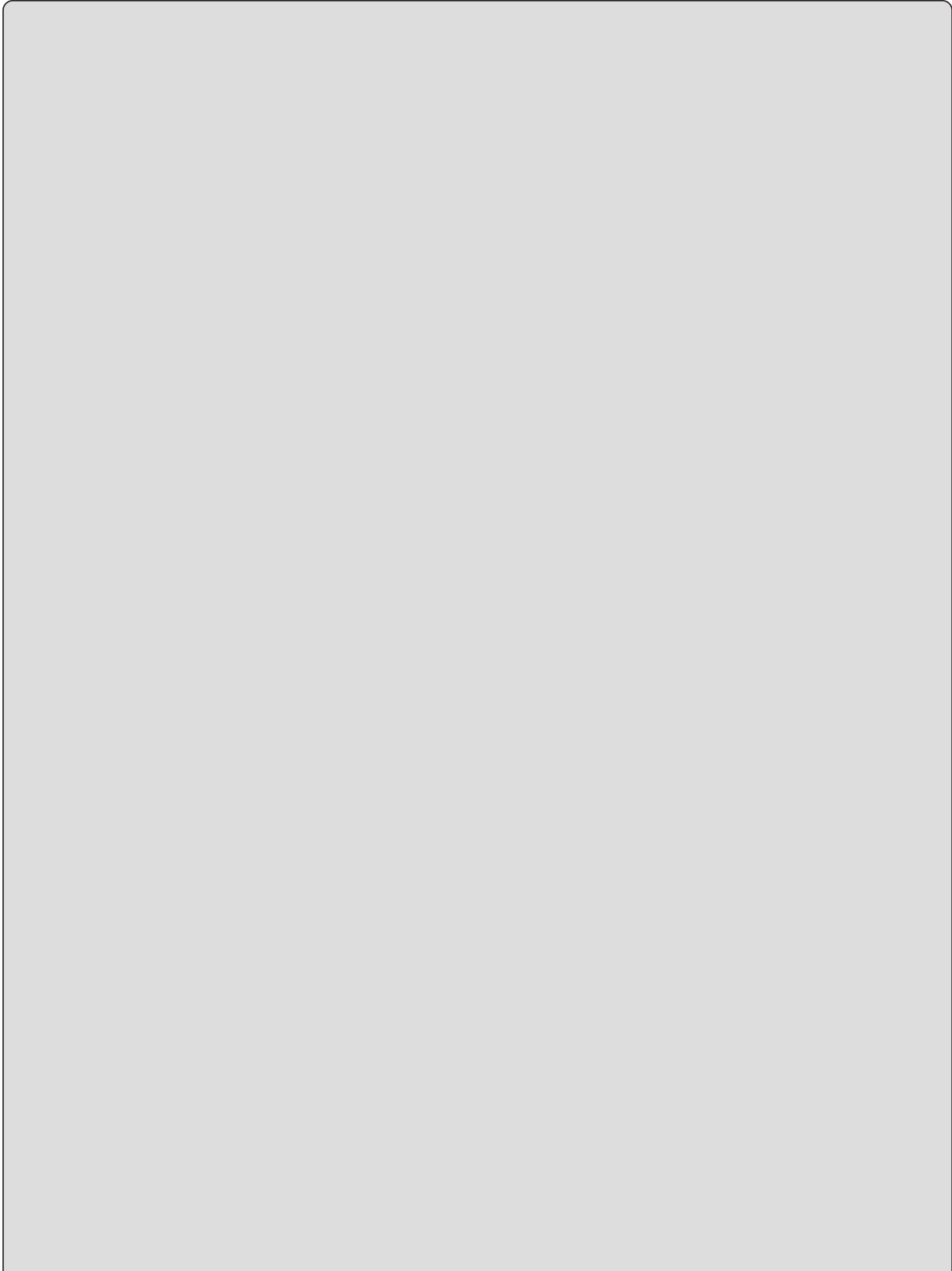
Before even considering the potential journey to the solution, ask yourself, your colleagues, or your client, who the key stakeholders are. Make a list of the individuals who have a role in implementing any decisions or recommendations you make. Who will care about its success and failure? Use this information to create a stakeholder map, which might look like an organogram, and then whittle this map down to the most important people. Make a shortlist of people who will have the most prominent role in execution and be most impacted by the outcome. Your chosen group should be as diverse as possible, with individuals of different seniority levels and with different tenures. Ideally, they should be from different backgrounds, too. Once you're confident with the group, and depending on your organizational culture, you may consider sending each person an email to request 20 minutes of their time to determine three initial things:

1. The essential questions that they would wish to have answered to move forward with the project confidently.
2. A shortlist of success or outcome metrics that matter to them.
3. Any unknowns that they are curious to explore and that are related to the issue at hand.

This inquiry is all about them—their problems, their questions, their business, and their success.

The goal of the initial communication is to kick-start the thinking process, to prime the brain pump, so to speak. You're not overwhelming them with sticky notes,

whiteboards, or breakout sessions; you're just asking them to start considering and contemplating. As a result, by the time you meet in person or virtually for your session, each participant should be in the right mindset to think creatively.



## SHARING E UMBRELLA

In 2017 a Chinese entrepreneur Zhao Shuiping zealously launched his own startup: an umbrella-sharing company aimed at catering to the scores of busy urban commuters who couldn't be bothered to carry an unwieldy umbrella with them in case of a sudden downpour.

Zhao thought that his idea was a wonderful, unique concept. The sharing economy was on the cusp of blowing up. In March 2017, the Brookings Institute stated<sup>1</sup> that the sharing economy was estimated to grow from \$14 billion in 2014 to \$335 billion by 2025. New-York-based Citi Bike users took more than 14 million trips in 2016, up from 10 million the previous year.<sup>2</sup> Surely, Zhao concluded, if Zipcar and Citi Bike were already successful, this would prove a hit.

The business model was simple. Sharing E Umbrella—as the company was called—placed 300,000 rainbow umbrellas around 11 Chinese cities, including affluent Shanghai, Nanjing, and Guangzhou. But what happened next threw Zhao entirely.

Within a few weeks, the umbrellas started to vanish, presumably into the homes of people who had forgotten to return them to the public pick-up/drop-off stations. The website Vox<sup>3</sup> later reported that each umbrella would have cost about \$9 to replace, equating to a bill of almost \$2.7 million if all 300,000 of them eventually disappeared, a number that would easily eclipse the reported \$1.4 million seed investment with which Zhao had launched his venture in the first place.

Such a spectacular false start might have caused any entrepreneur to stick his head in the sand and wait for the media attention to pass. But Zhao doubled down, claiming that he wanted to launch millions more umbrellas and try again. Very little has been heard of him since.

In some ways, the story of Zhao and the vanishing umbrellas is understandable. The data and evidence seemed to stack up, at least at first. In the case of umbrellas, people like sharing. That's undeniable. They share bicycles, cars, and even entire apartments, so why should umbrellas be any different?

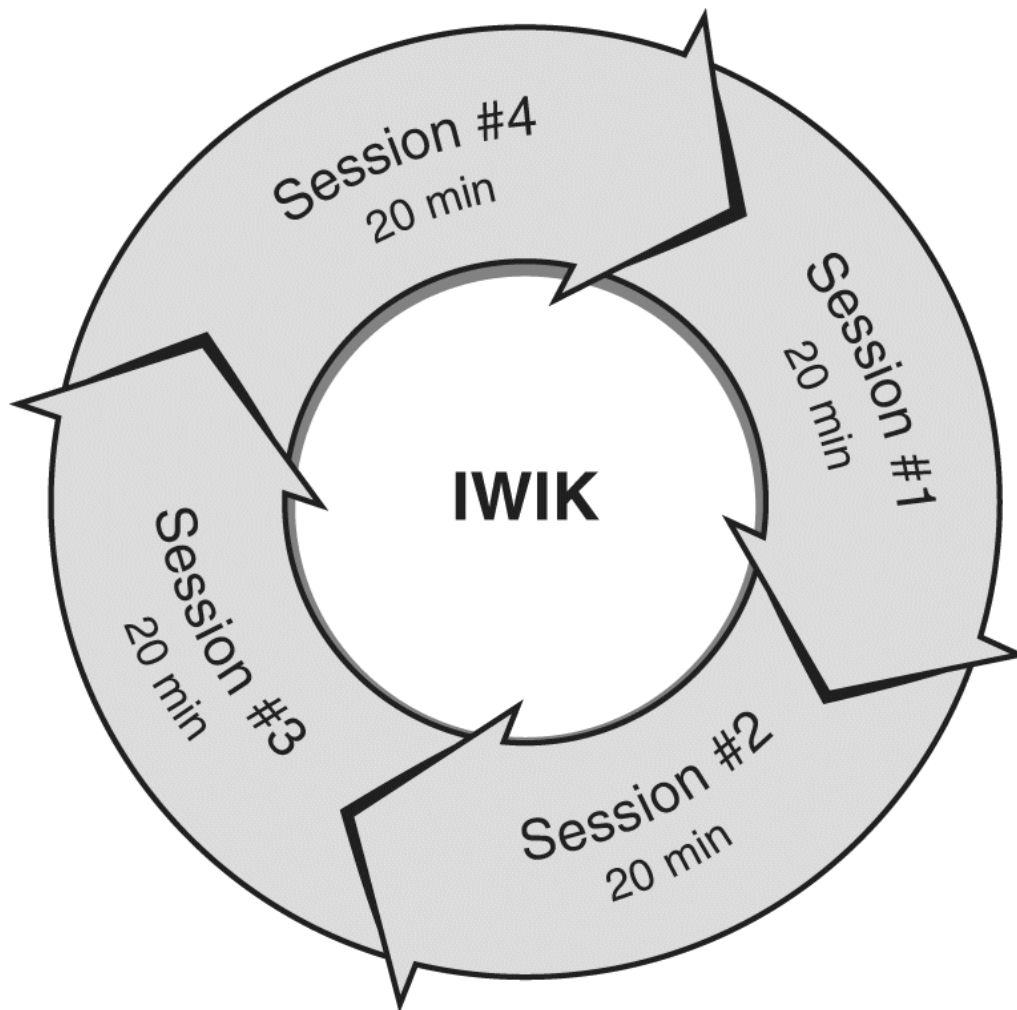
But had Zhao tapped into his intuition a little more committedly—if Zhao had considered for a moment his own habits of losing umbrellas, or perhaps forgetting where he'd left them, if he'd run through an IWIK session to determine the customer need for his business and about how easy it might be for someone to accidentally take one of his lovely, rainbow-patterned umbrellas home with them and misplace it as well—would he have been so eager to launch Sharing E Umbrella in the first place? It's hard to say for sure.

### Brainstorm: Optimizing the Discovery of Information

In a fast-moving world, you need to gather information and think through a range of solutions. This has often been done by brainstorming. The term *brainstorming* was coined in 1953 by advertising executive Alex Osborn, who describes it in his book *Applied Imagination*. Osborn discusses the power of creative imagination “as the basic tool in the acquisition of knowledge.” For knowledge, Osborn reasons, “becomes more usable when imaginatively synthesized and dynamically extended.”<sup>4</sup> He's spot-on, yet few leaders take the time to build a culture to tap into this basic tool of imagination, and the typical brainstorming process today falls far from Osborn's ideal of keen synthesis and dynamic extension.

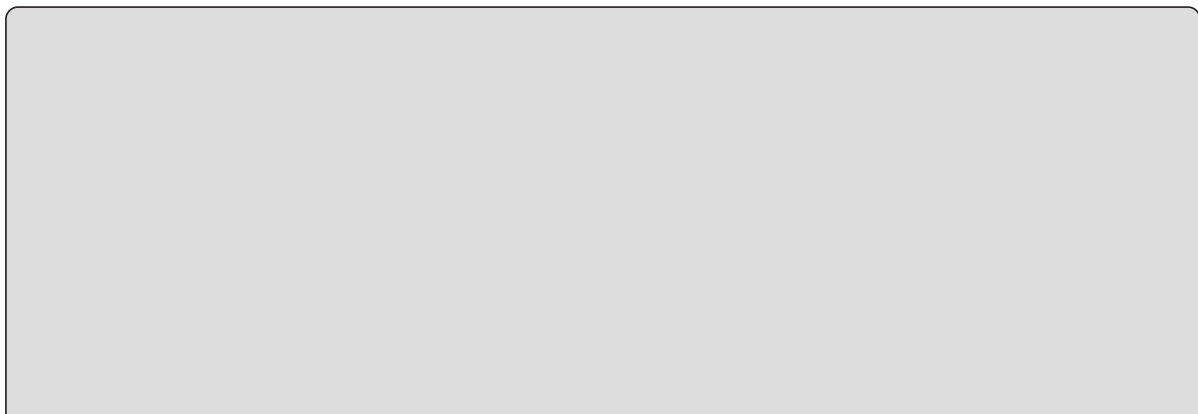
In today's reality, brainstorming is often a massive problem for time-starved teams. In fact, when we hear the term *brainstorming* we usually think of colored sticky notes, long days of meetings, flip charts, whiteboards, random ideas, and loud participants dominating smart ones. These sessions are often hard to organize, challenging to lead, inefficient, and ineffective. The results are often a series of ideas that no one knows how to evaluate in a useful way. Virtual meetings add another layer of complexity, amplifying many of these problems.

IWIK is designed to eliminate these issues. IWIK sessions can be conducted as a group discussion; however, based on our extensive experience, we believe that the most productive IWIK sessions tend to be one-on-one or in small groups of no larger than three. To optimize the value of IWIK, you should plan to conduct successive rounds of sessions (see [Figure 2.1](#)) with various stakeholders. By its very nature, the goal of the exercise is to expose knowledge gaps, and it is essential, as a leader, to understand and appreciate that some people are more comfortable than others highlighting what they don't know and acknowledging the limits of their competencies. Small group discussions have the advantage of unlocking conversations that may not happen in other group settings because of fear or inhibition.



**FIGURE 2.1 IWIK round robin**

A more intimate group is also likely to be sensitive to various personality types and communication styles. Introverts particularly might not feel comfortable contributing in larger groups. Finally—on an entirely practical level—smaller group meetings might be shorter in duration and easier to schedule. Fewer calendars have to be coordinated, and the time spent with a small number of stakeholders may also deepen critical professional relationships in a unique way.



## **STORY: ARE YOU A PLUNGER OR A TOE DIPPER?**

At Columbia Business School, Chris once participated in a fascinating exercise profiling the team dynamics of a group that had worked together for a long time. The facilitator began by introducing a scenario: It's a hot, sunny, summer day, and you are visiting a lake you've never been to before. You enjoy swimming, and the weather is humid and sticky, so you decide to cool off in the water. The facilitator then asked, what would you do: dip in your toe, slowly wade in, or plunge? We were asked to write down our responses. The ratio of toe dippers to plungers was eight out of ten. The scenario sparked a dialogue on how the team approaches unknowns, our comfort level in embracing ambiguity, and our willingness to dive in. The discussion continued to explore whether those feelings applied to how we approach work. There was a very high correlation. The exercise was done with the entire team, and although we thought we knew each other well, the findings were unexpected. Our everyday working environment and the general group dynamic weren't conducive to this kind of exploration and openness. Interestingly, because the exercise provided a different way—a safe way—for people to discuss their appetite for risk, the experience gave many people a new appreciation for their colleagues. Using an alternate approach, framing the issue in a fresh way, revealed new learnings.

### **Capture: Leading IWIK Discussions**

Leading an IWIK session is simple, deceptively simple. Your role is that of a scribe. When you ask your colleagues or clients “What do you wish you knew?”, you're extending an invitation to them to think expansively without concern for existing data, time, resources, headwinds, budgets, or guard rails.

When you first do this, you might be met with blank stares and stony silence. But don't be taken aback. This reaction may occur because you have just opened a new portal to the imagination, and that takes some getting used to. Rationally, we're all aware of the power of imagination. It's just that the business world in which many of us operate has conditioned us to think within parameters and constraints. That environment has wired us to refrain from thinking creatively, or at least to be extremely cautious when doing so. IWIK can change that and help us become comfortable with thinking differently, challenging the status quo, and talking as honestly and openly as possible about the things we don't know but wish we did.

An interesting dynamic occurs after you pose the IWIK question: The mode slowly shifts from a quiet, awkward silence to one of high energy. Once the questions start flowing, your colleagues, liberated from the pressure to know and have answers, may actually feel unable to stop. Not unlike a series of dominos, once the first few IWIK statements begin to fall, the rest follow.

What's important to bear in mind at this stage is not to answer any of the questions that come up. The competitive environment nurtured by the world of work might create the temptation to do so, but it's crucial to resist: dedicate this phase to

generating the IWIK statements rather than getting distracted by what the answers might be.

In the same vein, avoid editorializing on questions in real time. Refrain from commenting on the question or sharing what you have learned so far or what you expect. Commenting on a question can interfere with the openness or flow of the process. For example, if you respond to a colleague's IWIK statement by saying "Three other people in operations asked the same question you did. I am surprised you are raising similar issues in marketing." you might unintentionally sidetrack your colleague's train of thought.

Particularly if you host several IWIK sessions, the IWIKs that arise will no doubt begin to duplicate. This isn't a bad thing. In fact, you can glean insights from these repetitions that might prove invaluable to your understanding of the problems at hand. In itself, that is a critical data point that will shape your data discovery step. Record every question in every session, even if it is a duplicate. During the process, resist the urge to share that you've heard something before, or the inverse, that you haven't. Be a neutral party. You will have plenty of opportunities to add your insights and synthesize your interpretation later on.

The key to effectively implementing IWIK is to make sure the process is not rushed and that all relevant stakeholders have the opportunity to provide their full input, including the things they know and the things they don't know, as well as the things they need to know and the things they don't need to know.

The output of an IWIK session will be a series of statements or questions highlighting what people want to know. Leading multiple sessions may result in numerous IWIKs being put forward, and while you might fear information overload, don't worry. At this stage, overload is perfectly fine. The IWIK process is designed to help us navigate this risk too. In the next part of IWIK, you will dedicate time and effort to thoroughly organizing all the captured information, so you won't feel like you're swimming in a disorganized swamp of data points. As you review the questions, they will reveal patterns around the essential needs as well as potential duplication of efforts across team members, conflicting requirements, and clarity on the outcomes and biases.

Once you have captured the IWIKs, it is time to categorize them.

## **Deliberate: Ordering, Aggregating, and Synthesizing IWIKs**

When you've collected all the IWIKs, the questions will vastly outnumber the answers, meaning that your job now is to create order and aggregate. You may be sitting looking at 10, 20, 50, or more statements generated from your IWIK sessions. That might feel overwhelming, but you're actually on track.

You've successfully broken down the initial situation into its components. The goal of organizing the IWIKs is to identify patterns in the requests and look for duplicates and outliers. You're on the path to understanding the root of the issue, and this, in turn, will inform the essential data you need, guide the specific analysis required, and focus your efforts on what matters most to your stakeholders, leading to faster, more confident decisions.



Consider the following steps optional if you have a shortlist of statements, for example, fewer than 12. Depending on your knowledge of the underlying issue and mastery of existing data, you can quickly analyze the IWIK statements without formally applying steps 1–5. Like any new skill, the more you use IWIK, the higher your comfort level will be and the faster you'll be able to process things. Mastering IWIK is analogous to learning to drive: at first, you study the driver's manual and are conscious of every step. Over time, you become unconsciously competent; you promptly assess situations on the road and react quickly, with confidence.

**Step 1. Create an inventory.** Build a simple table (see [Table 2.1](#)). Consider using a spreadsheet (e.g., Google Sheets, Microsoft Excel, Apple Numbers) so that you can quickly sort and filter the list. A Microsoft Word document will also work, but the manipulation of the statements might prove harder.

Save this file as IWIK\_Master\_[project name]. Then open it and save a second copy under a different name, as you will be doing a fair bit of manipulation of the IWIKs. If you accidentally delete a statement, you will have the master file for reference. Alternatively, if you are using a spreadsheet, you can simply duplicate the tab as your backup.

Enter all of the IWIKs you captured into the table along with the person or team who provided each. At this stage in the process, do not dismiss any IWIKs; any single IWIK could point you to an essential piece of analysis or data. Enter all of them. Number them 1, 2, 3, and so on, in column 1, so you can quickly reference any statement later.

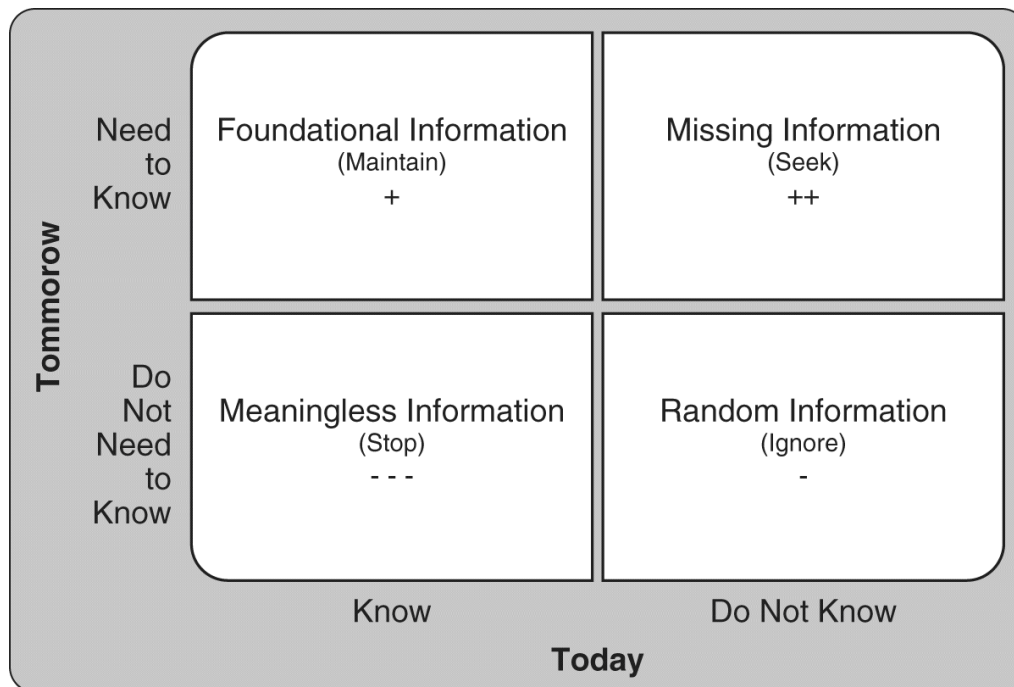
**[TABLE 2.1](#) IWIK inventory**

Col 1: Reference Number	Col 2: Category (e.g., a, b, c)	Col 3: IWIK statement	Col 4: Person (or team)	Col 5: Have Data (Y/N)	Col 6: Urgent (must have/nice to have)
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**Step 2. Code the statements.** As you read the statements, assign a letter, for example, A, B, C, in column 2. If you come across a similar statement, assign the same letter. In column 5, enter “Yes” or “No” if you already have the data or can easily find it to satisfy the statement. In column 6, assign an *M* or an *N*, denoting must-haves or nice-to-haves. Don't worry about getting it perfect. This file is for your use only. You will have the opportunity to revise.

**Step 3. Sort.** Begin sorting the IWIKS by column 2. Look for patterns on how many statements have the same letter, which points to a significant knowledge gap and helps establish specific areas to explore. Next, sort by column 6, which will uncover priority needs.

**Step 4. Analyze.** A helpful tool to make sense of the IWIKs—the raw material you've collected—is to create a simple two-by-two matrix of four buckets. The *x*-axis denotes the current information, while the *y*-axis is divided into what you currently know and what you do not need to know to make the best possible decision. We call this your IWIK Knowledge Matrix™ (see [Figure 2.2](#)).

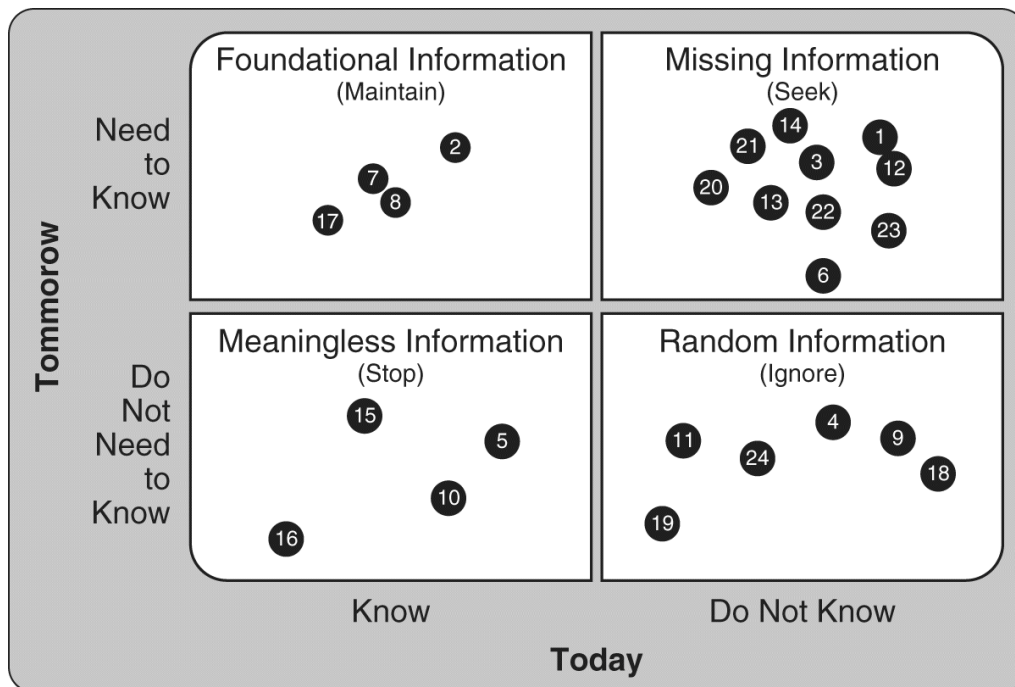


**FIGURE 2.2** IWIK Knowledge Matrix

This mapping of the IWIK statements to each bucket helps you frame the problem and will serve as a guide in your data discovery (see [Figure 2.3](#)). There's no right or wrong number of questions to have in each quadrant.

**Step 5: Assess data needs.** The matrix regulates the firehose of information as it paints a picture of your data needs. The bottom half reveals where you are collecting data that is not critical for the current decision you are tackling, so you can stop gathering or analyzing unnecessary data. The top is where you want to focus, as these are the essential questions your stakeholders identified as the must-have IWIKs to move forward.

At this point, you are in a very good place as you have deconstructed the initial problem into its core elements. You can easily translate this map into a data discovery plan (see [Table 2.2](#)). By taking the questions plotted in the upper right quadrant, you can now assess the time, cost, and resources needed to answer this question. The Knowledge Matrix becomes a practical tool to prioritize work for your team: by guiding data discovery efforts, it ensures that your team is working on what matters.



**FIGURE 2.3** Example Knowledge Matrix

**TABLE 2.2** IWIK data discovery plan

<b>IWIKS</b>	<b>Priority</b>	<b>Timing</b>	<b>Assess difficulty/cost to obtain data or to answer question?</b>	<b>Identify existing, new sources or innovative methods</b>	<b>Status / Next Steps</b>	<b>Data Analyst</b>
<b>SEEK</b>						
3. Who are our best prospects for growth—new customers (acquisition) or existing (organic)?	High	S/T	Medium	Primary research	Design Q'nre	LM
6. Is our value proposition superior, distinct, and ownable?	High	S/T	Medium	Synthesis of competitive offerings Assess internal transaction data	Harmonize data	AF
14. How can we get to market quickly and in a low-cost, low-risk, short-term way? What is our minimal viable product?	High	M/T	High	New product design	Product portfolio analysis	EM
<b>MAINTAIN</b>						

<b>IWIKS</b>	<b>Priority</b>	<b>Timing</b>	<b>Assess difficulty/cost to obtain data or to answer question?</b>	<b>Identify existing, new sources or innovative methods</b>	<b>Status / Next Steps</b>	<b>Data Analyst</b>
2. How have our attrition, renewal and cancellation rates changed over time? Does it vary by tenure or demographic group?	Med	M/T	Low	Subscription file	Internal modeling	LF

## Framing the Decision

IWIK is the first of many workable tools or methods that we discuss in this book.

IWIK and the Knowledge Matrix are designed to prevent companies from the immense temptation to drown themselves in data. They won't help you answer every single question that might possibly be related to solving a greater problem, but they will help you determine what the most important and salient questions are for framing the problem at hand.

The beauty of IWIK is that it scales. It is a flexible technique that can be used in a single conversation or over a series of conversations. You do not need to complete the entire end-to-end process. With repetition, IWIK can be done one-on-one in less than 15 minutes or even asynchronously via mail. By asking stakeholders to answer a simple four-word question “I Wish I Knew...,” you will start to discern the series of essential questions to answer. IWIK is easy to apply, does not require any preparation, and will quickly make you smarter about a new situation as well as engage your colleagues in a strategic conversation.

IWIK is also an unexpected technique that forces people to think differently. As they complete this four-word statement, it serves as a key to unlock a new dialogue. It gives your clients or stakeholders permission to think differently, providing an alternate way to explore the situation by simply rattling off a wish list of questions. This fresh thinking uncovers new learning and a deep understanding of what matters to them. It opens the aperture.

For your teams, the IWIK process helps produce smart decisions that will inspire action. It sets up teams for success and enables them to understand what needs to be done to appreciate the whole metaphorical data elephant in all its mysterious glory.

If you're a manager within a team and decide to adopt IWIK as a technique, you should derive comfort from the fact that, even though it might feel like a cumbersome process at first, it becomes easier the more you do it. IWIK can become habitual. We have heard from teams that have embraced IWIK and now find it necessary before any strategic decision is made.

The IWIK technique is self-perpetuating. The IWIKs used to frame the issue can even serve as the kick-off slide when you present your recommendation: they link and label your analysis of essential needs. We discuss this further in [Chapter 8](#).

## Key Learnings - Chapter 2

- Improving the quality of your decision is directly proportional to the effort invested in framing the problem.
- Applying the IWIK process is a four-step approach—ask, brainstorm, capture, and deliberate.
- Capturing a series of strategic questions quickly enables you to clarify priorities and identify knowledge gaps pointing to the critical information needed while exposing potential biases.
- IWIKs leads to finding the essential questions that you wish to have answered, a shortlist of success or outcome metrics that matter, along with any unknowns that you are curious to explore related to the issue at hand.
- Assessing IWIKs is easily done using the Knowledge Matrix to identify the salient questions.

## Notes

1. The Current and Future State of the Sharing Economy, Brookings India IMPACT Series NO. 032017, March 2017.
2. Kaufman, Sarah M., and Jenny O'Connell. "Citi Bike: What Current Use and Activity Suggests for the Future of the Program." NYU Rudin Center for Transportation, February 2017. Available at: link.
3. Maizland, Lindsay. "A Chinese Company Tried Making Umbrella-Sharing a Thing. It Didn't Go Well. [Vox.com](https://www.vox.com/2017/7/11/15944444/china-umbrella-sharing), July 11, 2017.
4. Osborn, Alex F. (Author) and Lee Hastings Bristol (Foreword). *Applied Imagination: Principles and Procedures of Creative Thinking*. Scribner Book Company, Revised Edition, Paperback, April 1, 1979.





## CHAPTER 3

# Working Backward to Move Forward

*We fail more often because we solve the wrong problem than because we get the wrong solution to the right problem.*

— **Russell L. Ackoff**

In this chapter, we focus on the power of working backward, a different but complementary approach to the IWIK™ approach we discussed in the previous chapter to focus on the essential question. Whereas the IWIK approach takes a wide-angle of working bottom-up, from exploring an extensive list of IWIKs to uncover the essential question, working backward takes a top-down approach. It allows you to start with the decision at hand and find the path back to the problem's conditions, to identify the minimum amount and scope of data and analyses that would enable you to make the decision. Starting with the impending decision and working backward also helps ensure that your decision-making journey is data-driven, purposeful, and action-oriented.

Remember the story of *Alice in Wonderland*? The narrative arc involves a young girl named Alice falling down a rabbit hole and finding herself having to navigate a world of bizarre situations and characters. At one point in Lewis Carroll's 1865 story, our youthful protagonist finds herself at a fork in the road. Utterly confused, she asks the Cheshire Cat which path she should choose. “That depends a good deal on where you want to get to,” her feline consultant responds. “I don't much care where...,” says Alice, at which point the cat interjects, “Then it doesn't matter which way you go.” Alice adds, “... so long as I get somewhere.” “Oh, you're sure to do that,” the cat replies, “if you only walk long enough.”

You're probably asking yourself where this is all leading in the context of this book. Think of Alice as an analyst, consultant, or data scientist walking in the thick forest of data, trying to find some useful insights but unsure of where she hopes to arrive or what that “somewhere” might even look like.

It is common for business leaders to assert that they've got loads of data and to believe, therefore, that there must be some gems in it.

And indeed, just like Alice, the analyst who walks long enough in the forest of data will inevitably find some interesting correlations or patterns. But without an end goal in mind, how much of that analysis will end up being truly relevant to what you're actually trying to achieve? Let's just say that a lot of luck would have to be involved. Of course, there is a slim chance that your stray expedition will lead to an unexpected gem, but unless you guide the process with intention, most of these exploratory journeys end up leading nowhere.

As we highlighted in the first two chapters, one of the most important steps in the Quantitative Intuition (QI)<sup>™</sup> framework is the ability to focus on the essential question. Very often decision-makers are uncertain or vague about what it is that they are looking for. We all appreciate the importance of understanding the problem, so why do we find it so difficult to frame it?

There are several possible answers to this question. First, thinking carefully about the problem and possible solutions is hard. It requires understanding the situation, having relevant acumen, and considering possible counterfactuals. Take physicians, for example, and consider the process they go through when a patient complains about chest pain. Of course, chest pain can be worrying, but it is actually not the patient's underlying problem: It is a symptom. Sometimes this kind of pain has a simple, easily remedied cause, but such a symptom could relate to many complex sets of conditions. Doctors rely on years of experience and education to assess and diagnose a patient's problem. They might administer some simple tests, ask questions, or order an EKG. The process of identifying the true cause can be difficult. It requires acumen, experience, and time.

In addition to the difficulty in identifying the problem, the process of defining the problem also involves risk. Embarking on a journey with no defined end is comforting because it means that you will almost certainly not fail by under-delivering. Defining the problem, on the other hand, forces you to anticipate and define what failure will look like. Going back to the physician example, physicians know that when they make a diagnosis, they run the risk of being wrong. As they weigh that risk against their experience and the data they have, they might decide to delay the diagnosis by running more tests, asking more questions, or referring the patient to other specialists. This could lead to unnecessary testing, expense, and delay. In a business

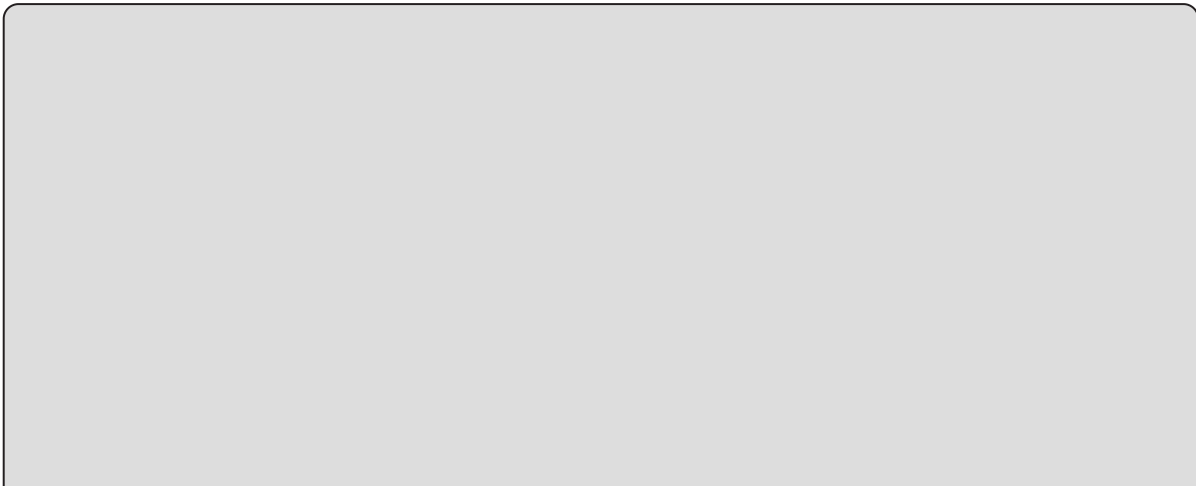
environment, decision-makers might be vague about the problem for similar reasons, or simply because of the erroneous belief that the data itself will define the problem. This is, unfortunately, rarely the case.

This leads us to one of the biggest mistakes we have observed among many leaders in companies we have worked with: *Do not expect the data to provide both the question and answer*. It is your responsibility, as a decision-maker, to define the problem. Then, if the data can provide sufficient evidence toward an answer, and if you are fortunate enough to have the right set of skills in the organization to appropriately mine the data for the answer, you may find a solution to the problem you previously defined so carefully. That brings us to the question of how we define that problem in the first place.

## Defining the Problem

Working backward suggests that effective decision-making actually starts from the end. What that means is that the decision or decisions at hand should inform and guide the steps we take to assessing the problem, understanding what information we need, challenging the data, synthesizing it, and determining what to do next. We begin with the decision in mind and then work backward to explore any questions that lead to that decision. It is important to emphasize that QI approach starts with a decision to be made (e.g., go/no-go) not with the decision itself that a certain branch of the decision should be taken (e.g., we should launch the product), as that would lead to a forgone decision that does not merit a data-driven journey.

The notion of working backward takes its cue from the 1985 *Harvard Business Review* article “backward market research,” written by Professor Alan R. Andreasen<sup>1</sup> in the context of marketing research (see the call-out box “Backward Market Research: HBR, Andreasen 1985”). The idea behind the backward market research approach is to start with the decision at hand and work backward from it to design the marketing research data collection and analysis. Since Andreasen's article, we've observed an ever more overwhelming firehose of data pointing at us, along with an increase in demand for fast-paced decision-making. Using the lens of the QI framework, in this chapter, we expand the backward approach beyond marketing research projects and toward more general data-driven decision-making, highlighting how it can be used for small and large decisions and combined with the IWIKs approach.



## **BACKWARD MARKET RESEARCH: HBR, ANDREASEN 1985**

In his 1985 *Harvard Business Review* article, Alan. R. Andreasen explained the idea behind the backward approach to marketing research.

Andreasen devised an eight-step plan that he dubbed the Backward Market Research strategy, or BMR. The first step involves determining how the eventual result of the research will be implemented. That step, in itself, can help the decision-maker or executive define the problem from the outset.

The second step is to determine exactly what the final report should contain and to prepare a sort of blueprint for analysis. This is the part in the journey where the researcher and the decision-maker begin collaborating closely.

Step three and step four involve specifying the analyses necessary and determining the kind of data that must be assembled to carry out these analyses. Again, these steps require researchers and decision-makers to imagine what sorts of information they might obtain, which in turn compels them to visualize how best that information can be put to use.

Steps five through eight follow a more traditional, chronological order that mirrors a forward approach to market research. These include scanning the available data, determining if available data does not address all data gaps, collecting new data, completing the analysis, and writing the report.

We propose three steps for backward decision-making:

1. Create a decision tree
2. Write the blueprint of your delivery using IWIK
3. Reverse engineer your data and analysis map

### **Step 1: Create a Decision Tree**

Our QI framework focuses on decision-making. Therefore, it is natural to think of the data-driven journey not just ending with a decision, but also starting by scoping such a decision. Of course, at the start of the journey you don't know what the actual decision will be, nor do you want to influence the process or tilt the decision in a particular way. What you should know early on are the various possible actions that might be taken at the end of the journey given different outcomes. At this step you would want to scope out the possible branches of the decisions or action that might be taken given the outcome of the analysis. The process of scoping out the possible branches of the decision needs to be comprehensive and often includes discussions with key stakeholders about what possible actions are on the table at this point in time. Examples of such actions might be whether to go ahead and launch an entrepreneurial idea or to call the whole thing off, whether to expand a company into a new region, which of a set of market segments a particular company should target, or what price point a company should select for a new product.

Each possible action needs to have at least two branches: two options for decisions that can be made. If, through this process, you come to realize that there's actually only a single branch—that the decision to launch or expand has in fact already been made—then there's no reason to invest time and money in the analysis.

If you're very familiar with the market or industry, the set of possible decision branches might be obvious. In other cases, however, some legwork may be needed to establish what the different branches might be. You might have to talk to key stakeholders in the organization or the field, or with consumers.

Take, for example, segmentation studies. In our experience, the usual entry points for conducting segmentation studies to have a better view of our customers or to better understand the business are generally not good enough to spend time and money on data collection and analysis. Our advice when you're embarking on a data-driven journey like a segmentation study is to behave like a child: to question incessantly and scrutinize shamelessly with a sequence of “why” questions. This advice should be familiar to you from [Chapter 1](#). This childlike intuition also has strong practical foundations.

The Japanese inventor Sakichi Toyoda, who founded Toyota industries, argued that by asking why questions five times the nature of the problem as well as its solution, becomes clear. Applying five whys approach for example, to the context of the segmentation study you can ask:

Q: **Why** do you want to conduct a segmentation study?

A: Because I want to know my customers better.

Q: That's really great that you want to know your customers, but **why** do you want to know your customer better at this specific moment?

A: Well, our sales have been plateauing, so I am worried we are not serving our customers as well as we did before.

Notice that we are starting to define the problem with the sequence of whys.

Q: **Why** do you think that is?

A: A new competitor entered our category, and I believe this competitor is addressing the needs of the younger segment of consumers better than we are.

Now we're moving toward an action-based definition of how that project could move us forward, and away from a generic request for a segmentation study as something that would be nice to have, without knowing what questions it needs to answer.

With the knowledge we've derived from this sequence of “why” questions, we can redefine our segmentation study as focusing on questions that would guide specific decisions. For example, in the face of the new competition, should we shift our targeting strategy to alternative segments and away from younger consumers?

Alternatively, should we identify aspects of our product that may be superior to that of the competitor's, and that may allow us to lure back the younger customers? Such lenses would lead to very different analyses and a much more action-oriented project than the generic segmentation study originally requested.



In our experience, by the time you are done with your why questions and scoping out the branches of the decision, the problem may well be half solved.

## **Step 2: Write the Blueprint of Your Delivery Using IWIKs**

The next step might seem controversial at first. It involves the decision-makers working in tandem with the analysts to write the blueprint of the report. For some projects there may not be a report; instead, there might be an analysis plan and a recommendation system for a machine learning project, or a simple memo for a smaller decision. Either way, the idea is to work backward from a decision to the analysis and information needed to make that decision.

Working backward might seem, at first, like a daunting challenge. How can we write a delivery document for a data analysis journey before we've even collected a single piece of information? What might such a blueprint include? Blank tables? For the most part, that's correct: The blueprint will include what is often called “planned,” “dummy,” or “ghost” tables, and it will formulate a plan for the analyses intended to be done.

Imagine that you work for Apple and have the brilliant idea of introducing an iPhone that's specifically designed for teenagers. As part of the project, you already know any decision-making about the feasibility of this idea will require a table describing the preference of teenagers at different age groups for the prototype iPhone you have in mind. The dummy table may look like [Table 3.1](#).

The table has labels for the columns and rows but is otherwise unpopulated. There's no data yet. As you collect and analyze the data, you'll populate the table, but for now, in your report blueprint, you'll simply describe the tables and figures that you would need—and only those that you would need—to be able to make a decision at the end, assuming these tables and figures will be filled with reliable information. The purpose of this exercise is to make sure that the data collected and the analysis conducted will help you make the right decision at the end of the process.

**TABLE 3.1** Interest in the proposed product by age

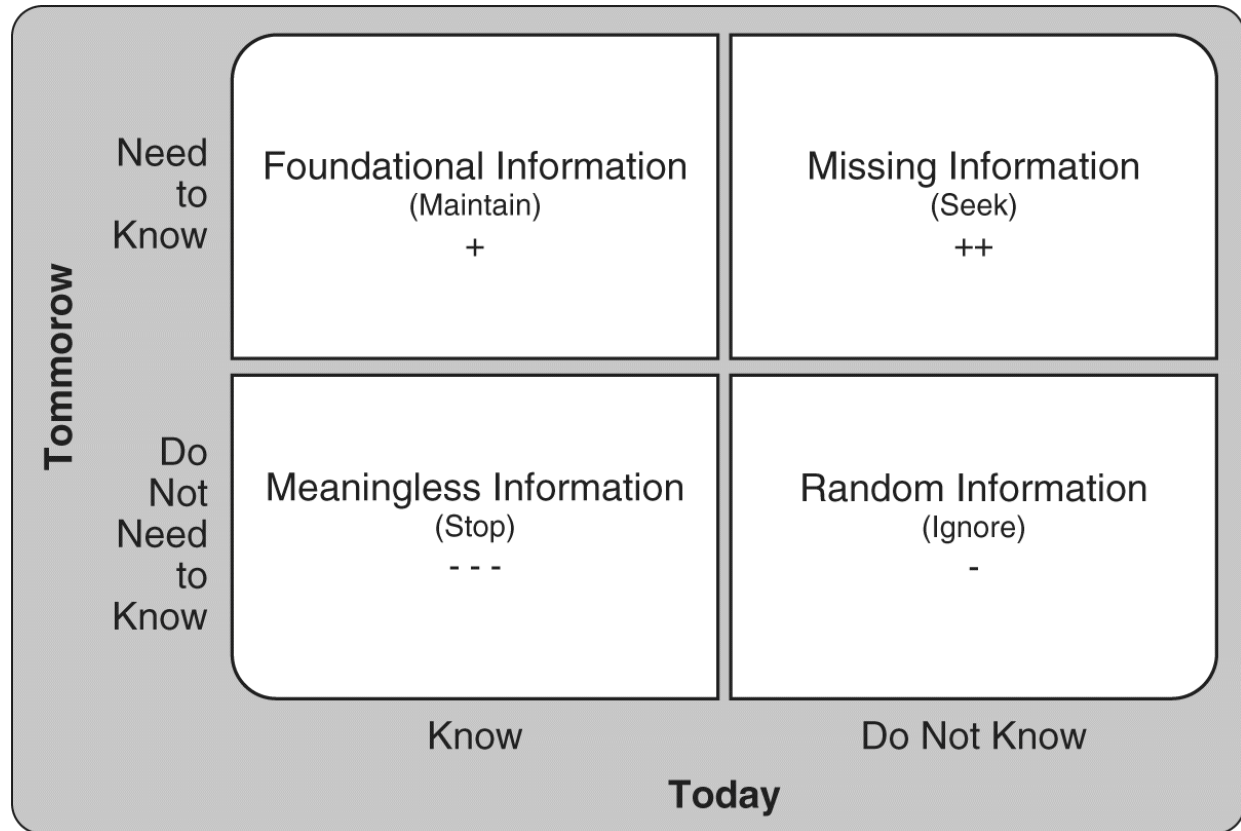
	Interest in the iPhone for teenagers	
Age	Yes	No
12–13		
14–15		
16–17		
18–19		

The simple act of considering how this table will be used to make decisions will enable you to refine your own thinking in terms of the decisions you should be making. For example, you will think through the scenario of the decision you would make if the results suggested that younger teenagers, but not their older counterparts, will be interested in the phone. This line of thinking might spark the idea of creating a separate table exploring who actually buys the product for the younger teenager, who makes the purchase decision, who pays for the product, and what other influences are at play.

Creating this blueprint before collecting the data has other advantages too. It helps ensure that you're communicating the granularity of the data and paying attention to necessary detail. In the iPhone example, it might help us inform the analyst that our definition of *teenager* is in the age range of 12 and 19. The dummy table (see [Figure 3.1](#)), in this sense, makes sure this information is delivered.

Much like IWIKs, the dummy tables are your global positioning system (GPS) to navigate your data journey. Without dummy tables or IWIKs, there's a risk that the data gathered will be a collection of whatever information is easily available—relevant or not—rather than a carefully curated slate of information that can actually help you make the decisions. Indeed, despite their differences—IWIKs (thinking bottom-up) and backward thinking (thinking top-down)—the two approaches both help focus on the essential question and are complementary. It is at the step of generating the dummy tables that you would employ the IWIKs method. IWIKs and the corresponding IWIKs Knowledge Matrix (see [Figure 3.1](#)) would help generate the set

of dummy tables and figures that can answer the IWIKs in the top right corner of known/unknown and need to know matrix.



**FIGURE 3.1 IWIK Knowledge Matrix**

The dummy table will also serve as a useful tool for helping you to focus on what information is needed in order to complete the analysis. By the end of the analysis, the information in the table might not be perfect, but it will provide an inventory of sorts and provide clarity on where you're at and where you need to be. Taking the time to think through the blueprint of the delivery will make the final delivery faster, sharper, more concise, and therefore more efficient.

Decision-makers often have a tendency to prefer being precisely wrong than vaguely right. Of course, no one intentionally prefers to be wrong, but in the trade-off between certainty and relevance, we often tend to err on the side of certainty. In the quest for certainty, we often prefer to have precise and validated information even if this information is less relevant for the decision at hand over rough estimates in tables and figures that we actually need. Planning the blueprint of the delivery in advance helps you focus the effort on

getting the most accurate, relevant, and necessary information for the analysis that you actually need to make the decision.

### **Step 3: Reverse Engineer Your Data and Analysis Map**

The next step in the process of moving backward from decision to data analysis involves asking yourself what data you need to be able to fill in the dummy tables and figures. If we were to draw up a questionnaire to complete the preceding iPhone for teenagers dummy table, the questions would be straightforward: Are you interested in the proposed iPhone? and What is your age?

From here, the process follows the more traditional pattern of data-driven decision-making: assessing the available data, collecting necessary information, analyzing the data, and delivering the information. If sufficient effort and diligence was put in the first few steps, these subsequent steps should be easy. Indeed, Charles Kettering, the one-time head of research at General Motors, is widely quoted as having said that “a problem well stated is a problem half solved.” In our own experience of making decisions using the backward approach, we found that once the first three steps of the backward approach are complete, the problem is indeed nearly solved.

# Harnessing Inside of-the-Box Thinking

It's also been our experience that the backward approach can help researchers and decision-makers avoid wasting time, energy, and money on work that will not directly improve the decision-making process. Working backward can help executives to formulate actionable outcomes and develop appropriate contingency plans.

In fact, starting the process with a decision and a decision tree can even lead to the appropriate realization that a project should be pivoted or canceled entirely if, through the process, you realize that the decision is already clear.

While the backward approach is best suited for larger decisions, it can also be used for smaller decisions. Consider the typical performance tracking reports full of numbers and analysis that you probably receive on a daily, weekly, or monthly basis. The next time you receive such a report, look at each number and ask yourself: if that number were double or half of what it is today, would you do anything about it? If the answer is no, there's a good chance that this number is of no use to you, and you should ask to stop seeing this number in the reports delivered to you. This number is irrelevant, and it clutters and distracts your attention from figures that are meaningful and important. Of course, this doesn't mean that this particular number is not important for someone else in the organization, but it should only be shown to those decision-makers who are likely to change their decision based on this number. Consider a car dashboard. Imagine if, rather than just flashing a warning light when the temperature is too high or the oil level is too low (a point at which you are required to take an action), it were to present you with all the information it draws on to reach the conclusion that something isn't quite right. That array of data would entirely overwhelm us, particularly because it would inevitably feature information that's entirely irrelevant to our decision-making process. Our business dashboards should look more like our car dashboards, working backward from the decision that the decision-maker needs to make, and clearly presenting the information - and only the information - that is relevant and useful, and at the appropriate granularity level, for our decision-making.



## THE FORGONE DECISION

Recently, an entrepreneur approached Oded and asked for help in conducting a feasibility analysis for an entrepreneurial idea.

My initial reaction was relief that the entrepreneur was even willing to evaluate the feasibility of his idea; many entrepreneurs I had encountered in the past have skipped that step entirely. But before I helped the entrepreneur I had an important question to ask him: “If in a few months, and having spent a few thousand dollars on research, evidence was to suggest that the idea is unlikely to succeed, would you be willing and able to abandon the idea completely?”

The entrepreneur's response didn't surprise me. As is the case with so many other self-assured founders we encounter, this particular entrepreneur noted that he had already spoken to many people and was therefore relatively certain that the idea was a good one. As such, he was determined to pursue it for at least two years, regardless of what any initial research might find. After that, he'd be willing to ditch it if it wasn't proving to be an unequivocal success. I was, of course, a little disappointed to learn that the entrepreneur was not really prepared to challenge his idea at this stage, but I was also thankful that I had asked the question.

The response highlighted the fact that dwelling on whether to launch or not would be a waste of time. The entrepreneur had already made the decision to go ahead. Instead, it would make much more sense to spend the time, energy, and available budget on addressing decisions such as which target market to go after, what features the product should have, and what the appropriate price point should be. Too often we conduct expensive and time-consuming data analysis to evaluate decisions that we've actually already made. Not only is such analysis wasteful in and of itself; the opportunity cost of delaying the decision can be detrimental as well. Working backward from the decision can help us avoid such mistakes.

Naturally, there are criticisms of the backward approach. One is that, by starting at the point of the decision and considering the branches of the decision tree, we might suffer from confirmation bias or blind spots, which can predispose us to miss certain branches that may reveal themselves throughout the process. Worse still, we might inadvertently influence the outcome of the decision. Indeed, the backward approach is an inside-the-box approach. It assumes that the decision-maker has identified the possible branches of the decision early on. That being said, the process of identifying the branches of the decision can be elaborate and include exploratory analysis that can take a few weeks or, in rare cases, even months, to make sure the relevant set of possible branches has been explored.

To provide the opportunity for outside-of-the-box insights, anyone taking the backward approach to decision-making should also be conscious of incorporating into the process opportunities to uncover unexpected insights and to act on those. As we mention repeatedly in this book, nothing in the QI process has to be linear.

Finally, we tend to be obsessed with outside-of-the-box thinking because of the risk of missing out on things we don't know we don't know. In our quest for the unknown, we often don't spend enough time finding answers for the things we know we don't know. But the reason we know we don't know the answers to these questions is often because they are on our critical path. Starting from the decisions you know need to be made, the backward approach maximizes the chance that the data-driven journey will shed light on the answers to the questions you know you don't know.

With respect to influencing the decision-making process, or confirmation bias, recall that by working backward we don't mean decide and then embark on the data-driven journey, but rather scope a decision tree with at least two meaningful branches to decide between and then develop the analysis plan to allow you to make that decision. By identifying the possible branches of the decision, making sure that there are at least two of them, and, most importantly, making sure that everybody involved in the process understands that all branches are viable and that the objective of the project is to identify which path we should take, you can circumvent the risk of affecting the selection of the branch itself.

# Taking the Road Less Traveled

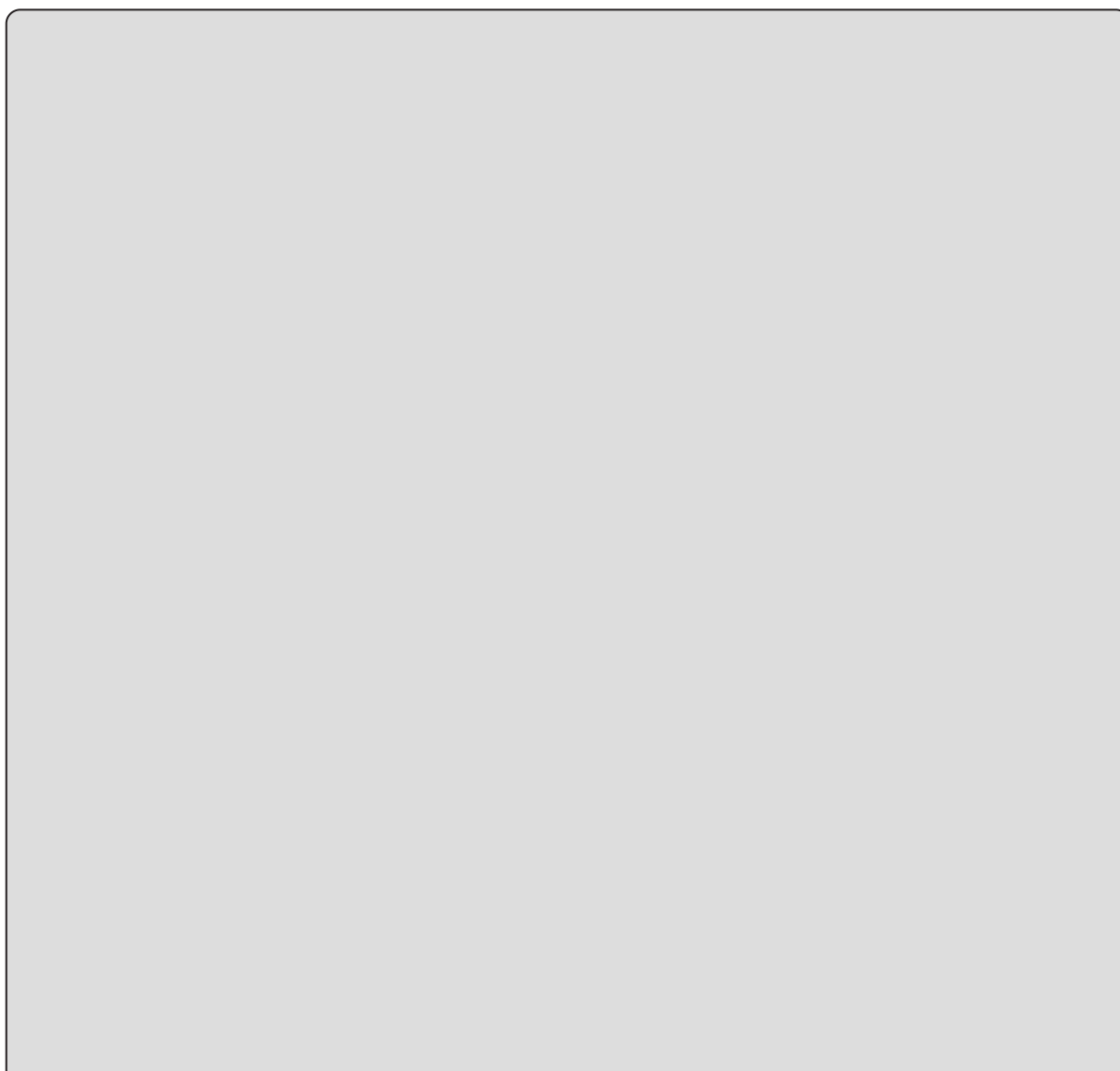
From our extensive experience, despite its clear appeal the backward approach is not frequently employed in business decision-making. Why not? One answer is lack of awareness of the approach and its benefits, which this book should help mitigate. Another answer involves effort and risk. The first two steps of the backward approach—outlining the possible branches of the decision and writing the blueprint of the report—require heavy involvement from top management early on in the process. Top management is always busy with fires to put out, and present bias leads us to believe that we will have much more time later on, when the report comes back, than we have now.

Another reason management may be unwilling to put the time and effort into clearly scoping out the project is the misguided belief that that's the job of an analyst or consultant. Particularly if, as a leader, I am paying a vendor or a consulting firm to run the analyses, why should I do their job and write the blueprint of the report for them? Similarly, the myopic vendor might be reluctant to push their client to be involved in the process, either because they want to avoid the client breathing down their neck or because of the perception that this is exactly their expertise and the reason they were hired in the first place. This combination nearly guarantees mediocrity and a project doomed to waste resources and end on the scrap pile.

Some might shun the backward approach because of risk aversion. This goes back to the scenario in *Alice in Wonderland*. Adopting the backward approach means deciding where you want to go, defining the impending decision, and determining the path to get there. By definition, this also means that we have outlined the measure of failure. The traditional forward approach provides some comfort and safety because with no decision to be made any insights uncovered can be counted as a win. If the forward approach eventually does not lead to any insights or a decision it is easy to blame the consultant or the analyst. Often, this feeling of risk is further amplified by the vagueness of the problem at the start of the process, although this vagueness, ironically, should be the main reason to invest time and effort early on to frame the problem and decision upfront.



One solution to the real- or perceived-time management problem would be to consciously, and well in advance of the project, carve out time on top management calendars. We should use this time for top management to collaborate with the team that runs the project, to frame the essential question, understand the possible decisions, and start the process of creating the blueprint of the report. Do not underestimate the importance of close collaboration and input from the management team. Spending time early on will prevent the common outcome of ending up on a misguided data-driven journey and discovering that you've wasted time and energy on the wrong thing. As for risk, by now it should be clear that the theme of QI is to give decision-makers the comfort of combining human judgment with data and analytics to confidently make decisions under uncertainty.



## **A CASE STUDY FOR WORKING BACKWARD—AMAZON PRFAQ**

One company that is well known for working backward is Amazon.<sup>2</sup> The tech company's successful use of a so-called Press Release/Frequently Asked Questions (PR/FAQ) has made Amazon the subject of many case studies demonstrating how to launch a successful product.

At Amazon, the ideation of most new products or services starts with the exercise of creating a PR/FAQ. This involves imagining the perspective of the PR team and writing a press release as if the time of the product's launch has arrived. This exercise in mental time travel almost tricks you into taking the backward approach to decision-making without having to cognitively engage in backward thinking. Before a decision about whether to invest in the new product or service has been made, and before the full scoping of the product has been defined, the champion of the idea looks months or years ahead and simulates Amazon's introduction of the product to the public. Envisioning early on in the process how the product would be introduced to the market by stating what the product is and identifying its target market, the customer problem the product would solve, and how it would solve it, should help decision-makers see the product from the perspective of the customers and decide whether to invest in this product idea in the first place.

To accompany the single-page press release, an FAQ sheet of no more than five pages is created. The FAQ is a list of questions that customers and internal stakeholders might have about the product; it, too, is crafted as if the product had already been released. Important FAQs to consider include why Amazon should create this product, why it shouldn't do it, what are some of the expected obstacles, what are the synergies and redundancies with existing products, and what are “the elephants in the room” when making a decision about this new initiative. Thinking about these aspects early on leads to a much more focused process of decision-making and development. The PR/FAQ then becomes a living

document that is reiterated on and updated multiple times, guiding the product movement from ideation to implementation.

According to Bryar and Carr in *Working Backwards*, most PR/FAQ documents do not eventually become a product. Is it a waste of time to put so much effort into writing PR/FAQs for ideas that don't make it? In most cases not. The process highlights the importance of working backward and investing our time in understanding the details and constraints early on: this effort minimizes further investment in the development of less promising ideas.

While Amazon popularized the exercise, this backward process is now used by other companies as a way of anticipating the challenges and questions that they might face if they were to decide to make a certain decision or launch a certain product.

## Key Learnings - Chapter 3

- Don't expect the data to provide both the questions and the answers. It is your responsibility to home in on the essential question and then combine data with intuition to attempt to identify the answers.
- Start with thinking about the decision at hand and work backward to scope out the needed data and analyses.
- When faced with a vague problem definition, use the five whys approach to identify the essential question or the impending decision.
- Understand that starting from a decision involves upfront time and risk, but it maximizes the chances for purposeful and effective data-driven journeys.

## Notes

1. Andreasen, Alan R. “Backward Market Research.” *Harvard Business Review*, 1985, 63(3): 176–182.
2. Bryar, Colin, and Bill Carr. *Working Backwards: Insights, Stories, and Secrets from Inside Amazon*. Pan Macmillan, 2021.



## CHAPTER 4

# Learning to Become a Fierce Data Interrogator

*Torture the data, and it will confess to anything.*

— Ronald Coase

Now that we've discussed how to align our focus on the essential question in [Chapters 1–3](#), it is time to move to the second pillar of Quantitative Intuition (QI)<sup>TM</sup>: data contextualization. It is the stage in which we collect, clean, and scrutinize the data to uncover answers to the questions that we have so carefully posed. This is where the *Q* in *QI* will take the lead, but even in this stage, intuition, judgment, and a great deal of skepticism will be essential.

This is also the stage where you may be thinking, “analytics is not my strong suit, so I will leave it to the ‘quants’”—those with a degree in engineering, math, economics or data science, or the Excel or even Python experts. There are skills needed to scrutinize data, but being strong in math is rarely one of them. It is about having context. It is often the manager with deep understanding of the business who is in the best position to evaluate the context of the problem or decision at hand, and the manager, therefore, who is best equipped to probe the data, not necessarily from a statistical point of view, but through a series of critical questions. This kind of interrogation can determine whether you have the right data to address the essential question and assess the soundness of the results and recommendations. This interrogative mindset requires a great deal of intuition and business acumen. As is highlighted in [Chapter 1](#), the key to become a fierce interrogator of data is to ask a series of powerful and precise questions.

The purpose of this chapter is to strengthen your aptitude to become a fierce interrogator of data and analyses without the need to be an analyst or a math whiz. At its core, interrogation is primarily about being able to ask the right questions. After all, your data is only as good as the questions you ask of it. We focus on three important dimensions of data interrogation:

1. Assessing the data and its reliability.
2. Putting the data in context.

### 3. Pressure testing your analysis.

For each of these dimensions, we provide steps, tools, examples, and questions—everything you need to become a fierce data interrogator.

But before we dive into the three dimensions of data interrogation, let's be clear about how they fit within the role of the manager.

As discussed in the Prologue, one could define a data-driven journey as a process with five steps: problem definition, data discovery, data analysis, insight development, and implementation. In our experience, managers tend to come in two types, and each type focuses on one end of this process. At one extreme, high in the realm of problem definition, we have the “30-thousand-feet manager.” This manager always has their eyes on the prize, is laser-focused on the decision at hand, and hardly ever worries about the data and analyses presented to them. In fact, this type of manager often knows their course of action before even looking at the data. They have (or believe they have) very strong intuition. The problem with these managers, to quote Andrew Lang, is that they “use data as a drunken man uses a lamppost—for support rather than illumination.” They rarely interrogate the analyses; instead, they interpret the numbers to match their own agenda, even torturing the data to derive insights or conclusions they wish to push forward.

The second type of manager is the “numbers type,” whom many of us have met. You send the numbers type manager an Excel worksheet with over a thousand cells, and they spend hours investigating every single cell in the worksheet as if the goal of the organization is to produce perfect spreadsheets rather than make effective decisions. The problem with this type of manager is that they often don't see the forest for the trees. They are so deep into the numbers that they tend to forget why we started this journey in the first place and what problem we are trying to solve or decision we need to make.

A good QI decision-maker progresses (not necessarily in a linear fashion) from scrutinizing and ensuring the validity of the data to evaluating the analysis and insights, making sure the insights are actionable while always staying focused on the business problem they are trying to solve. This requires diving into the data only when necessary to positively impact the eventual course of action. As you can see, the art and science of data interrogation is crucial through the three steps of the QI framework: Precision questioning, contextual



analysis, and synthesis. Now we're ready for the first dimension of data interrogation, assessing the data.

# Assessing the Data and Its Reliability

We live in a world of Big Data, and it's clear that Big Data and data science are here to stay, delivering great value. But at the same time, Big Data comes with several shortcomings. With the firehose of data pointed at us, we typically spend less time looking for available data, and more time and effort sifting through mountains of data to identify the relevant and reliable data sets. With the availability of more data, the typical presentation deck has become longer, with even more tables and figures. Rather than getting more concise with deeper insights, we often find ourselves overwhelmed with endless analyses and figures, while gleaning very few, if any, insights. This data overload—sometimes coming from unknown or dubious sources—makes it difficult to evaluate the data's integrity. It also increases the risk of data fishing, where any individual with an agenda or even a hypothesis can hook the snapshot of data that supports their story. This behavior—interpreting the data to see what we want to see, to reinforce a point of view—is often called *confirmation bias*, as discussed in the prologue. The firehose of data can make confirmation bias errors easier to commit and harder to detect.

With the sheer volume of data creating so many challenges, how can a manager who is not a data analysis expert avoid biases and analysis paralysis? It is all about asking the right questions.

To guide us in assessing the data and analysis for reliability, we suggest asking the following three questions:

1. What data was collected?
2. What data am I not seeing?
3. Can I trust the data and analyses?

## What Data Was Collected?

The first question you want to ask yourself before conducting any analysis is what are the variables and metrics that are available to you? Was the data collected the data you really need? Do you have the right variables to help you make the decisions? As discussed in [Chapter 3](#), decision-makers sometimes prefer to be precisely wrong rather than vaguely right. They may feel more comfortable looking at available data

sets that are precise but less relevant to the problem, than less accurate data that has the key metrics they need to make the decision.

Consider the case study of a new chocolate chip cookie brand. Prior to the national launch of the product, the brand followed the common practice of introducing the product in a single representative test market. The test market was used to examine the product's performance and evaluate different pricing strategies, advertising tactics, and distribution. During the test, the company collected information on sales, market share, and advertising expenditure—both their own and that of competing brands—as well as survey data. Three months into the test of the product, the hard data looks great. The brand has backed the pilot launch with strong marketing, and sales of the product are above expectations and comparable to, or even better than, previous new product launches. The product has captured substantially more than its expected market share in the category.

The decision at hand is whether the brand should stop the test market and launch the product nationally, stop the test market and not launch the product, or continue the test market for a few more months. The third option, continuing the test market, risks an opportunity cost of delaying the national launch and sparking possible competitors' reactions. The data seems to support the first option—stop the test and launch the brand nationally—but at this point, you want to ask yourself what data was collected and what are your IWIKs™. Do the pieces of evidence collected help you answer your IWIKs? Working backward from the decision, do you have the inputs needed to call the shot and make an informed and confident decision about the launch?

Thinking about the drivers of the sales data and the forward-looking nature of a decision to introduce the product nationally, you probably want to know the breakdown of the overall sales data between trial and repeat. What are customers' repeat purchase intentions? Indeed, when we looked at the trial and repeat purchase data for the new chocolate chip cookie brand, we see that the strong marketing behind the launch led to trial sales that exceeded expectations. However, both the actual repeat purchase data and the post-purchase survey results—which asked customers if they planned to buy the product again—were well below expectations. The excellent product trial had helped to compensate for the low repeat sales figure, leading to rosy overall sales and market share figures. However, asking the right questions and going beyond the sales and market share data revealed a different and

less favorable outlook for the brand. A manager who had not thought in advance about collecting the trial and repeat data would have missed this important insight and would probably have made the wrong decision in this case.

Many famous failed decisions are attributed to the wrong data being collected. One notable example is Coca-Cola's decision in 1985 to discontinue the Coke formula—loved by consumers for almost 100 years—and introduce New Coke. The decision came in response to their major competitor, Pepsi, showing that in blind taste tests, Pepsi the drink has been called Pepsi since 1961 was preferred to Coke. Coca-Cola management conducted large-scale and expensive market research. Almost 200,000 prospective customers were blindfolded and instructed to taste different iterations of a sugary concoction, some of which had been manufactured by Coca-Cola, and some by rivals. Coca-Cola's extensive research led to the creation of a new formula that, in blindfold taste tests, was preferred to the original Coke formula and to Pepsi. Coca-Cola then decided to replace the original Coke formula with a New Coke flavor. That decision met strong resistance, demonstrations, and, in some cases, even riots among Coca-Cola's loyal consumers. That furious consumer backlash caught Coca-Cola's management by surprise and eventually led them to revert back and reintroduce Classic Coke, keeping the loved original formula. Such dramatic U-turn decisions by companies are rare, but when they occur, they're often damaging.

What went wrong with the New Coke decision-making process? After all, Coca-Cola invested millions of dollars and thousands of hours in marketing research prior to making the decision. Let's ask the question of what data was collected. The primary metric or key performance indicator (KPI) used to decide on the optimal cola flavor was a measure based on blindfolded consumer taste tests of various cola formulas. Why was this the wrong KPI to make that decision? The answer seems, in retrospect, simple: Consumers don't go blindfolded to buy their soft drinks in the supermarket. The question Coca-Cola failed to ask, considering the brand and taste that has shaped American preferences for decades, was this: Would supermarket consumers, with their eyes wide open to labels, names, and packaging, prefer a new flavor of Coke over the original? The answer to that question was, apparently, no.

How can managers ask the right questions and make sure the right KPIs are being collected? Let's examine the two preceding examples: the test market for the chocolate chip cookie brand and the introduction of New Coke. What was missed in both examples were the fundamentals: understanding and exploring the drivers of consumer behavior. Had the leaders of Coca-Cola conducted an effective IWIK session, as discussed in [Chapter 2](#), or a careful backward approach from the decision to the information needed to make that decision, as discussed in [Chapter 3](#), they would have been much more likely to collect the right information and make the right decision. These tools would have helped the decision-makers identify the right metrics to describe the customer purchase decision, like trial and repeat purchases in the test market case, or the preference—even love—for a classic brand, which couldn't be measured by blindfolded testing.

Another red flag to look for when it comes to assessing data and major KPIs are averages. Because one can almost never report all the data points, it is common to report averages across different groups. However, averages can be misleading. Consider a survey in which customers reported their preference for pulp in the orange juice they drink on a -2 to +2 point scale. Having two segments in the population, one that likes pulpy orange juice and another that dislikes the pieces of fruit in their drink may lead to an average preference for pulp of around 0. Seeing only the average preference for pulpiness, the researcher may conclude that consumers do not care about pulp. This would mask the truth, as all consumers actually care about the level of pulp in their orange juice, but half of them truly like it and the other half dislike it.

Averages may not only mask the truth, but they may also lead to an entirely wrong conclusion. Imagine you have run an advertising experiment where some of the customers were targeted with an online display ad, and another randomly selected group was not. The campaign seems to have worked. As the last row in [Table 4.1](#) shows, 8.3% of the customers who were shown the ad ended up buying the product and only 7.8% of the customers who were not shown the ad bought the product. Because customers were randomly either shown or were not shown the ad, the analyst concluded that the campaign was successful and recommended showing the ad to all customers. Another analyst who looked at the campaign results was interested in investigating how effective the campaign was for new versus repeated customers (rows 2 and 3 in [Table 4.1](#)). To her surprise, the analyst

found that whether she looked at repeat customers or new customers, showing the ad led to a lower purchase rate than not showing the ad. But how could that be? The overall results are simply the sum of the two groups? How could each group (new and repeat customers) have a higher purchase rate when they do not see the ad, but overall, the campaign showed a positive effect for showing the ad? This situation is known as the *Simpson's Paradox*.<sup>1</sup> Looking across groups leads to the opposite result than looking at each of the groups separately.

What should we do? How do we know which slice the data we should look at? The analyst happened to slice the data by new versus repeat customers, but what would have happened if instead, she sliced the data by geography, age of the customer, the income of the customer, and customers who saw the ad on a Mac versus a PC? Would that lead to different results? As with the previous examples, it all comes down to what KPIs are relevant for the decision. The splits of the data that matter should be the split that you can and may want to act on.

**TABLE 4.1 Simpson Paradox example**

	<b>Not shown a display ad</b>	<b>Shown a display ad</b>
<b>New customers</b>	7.3% (1,920/26,300)	6.9% (550/8,000)
<b>Repeat customers</b>	9.3% (810/8,7000)	8.7% (2,340/27,000)
<b>Overall purchases</b>	7.8% (2,730/35,000)	8.3% (2,890/35,000)

Because many companies fail to understand the risk of looking at averages, such companies often create the average product that sits in the middle of consumers' preferences but may serve no one. Putting it in simple terms, if we were to serve customers the average tea that lies between the preferences of some customers for iced tea and the others for hot tea, we would have served all customers a lukewarm tea that none of our customers would want. Be aware of averages and make sure you don't serve your customers or colleagues lukewarm tea.

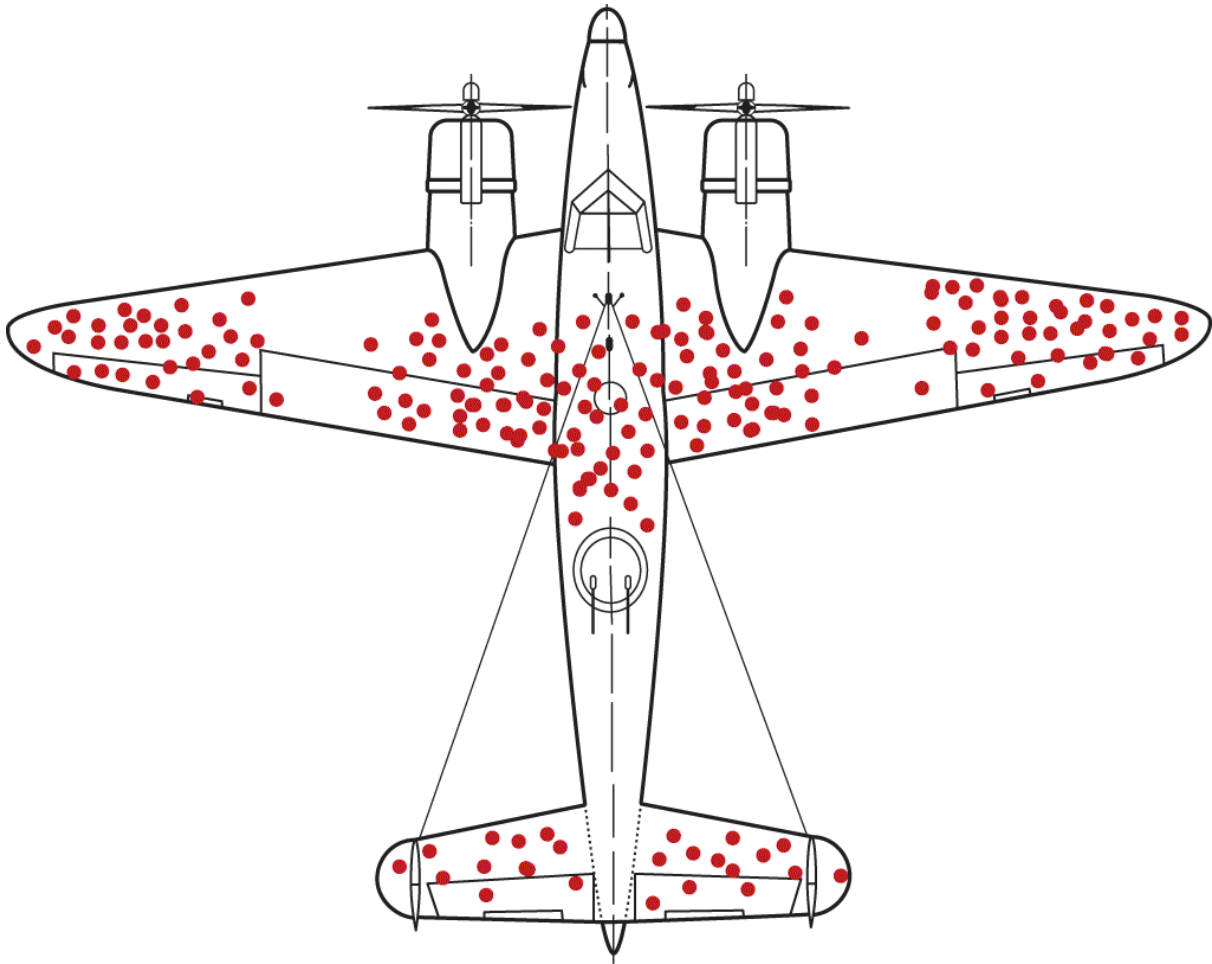
When considering data or analyses, managers need to be fierce interrogators. To begin with, ask yourself some key questions: Are these the KPIs I would expect to see? Are these the KPIs I need to know to be

able to make the decision? What else do I wish I knew to be able to make the decision?

## What Data Am I Not Seeing?

The data points you observe are almost never the entire data. There are almost always some aspects of the data that you are not seeing. Even the census data collected by the government, which, by design, is aimed at reaching every citizen, tends to miss people who have no permanent residence, like homeless people or students, or people who elect not to respond. There are two critical questions the fierce interrogator must ask: What data am I not seeing? And is the data I am missing similar to the data I do observe? It is often assumed that the unobserved data are similar to the observed data, but if this assumption is incorrect, it could lead to erroneous predictions and faulty decision-making.

A famous example illustrating the issue of missing data dates back to World War II. U.S. Army engineers were examining the airplanes that came back from combat to assess where to add more armor for critical protection. As you can see in [Figure 4.1](#), most of the hits and damage to the airplanes (the dots in the figure) were, as one would expect, in the large surface areas like the wings and the main body of the airplane. Based on this figure, the engineers decided to reinforce these high-risk areas. Abraham Wald, who was a statistics professor at Columbia University at the time and was consulting to the Army, looked at the figure and recommended reinforcing the armor around the cockpit, the engines, and the gas tank surfaces. The army engineer asked whether Wald was looking at the same figures they looked at. In fact, Wald was thinking of the missing data. He made his observation realizing that the Army engineers hadn't accounted for what is known as *survival bias*—an error that arises when sampling is limited to people or things that have passed some sort of selection process. Tragically, the planes that were hit in the cockpit, the gas tank, or the engine, never made it back from combat.



**FIGURE 4.1** Location of hits in WWII aircraft

In this example, the data observed (damage to airplanes that came back) was diametrically opposed to the unobserved data (damage to airplanes that did not make it back). Asking two questions—what data am I not observing? and are the observed data points similar to the unobserved ones?—helped Abraham Wald detect the problem with the observed data.

Two other famous cases of missing data involved incorrect predictions of many polls in the 2016 U.S. presidential election and the 2016 United Kingdom European Membership Referendum (better known as Brexit). Many people refused to answer these polls, and these people's opinions differed sharply from the opinions of those who did respond. Pollsters failed to adjust correctly for the opinions of nonrespondents. This is called *nonresponse bias*. It reflects a specific missing data problem that becomes a bias only if nonrespondents differ in a meaningful way from respondents. One possible solution to the missing



data problem of nonresponse is to create one degree of separation between the respondent and the response. For example, in the 2016 U.S. presidential election, the few polls that did well in predicting the outcome were those that asked people to predict how their neighbor would vote. This approach helps adjust for nonresponse bias as well as biases arising from dishonest responses.

In the preceding three cases—the WWII airplanes' analysis, and the failures of the U.S. election and the Brexit polls—there was no intent on the part of the data provider to hide part of the data from the decision-makers, and yet missing data led to erroneous predictions or conclusions. Now consider the situation common in business or public policy where data providers may be motivated to show only the part of the data that supports their agenda. Such cases might include deliberately withholding or obscuring data.

The missing data problems previously described are just a glimpse into the world of unobserved data errors. How does a fierce interrogator of data mitigate the risk of missing data? As always within the QI framework, the answer is to apply a set of questions: What are the data points I am not seeing? Does the data include nonresponse? Is the data I am not seeing similar to the data I am seeing? Who provided the data? Do they have a reason not to show me the entire data, and, if so, what are they likely to hide?

## **Can I Trust the Data and Analyses?**

One of the most common pitfalls of data-driven decision-making is failing to see that the data you're basing decisions on is flawed. Assuming the data collected included the right KPIs, you should explore whether that data is accurate and reliable. It is equally important to understand the assumptions underlying the generation and analysis of the data.

There are many famous examples of wrong decisions based on inaccurate data. Consider, for example, Christopher Columbus crossing the Atlantic Ocean in 1492. Hoping to reach Asia from Portugal, Columbus based his idea of the journey's distance on the calculations of a medieval Persian geographer. Not only were those calculations erroneous, but Columbus also assumed the geographer was referring to Roman miles when, in fact, the measures were in Arabic miles. That mistake amounted to a difference of almost 5,592 miles (9,000 km)

more than Columbus's estimate. Centuries later, the National Aeronautics and Space Administration (NASA) made a similar mistake with the Mars Climate Orbiter (MCO). Relying on calculations provided by Lockheed Martin Corporation, NASA assumed that the crucial acceleration figure was presented in the metric system. In fact, Lockheed Martin had used the English system of feet, inches, and pounds. This error led to the loss of the MCO, at a cost of \$125 million.

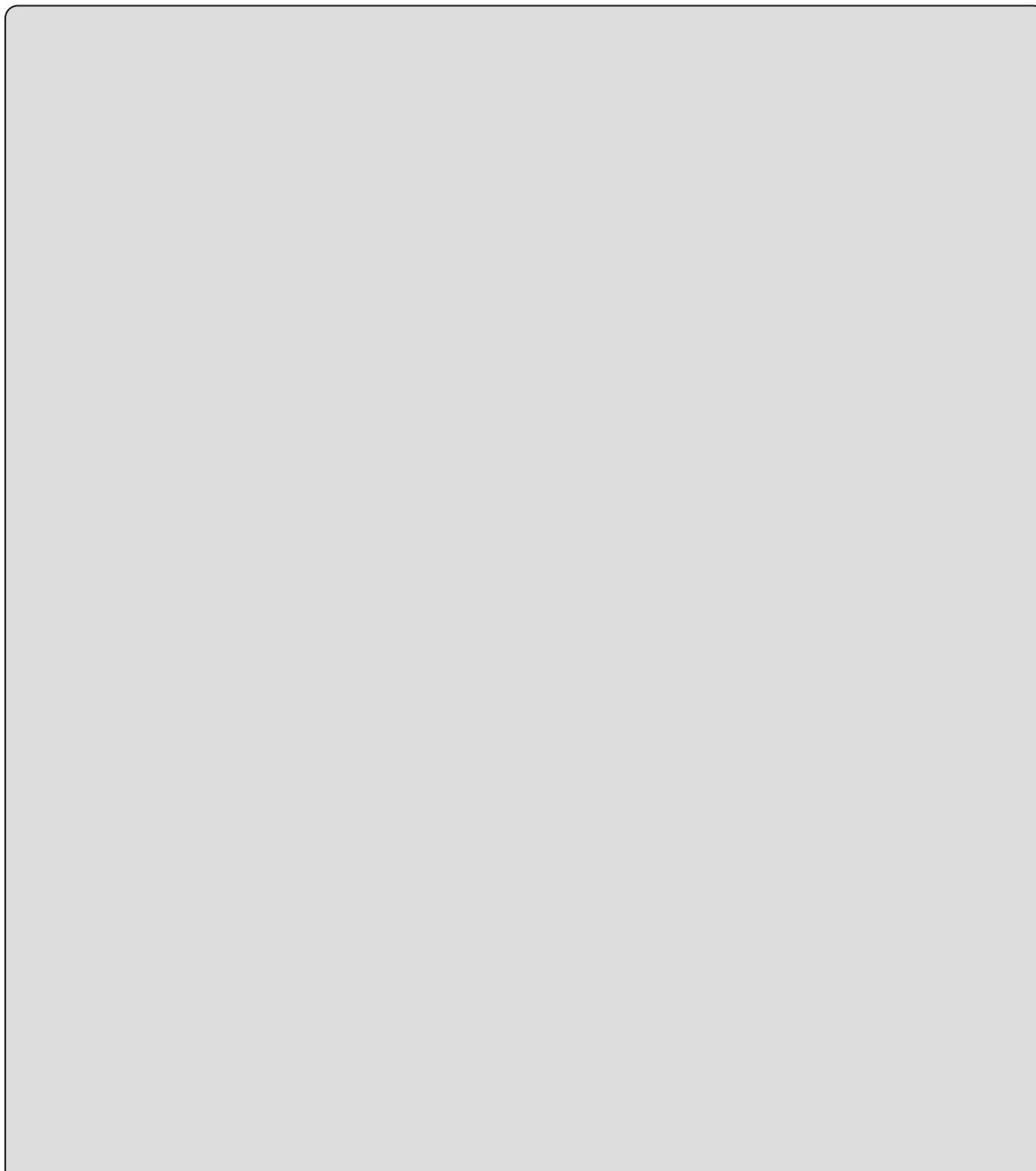
Another example of the dangers of faulty data, and one that was more costly by far, is the financial crisis of 2008. The crisis has been attributed to bad and missing data about the risk inherent in subprime mortgages. In the case of the 2008 financial crisis, some of the faulty data may have arisen from ill intent on the part of those who were selling these loans who may have presented these using *vanity metrics*. Vanity metrics look impressive on the surface, but don't truly reflect the underlying situation and are not useful to understanding performance or informing decisions. Typical vanity metrics in business include figures like the number of social media likes or shares or sales due to promotions without accounting for the cost. Another common vanity metric is for a business with a decreasing trend of annual revenue to report the cumulative revenue, which is, by definition, always increasing.

So how do you identify such data reliability issues? The first thing you want to do when you receive data or analysis is to examine simple summary statistics like the average and the range of the values of each relevant variable in the data. This should help you quickly identify the more apparent problems in the data. If you find that the average age of the customers in the data is 150 years, or the average tenure of employees in the company is 45 years, you know these variables are faulty. Similarly, looking at the minimum or maximum values can help identify outliers. If you are looking at the survey responses to a 10-point scale Net Promoter score survey question, and you find a minimum value of 1 and a maximum value of 34, you know there is a problem in the data. The maximum cannot be larger than 10 in a 10-point scale.

Another way to quickly interrogate the data is to plot it in whatever way allows you to readily explore its reliability. Simple plots are a great way to reduce large or complex data to a visual. We cannot count the number of times we have identified issues with data simply by asking our analysts to report the average of each variable or to visually plotting the data. A simple plot can help you explore important patterns in the

data, as in the case of Anscombe's Quartet (see “The Anscombe's Quartet” call-out box).

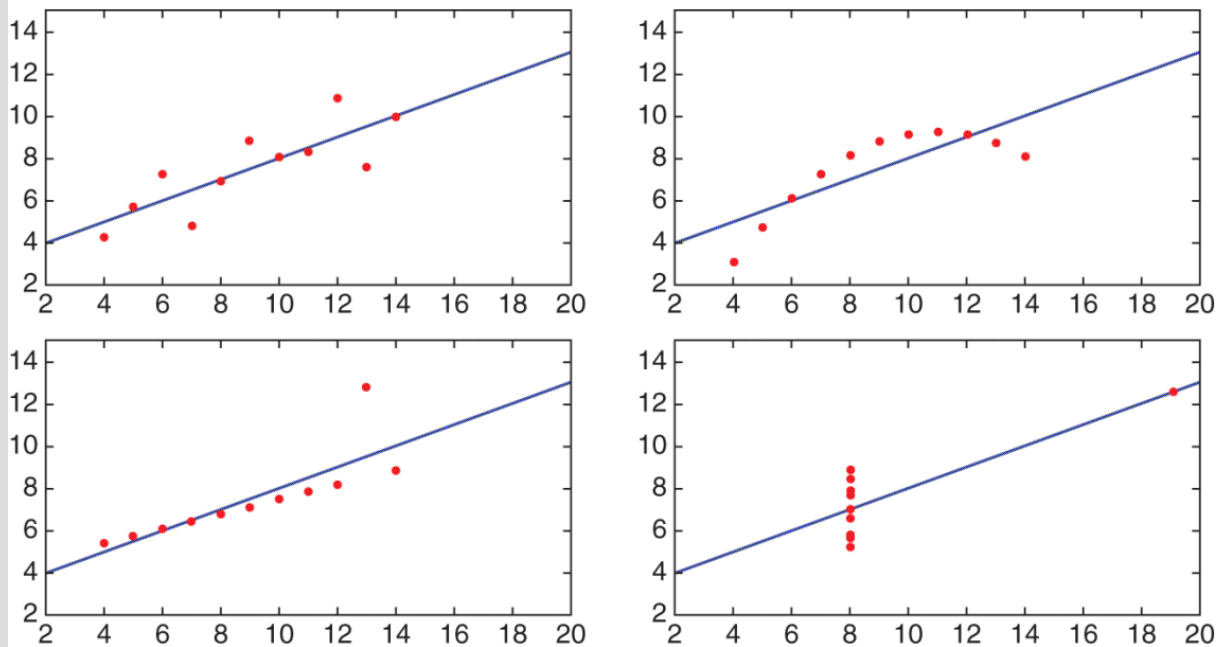
Keep in mind that data can get distorted when it is imported from one software or one system to another, as in the preceding NASA example. Your analyst, being well versed in analytic methods and eager to jump straight into the analysis and deliver results, may be tempted to skip the step of looking at summary statistics of the data plotting it. Make sure they don't!



## THE ANSCOMBE'S QUARTET

In our QI workshops with executives, we share the famous Anscombe's Quartet data created by the statistician Francis Anscombe (see the left side of [Figure 4.2](#)). We ask participants to identify the relationship between the two variables  $X$  and  $Y$ , like advertising and sales, in each of the four data sets (I, II, III, and IV). An interesting pattern often emerges. Workshop participants who have a statistics or data science background tend to turn immediately to statistical analysis methods commonly used to identify relationships between variables, like correlations or regression analysis or even fancy machine learning models. On the other hand, participants who are less familiar with statistical analysis often attempt to identify the relationship between the variables by simply plotting the data (e.g., using a scatter plot) to identify possible patterns. In this case, the participants less well versed in statistics gain the upper hand.

	I		II		III		IV	
	x	y	x	y	x	y	x	y
0	10	8.04	10	9.14	10	7.46	8	6.58
1	8	6.95	8	8.14	8	6.77	8	5.76
2	13	7.58	13	8.74	13	12.74	8	7.71
3	9	8.81	9	8.77	9	7.11	8	8.84
4	11	8.33	11	9.26	11	7.81	8	8.47
5	14	9.96	14	8.10	14	8.84	8	7.04
6	6	7.24	6	6.13	6	6.08	8	5.25
7	4	4.26	4	3.10	4	5.39	19	12.5
8	12	10.84	12	9.13	12	8.15	8	5.56
9	7	4.82	7	7.26	7	6.42	8	7.91
10	5	5.68	5	4.74	5	5.73	8	6.89



**FIGURE 4.2** Anscombe's Quartet

The participants who dive into statistical analysis—running correlations or a regression analysis—resurface with erroneous

conclusions that all four data sets are identical, as all typical statistical metrics like averages or correlations are identical across the four data sets. The participants who look at the data and plot it visually identify the patterns on the right side of [Figure 4.2](#). This allows them to interrogate the data. They see that the four data sets have inherently different patterns, which are masked if one jumps straight to the analysis. Plotting the data also reveals the possibility of an outlier that needs to be examined for data sets III and IV. The more quantitatively minded our workshop participants are, the more likely they are to fall straight into the trap, failing to question the data before they jump into the analysis. The lesson is, look before you leap: Before you conduct any analysis, plot the data to understand the likely patterns and guide the analysis.

## Assessing the Data—Key Learning

To examine the reliability of the data, the fierce interrogator asks a series of questions. We encourage you to use this list to guide your data interrogations.

1. **What is the source of the data?** Data and analyses rarely arrive at your desk at random. There are often intentions (good ones, but also possibly bad ones) behind how and why the data was collected and how and why the analyses are presented to you. Depending on the source and the intention, there could be possible agendas behind the data delivered to you. A good data interrogator asks these questions: Does the data provider have a reason not to show me the entire data? If so, what are they likely to hide? For example, is it the marketing team that provides evidence about the success of the advertising campaign? Understanding the source of data, and the intent or possible agenda, can inform me about possible issues in the data that you want to pay closer attention to.
2. **Are the metrics provided the ones you expected to see? If not, why not?** Are your data providers showing you the right KPIs? Are you being presented with vanity metrics that make the data provider look good?
3. **How were the metrics calculated?** Many metrics have no clear definition. For example, when a company reports having 10

million customers, you want to ask yourself how *customers* are defined. Are *customers* everyone who ever visited the company's website (even if they never bought anything), people who last bought from the company five years ago, or only active customers who purchased in the past year? Depending on the agenda behind the data, the data provider may choose different metrics. Make sure that you understand the metrics, particularly those that are critical to your decision-making.

4. **When and where was data collected?** Are the time period, location, and context relevant to the decision at hand? Should we make decisions about mobile wallet adoption in 2022 in Hungary based on mobile adoption data in Austria in 2017? We happen to have accurate and reliable data from Austria, but no readily available good data from Hungary. Am I better off with accurate but less relevant and possibly outdated data from Austria or less precise but more current data from Hungary?
5. **Are the comparisons being made to relevant and comparable alternatives?** Almost every company can look good if compared to the right competitor. If comparisons are made, are the metrics comparable across alternatives? Different companies may measure the same KPI (e.g., the number of customers) in different ways.
6. **What is missing?** Are there other data points that may be relevant? Do you have this data over time so you can explore possible trends?
7. **Is the data I am not seeing similar to the data I am seeing?** What data didn't you capture? Who was left out? Could you have fallen prey to a nonresponse or a survival bias?
8. **Are there outliers?** Was there any data the provider could not explain (outliers) and therefore did not show? Is there a pattern in the outliers that may prove valuable?

Asking yourself these questions can help you scrutinize the data and analysis presented to you. Note that to be able to ask or answer these questions, you do not need to be a math whiz or a skilled data scientist, in fact, as the example in the Anscombe's Quartet call-out box demonstrates, quite the opposite. You simply need curiosity, critical thinking, and a good understanding of the context. You need to

combine quantitative information with a great deal of intuition and business acumen. This is why the *I* in *QI* is a strong way to lead early in the process: good intuition is the key component of great data interrogation.



## Putting the Data in Context

Let's assume that you have completed the first dimension of data interrogation, assessing the data and its reliability. In short, you have made sure that you are collecting the right information and the data is reliable. You have plotted the data and it all looks fine. Your analyst has run the analysis using the shiniest new three-letter-acronym analysis tool on the data and has delivered the results.

The next dimension of data interrogation is to put data in context. This is the Golden Rule whenever considering any information. We cannot emphasize this point enough. Context is king. Three questions will help you put the data in the context of your business and in context of your business environment:

1. What does the data mean in the context of business operation?
2. How does the data compare to historical data?
3. How does the data compare to competition or other comparables?

To understand how context matters, consider the situation of Alex, a CEO of a newspaper, the *Local Gazette*, who is worried that the big trend of consumers moving away from traditional news consumption might affect the viability of her business. This year, *Local Gazette's* profits were 5% down from last year. Of course, Alex is concerned about the profitability of the newspaper, but does this figure indicate that she should change anything about her business?

Asking the first question, how does the figure relate to the company's entire operation, leads Alex to examine the decrease in profitability in context: The 5% decrease could be due to lower demand or higher costs. Either of these could be sufficiently negligible, relative to the entire operation of the business, which could indicate that Alex doesn't need to worry about changing her business overall. In fact, the increase in cost could be due to investment in new products that will generate future revenue, in which case a resultant 5% decrease in profitability is not a negative sign. Putting the absolute figure in the context of the company operation helps Alex understand whether the decrease in profitability is meaningful.

Alex's second question should interrogate the historical context: How does the 5% decrease compare to previous years' changes in

profitability? If profitability has been fluctuating year after year by plus or minus 7%, then a 5% change is within bounds of what we would expect. On the other hand, if the newspaper's profitability has been increasing steadily over the last five years, with a sudden decrease this year, this year's decrease may be a much more alarming signal.

Finally, Alex should consider the third context, the competition or the comparable. Should Alex be more or less worried about the future of her business if she looks at her local competition and sees that their profitability has all been either up or stable this year? At first glance, you may think Alex should be more worried if it is only her newspaper that is down this year. However, remember that the real fear for the *Local Gazette* is that demand for print newspapers, as we know it, is going down. In such a case, Alex should be more worried if all newspapers are down than if only her newspaper is down. Even if the *Local Gazette's* decrease is within historical ranges and may be relatively negligible, if the entire industry is down, that might signal bad news for the newspaper industry as a whole. If this is the case, Alex may want to explore alternative metrics like the growth of her digital subscriptions or online readership.

Putting the data in context is crucial to understanding its significance for your business. Always triangulate the data. When you see a positive or negative figure, don't jump to conclusions; consider what the number means in the context of your business, in view of history, and in the business environment, both current and future.

# Pressure Testing Your Analysis

Now that you have assessed the data and put it in context, you will need an expedient method of pressure testing the analysis and verifying the viability of the results.

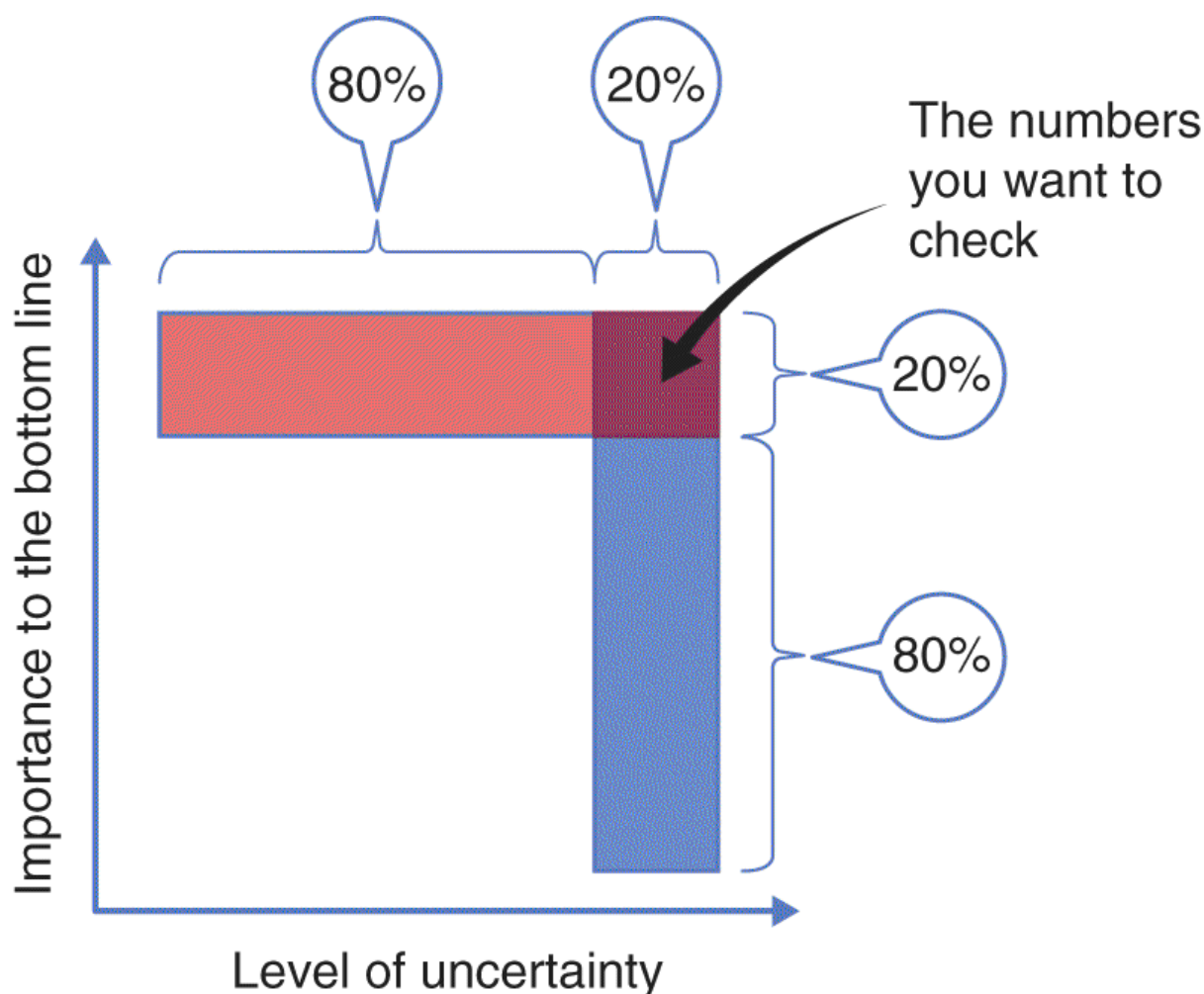
In a typical scenario, a colleague sends you an Excel worksheet with projections for next year's profitability. As is often the case with these files, it is an overwhelming worksheet with over a thousand cells crowded with numbers. How do you pressure test the model without going through the gory task of examining each number?

An efficient, reliable way to pressure test any model is to use the Pareto Principle, which asserts that 80% of consequences often come from 20% of the causes. Luckily, there are two types of 80–20 Pareto rules that can make this task manageable. The first is that often only about 20% of the numbers in the spreadsheet affect the bottom line; the remaining 80% are only needed for completeness or calculations. Consider, for example, the cost of cleaning the building. This number needs to be included when calculating the cost of running the business next year, but triple it, or even multiply it by 10, and its impact on the bottom line is still likely to be minimal. You do not need to look at such low-impact numbers, even if you believe they are absolutely wrong.

The second 80–20 rule has to do with your level of certainty about each number. Again, luckily, your level of certainty should be pretty high for the majority of the numbers, possibly because they are similar to last year's figures and because most aspects of the business didn't change much, or because you are familiar with the figures and their components (like the exchange rate from dollars to euros). You only need to focus on the minority of the numbers that make you do a double take. In fact, you should only focus on the numbers that are both uncertain and important, which, if both 80–20 rules work, should be only approximately 4% of the numbers (because  $0.2 \times 0.2 = .04$ ; see [Figure 4.3](#)).

Now you may wonder, how do I know if a number has an impact on the bottom line? For many of these figures, your acumen and familiarity with the business will help. For others, you can do a sensitivity analysis. Change the number you want to investigate and examine what happens to important metrics in the model. For example, if you are not sure about the impact of the compensation of the salespeople on the firm's

profitability, half or double the current compensation value and see what happened to profitability.



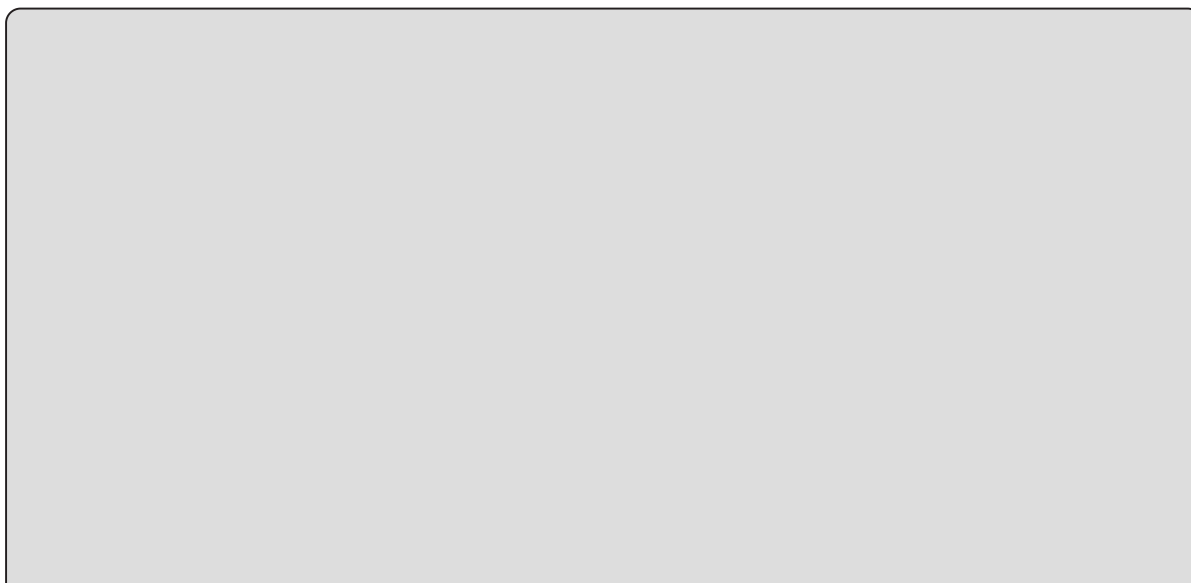
**FIGURE 4.3** The two Pareto rules of data interrogation

What about the level of uncertainty? How do we develop an intuition for numbers to know if they are out of the ballpark? By experience, you already know some numbers about your business—this is the starting place of your numbers intuition. You'll need to develop your intuition further to handle numbers you're not familiar with, for example, an intuition for knowing whether the numbers are too large, too small, or about right. To develop this intuition, you can do a back-of-the-envelope estimate, which we discuss in [Chapter 6](#).

The source of the data and analysis should also affect your level of uncertainty. You should always look out for possible hidden agendas. In this regard, you probably have better intuition for some aspects of the

business than other aspects. You can easily increase your intuition by involving your teams. Different members of the team are likely to have good intuition for different aspects of the business. For example, if you come from operations, you are probably quite familiar with the inventory numbers, but possibly less so with the marketing figures. Look at the marketing numbers, focus on the ones that you are particularly uncertain about, mark them, and ask your chief marketing officer or marketing director to look only at those numbers. Building diverse teams with diverse expertise helps to increase the collective intuition of the team and the understanding of which numbers are important and/or uncertain.

Another way to pressure test your analysis is to focus on the areas in the analysis where you have good intuition. You often have good intuition for what should happen at 0, 1, or infinity. For example, to pressure test a spreadsheet with projections for next year's profitability, you can take the figure of units sold and set it to zero. You already have good intuition about what should happen to the profitability of the business if it sells no products whatsoever. It should be seriously negative. A similar situation should happen if you sell only a single unit (see call-out box "IBM Pressure Testing a Silicon Valley Startup"). What about infinity? You cannot plug in infinity in Excel, but you can set units sold to 10 times last year's figure. The revenue figure should explode, and hopefully, with it, the business profitability. By pressure testing your model in that way, you can very quickly assess almost any model or logic, no matter how complex it is without the need to dive into the specifics of the model or the analysis.



## IBM PRESSURE TESTING A SILICON VALLEY STARTUP

It only took five minutes to review the data.

Paul called back and said exactly what he thought: “I’m not sure how to interpret this spreadsheet. Either it’s broken or there’s something broken with your business.”

Clearly this was a provocative statement. Why was Paul so blunt? It would be several more years before Oded, Chris, and Paul would define the vocabulary and model, but Paul’s response was Quantitative Intuition in action.

At the time, Paul was part of a due diligence team at IBM, which was seeking a technology partner to deliver Silicon Valley innovation. As Paul tells it: My team was evaluating a particular Silicon Valley startup. The diligence should have taken a few weeks but was beginning to drag on. The management team’s presentations were well structured, their projected business outlook was rosy, they were backed by a major venture capital firm, and their executive relationships were solid. They weren’t quite a Silicon Valley darling yet, but they were certainly on the right track. This was a potential high reward for IBM if the startup could deliver on their promise. Given the growing hype, it would be a costly investment for IBM, so the diligence had to be spot on and avoid detours and risks.

From a Quantitative Intuition perspective, their storytelling was on point, but to me the substance wasn’t clear. Their technology seemed good but replicable. Were they truly innovative or exceptional? When my team and I asked ourselves what surprised us about what they were presenting us with, the answer was, very little. The startup’s team continued to attempt to anchor us on, or divert our attention to, outstanding outcomes with little detail. When we told them our IWIKs, they countered by referencing proprietary software and explaining that they weren’t able to disclose the details. They were avoiding not only answering the questions but any open discussion of questions in the first place.

Was this new company an exceptional outlier? Could we come to an agreement to invest in their venture and adopt their technology based on guesstimating economic impact? Could we infer that they truly did bring exceptional value to the table? Both their Total Available Market (TAM) and their Serviceable Available Market (SAM) were enormous. Their focus on North America and Europe alone would seemingly run to hundreds of billions of revenue. Given that the quantitative view was simply very large but not specific, another great force of nature called “Fear Of Missing Out” (FOMO) started to surface as we weighed our decision.

Then came the spreadsheet. It was what they intended to be a “profitability model” for IBM, as a user of their product, and it was built using industry standard costing for data center equipment and average operational costs. If the spreadsheet made the case for IBM to benefit as a customer, it would then also make the case for the full market potential.

The spreadsheet was locked apart from a single cell for input, namely, the number of computer servers. It was preloaded with the figure 10,000 and showed fabulous revenue projections. The team suggested I insert whatever number of servers made sense. They assumed I would simply go up from 10,000 to show the “hockey stick” increasing value but following what we have discussed in Chapter 4 around model pressure testing, I tried three very different numbers: 100,000, 1, and 0. I had good intuition about what the model should show in the case with 1 single unit. This would allow me to get a view of the unit cost and the economic levers that drive a product business. Amazingly, however, all three inputs showed wildly successful revenue projections. It stunned me that one server yielded an enviable profit projection, but zero servers? The only explanation was that these people were wizards and their product was entirely magical.

Of course, the spreadsheet wasn't the problem. The real problem became clear in that the startup was not terribly innovative and was simply pursuing a sale and more investment funding. Testing the spreadsheet confirmed our skepticism about the limited data, highly polished messages, and mixed signals we had received. Our overall synthesis across all that data, combined with instinctual interpretation, led us to decline working with the startup.

Weeks later we learned of other business challenges, including intellectual property constraints, that we would have faced if we had chosen to work with them. Again, our intuition proved spot on. My team and I had avoided being drawn in by an alluring story and superficially impressive data because we listened to our instincts, probed, and determined that the data was entirely inadequate for making a fully informed decision.

We encourage you to apply this set of questions to pressure test your analysis. Notice that these questions do not require you to be well versed in data science or analytics. In fact, stepping back from the gory details of the shiny analytics tool and using your intuition to put the information in the appropriate context, are essential to becoming a fierce interrogator of data and an effective QI leader.



## Key Learnings - Chapter 4

- Remember: Your data is only as good as the questions you ask of it.
- Ask yourself whether you have the right data and the right metrics to make the decision: What IWIKs cannot be answered with the data collected?
- Be aware of averages. Ask yourself what are the splits of the data that are relevant for your analyses.
- Ask yourself about missing data: What data points are you not seeing? Are they similar to the data you are seeing?
- Plot the data to get intuition: This should be your first step in data analysis. Did the plot reveal any issues? Evaluate data reliability by asking a series of questions: What data was collected? How are metrics calculated? When and where was the data collected? Are the comparisons reasonable?
- Put the data in the context by looking at it in absolute, over time, and relative to competitors and comparables.
- Pressure test the analysis by diving only into figures that are both uncertain and can have an impact on the decision. Quickly evaluate them by looking at 0, 1, and infinity. Does this reveal any issue with the analysis or the model?

## Note

1. Wagner, Clifford H. "Simpson's Paradox in Real Life." *The American Statistician*, February 1982, 36(1): 46–48.



## CHAPTER 5

# Developing Intuition for Numbers

*It is better to be roughly right than precisely wrong.*

— **John Maynard Keynes**

An important question we're often asked about the Quantitative Intuition (QI)<sup>™</sup> approach is whether you can actually learn intuition. It is clear that you can teach the *Q* in *QI*, but isn't intuition something you either have or don't have? Can you really learn to be intuitive about numbers? Quite simply, the answer is “yes,” you can develop intuition, and in this chapter, we show you how.

We first discuss how to resist the urge for certainty and the benefit in rough approximations. We then demonstrate how business leaders can learn numbers intuition by practicing the power of approximation. We show how to look at a number and, relatively quickly—by using available related figures or back-of-the-envelope calculations—assess whether that number is likely to be within the ballpark of the true figure. Approximations allow decision-makers to get a practical check on the numbers presented to them and better understand the drivers behind the figures. The habit of approximating translates into intuition. Rather than relying on complicated calculations that promise exact accuracy, you develop a feel for what seems about right. You also build the trust and confidence that underlie intuition.

In our work, we often observe that decision-makers are swayed by statisticians and analysts to require universal, predefined high levels of accuracy. Of course, some decisions do indeed require a high level of accuracy, but many do not. The QI framework tells us that decisions (not data) should guide the process. For every decision, we should ask ourselves “What accuracy level is needed to make this particular decision?” For many business decisions, particularly when evaluating whether to pursue a project or idea at an early stage, rough estimates are entirely sufficient.

# The Power of Approximations

Oded had the occasion recently to observe a group of MBA graduate students presenting their entrepreneurial idea of opening a farm-stay in Guatemala to a panel of experts. Farm-stays are vacation resorts where guests stay on a farm, enjoy the countryside, and take part in farm life. This sort of vacation has become increasingly popular.

The students' slide deck was packed with data. To establish the feasibility of their idea, the team adopted a top-down approach, starting with a measure of the overall size of the world tourism market, then narrowing down that figure to the tourism market in Central America, and subsequently inferring what the size of the market in Guatemala might be. Using that figure as a basis, they then estimated the proportion of tourists to Guatemala who would prefer a farm-stay experience over something else. They then used this to calculate the likely demand for services offered by their particular business. Multiplying by the average likely cost of a stay in the farm for one family, they arrived at an expected revenue of \$32 million a year for their farm-stay business in Guatemala.

As they went through their pitch, the team was grilled by the panel members on almost every aspect of the analysis. Is Guatemala similar to Costa Rica in terms of counting tourists to Central America? Aren't the segments that visit Costa Rica and Guatemala quite different? Where did you get the numbers for the share of preference for farm-stays? Does your analysis include eco-tourism? were only a few of the numerous questions fired at the team. Seeking certainty and accuracy, the panel members left almost no number unchallenged. It was a grueling 25 minutes for the student team.

As Oded tells it, sitting at the back of the room, and having practically no experience of or expertise in the tourism industry, particularly in Central America:

I had little intuition about whether the team's calculation and the eventual projected revenue was high or low.

Rather than strive for certainty by scrutinizing every number, as my colleagues on the panel seemed to be doing, I decided to take a different approach. I started at the end, with the projected estimate of \$32 million a year in revenue. The question I asked myself was not whether that figure was accurate. In fact, considering that it was a projected number for a project that wouldn't launch for at least a couple of years, I knew that it was not accurate. Instead, I asked myself whether this number was likely to even be in the ballpark of what a farm-stay in Guatemala would be able to make in a year. If the team's estimated revenue was indeed reasonable, this could be a great business. But was the figure way too small, way too large, or about right?

By reformulating the question—leaving aside the accuracy of the calculations and focusing instead on the single most important number in the presentation, the projected revenue—I felt more comfortable relying on my intuition. I asked myself what my gut told me about this number, and then I turned to an approximation.

Oded avoided analysis paralysis. He didn't concern himself with every aspect of the group's thinking and calculations. Focusing only on the essential question, Oded's IWIK™ (see [Chapter 2](#)) was: “I wish I knew whether the team's revenue estimate was even within a reasonable range.”

Even as a total tourism industry outsider, Oded knew a few figures—even erring on the high side—a night at a rustic, rural farm-stay in a country like Guatemala should never cost more than \$300 per room, and he knew that such a property was unlikely to have more than 50 rooms.

Assuming that each room is occupied for 250 days of the year and doing a quick back-of-the-envelope calculation in my head, I came up with a yearly revenue of just \$3.75 million. The team's calculation of \$32 million wasn't even close. Even if I had been more generous on price per night, number of rooms, or occupancy rate, I still wouldn't have come close to the team's reported number.

Using fifth-grade multiplication allowed Oded to circumvent his lack of experience in the hospitality industry and develop an intuition for the

numbers presented.

By resisting the temptation to strive for certainty, and by challenging yourself to establish whether the numbers looked in any way realistic, you can save yourself time and energy, and focus on the issues the matter.

# Learning to Approximate

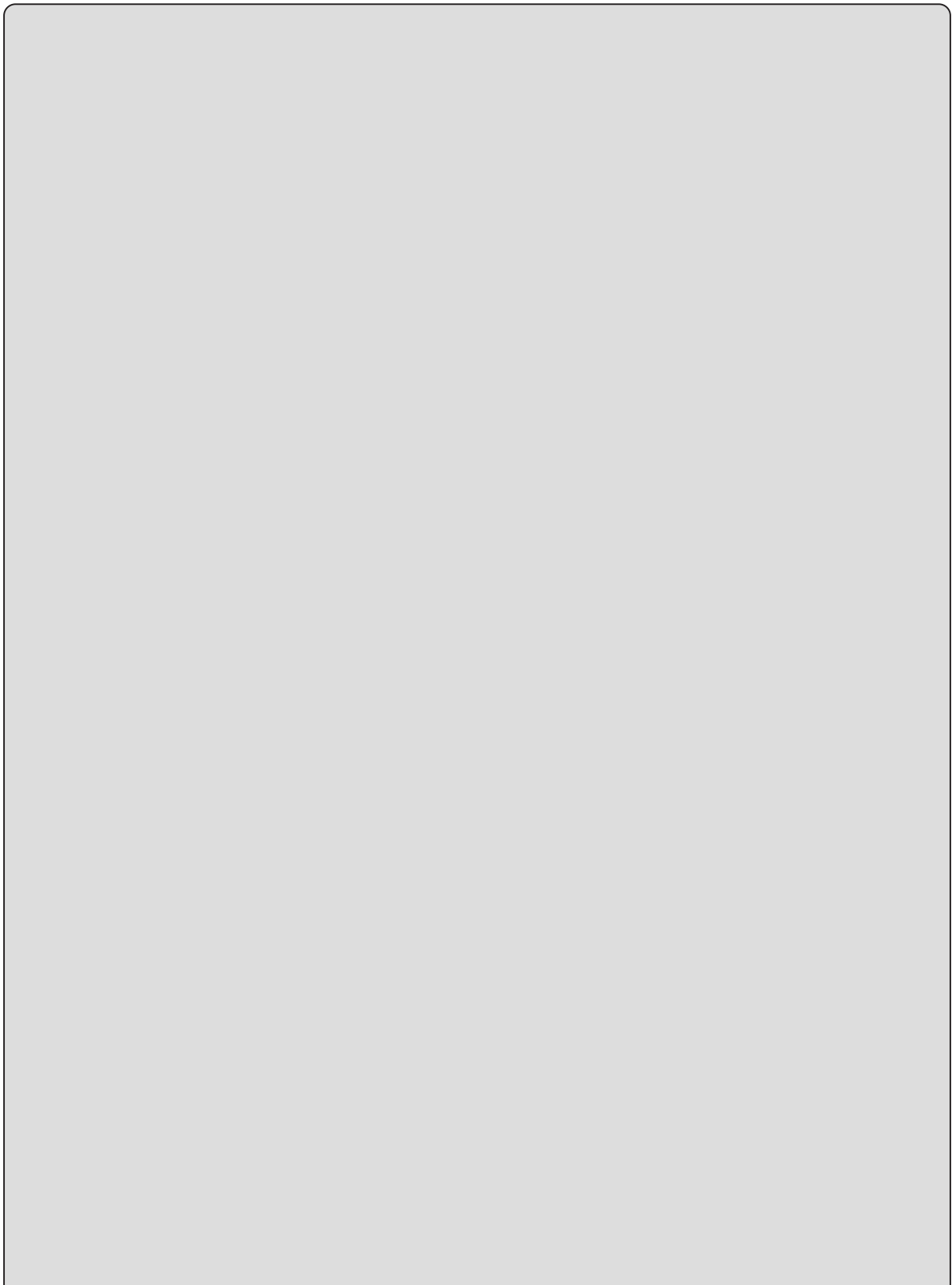
As decision-makers, we often find ourselves flooded with figures that have varying degrees of credibility, so it is crucial to be able to make first-order approximations. Making such approximations does not require you to be a math whiz; all it takes is having a few numbers at your fingertips and basic multiplication and division skills. The idea behind such approximations is to provide a practical check on a number you are faced with. While approximations are almost certainly incorrect, they provide an easy and simple calculation to check for possible errors and uncover unreasonable assumptions that might have led to a figure that is either far too large or far too small.

How can decision-makers acquire intuition for numbers? Experience helps, but to quote the famous German poet Heinrich Heine, “Experience is a good school. But the fees are high.” Through our decades of experience, we’ve learned that business leaders can often make up for a lack of experience, and complement the experience they do have, by grasping a few key numbers about their business and learning to approximate. Sometimes, all you really need is a guesstimate. The writer A.A. Bell defines *guesstimate* as: “better than a guess but not as guaranteed as an estimate.” To practice the art of guesstimation, we need an approach that can make the most of a little data.

Scientists often use first-order approximations to get a rough estimate of an answer before turning to more sophisticated analyses to obtain a precise solution. The Italian Scientist Enrico Fermi devised an approach to make such rough approximation (see the call-out box, “Enrico Fermi”). Fermi believed that the starting point to solving any complex problem is using shortcut simplifications to make meaningful approximations. The Fermi approach allows us to estimate quantities that seem difficult or even impossible to estimate at first, like how many piano tuners there are in Chicago (see call-out box “Guesstimating the Number of Piano Tuners in Chicago”). His approach is to break down a problem into smaller problems, or factors, that are easier to estimate, and then to piece these together to get a rough estimate of the number you are trying to approximate. If scientists, who are much more comfortable than most of us in applying sophisticated methods, often get a rough estimate before turning to



more sophisticated analyses, we should feel comfortable doing so as well.



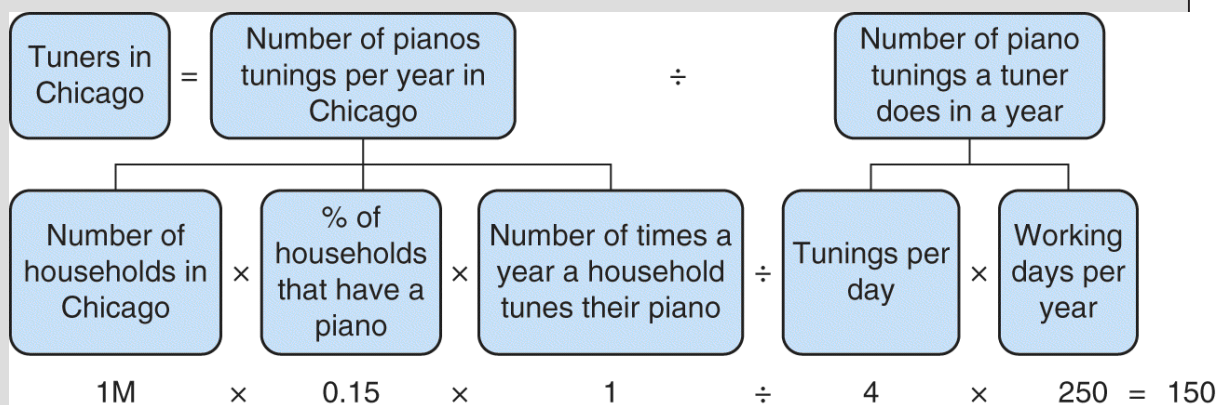
## **ENRICO FERMI (1901–1954)**

The Italian physicist Enrico Fermi (1901–1954), who became known as the “architect of the atomic bomb,” was responsible for the creation of the first nuclear reactor, for which he received the 1938 Nobel Prize in Physics. Soon after receiving the Nobel Prize, he fled fascist Italy to join Columbia University as a professor. In addition to Fermi's ability to easily address complex problems, he was known for his ability to make fast and good approximations with little to no actual data. In fact, using a simplification approach, he was able to estimate the impact of the atomic bomb within an order of magnitude of its current estimated impact, years before a bomb was ever used.

# GUESSTIMATING THE NUMBER OF PIANO TUNERS IN CHICAGO

If you want an example of guesstimation, consider the classic Fermi problem of estimating the number of piano tuners in a particular city, say Chicago. The vast majority of people faced with this problem wouldn't know where to start. Is the number likely to be in the order of a few dozen, a few hundred, or maybe a few thousand? Fermi's approach breaks this problem into smaller factors that are easier to approximate, and that, if known, enables you to estimate the desired figure.

There are several ways you can approach this. First, you can break the problem into estimating how many pianos are likely to be tuned in Chicago in a year, and how many pianos a piano tuner can tune in a year. We might even break it down further and estimate how many households there are in Chicago, what proportion of those households might have a piano, and how often these households tune their pianos. To estimate the number of pianos a piano tuner can tune in a year we would need to know how many days a piano tuner works a year and how many pianos that a tuner tends to be able to tune in a day (see [Figure 5.1](#)). It's likely that you don't know any of these numbers, but you'll probably have much better intuition about these subproblems than the original overarching question about the number of piano tuners in Chicago. Once we have broken down the problem into relatively knowable components, the original problem seems much more manageable.



**FIGURE 5.1** Approximating the number of piano tuners in Chicago



## Approximating in Practice

Approximation is also an excellent tool when we simply don't have all the numbers we'd need for an accurate calculation. For example, imagine that you are in the business of developing disposable towels to be used in delivery rooms for wrapping babies right after delivery to maintain their body temperature. You'd probably want to estimate the number of babies delivered in the United States per day. Estimating this number will allow you to approximate your expected revenue if you were able to sell to every hospital, or to a certain share of hospitals. How would you go about estimating this number? Some people might start by simply attempting to guess the number itself, but unless you have seen a similar figure before, you probably won't have a good enough gut feeling to make a guess.

Following Fermi's estimation method, you'd want to break the problem into smaller factors that are easier to approach. There are multiple ways you could go about breaking down this quantity. You can estimate the number of maternity wards in the United States and the number of deliveries per ward, but the number of maternity wards is probably as difficult to estimate as the number of babies born per day in the United States. So, let's start with possibly relevant figures that we do know. We definitely know how many days there are in a year (365). We probably also have a good idea about the number of people living in the United States (approximately 330 million), and let's say that approximately half of them are women. We probably also want to guesstimate how many children an average family has. Looking around at your friends, we can probably guess about two. We have almost all of the ingredients to try and address the problem. You can estimate the number of women of childbearing age and assume that within the 15–20 years of childbearing age, women deliver on average two babies. That would probably get you pretty close to a good estimate.

Here are a couple of simpler routes to breaking the problem into factors. If, on average, every woman in the United States delivers two babies during her 80 years of average lifetime, we can estimate how many babies are delivered each day. For that, we need to know the number of women in the United States, the average lifetime of a woman in the United States, and how many babies an average woman delivers during her lifetime. From there it's simple multiplication and division.

Number of women in the U.S. = 165M

Babies delivered per women = 2

Average lifetime of a women in days = 80 years \* 365 days

Number of deliveries per days =  $165\text{M} * 2 / (80 * 365) \cong 11,300$

An alternative approach would be to say that the 330 million people living in the United States with an average age of 78 years had to be born on a particular day of the year. Leading to this calculation:

Number of people in the U.S. = 330M

Number of days they live = 365 \* 78 days

Number of deliveries per days =  $330\text{M} / (365 * 78) \cong 11,600$

The actual number in 2020 was 9,877 births per day, so both estimates are pretty close. In fact, they are both about 15% larger than 9,877. That is totally fine. Keep in mind why we estimated this number. We are not looking for the exact figure, just for estimates that are in the same ballpark. We can later conduct a study or contact the department of health for the exact number. By the way, by the time you finish reading this sentence, another three babies will be born in the United States, so do you really need to know the exact number?

# Why Guesstimation Works

In estimating the number of babies delivered, we made a lot of simplifications. We ignored a lot of details. We didn't take into account the uneven spread of the population over years and the baby boomers, the increase in life expectancies over the years, or the fact that because of their higher life expectancy, the share of women living in the United States is higher than 50%. But recall that we are looking for the Goldilocks measure—the too big, too small, or about right estimate—not an accurate estimate.

In breaking down a problem into smaller problems, we ignore the details and focus only on the major factors. When you first begin using this estimation method, it may feel odd to ignore so many details, but as you keep practicing and see close enough estimates, a weight will lift off your chest, and you will become more comfortable with the process, and with inaccuracy. In our striving for certainty, we forget the cost-benefit of obtaining the so-called accurate estimates. If you do not need an accurate estimate at this point to make a decision, getting a guesstimate is the most effective and efficient course of action.

Why does this method of estimation work? One of the reasons is that the estimates you use for each of the smaller problems in your breakdown are often much more accurate than your best guess for the eventual number. In addition, the overestimates and underestimates you make in each of the smaller problems will tend to cancel each other. For example, in the baby deliveries problem, if you erroneously underestimated the life expectancy to be 70, and you overestimate the number of kids per household to be three, you nearly cancel the two errors. Breaking down the unknown and uncertain figures to figures for which you have greater certainty has another benefit, too: it helps you develop and gain confidence in your numbers intuition.

In a business context, when using Fermi's approach to assess a figure presented to you, you can make adjustments to the factors as indicated by your problem. For example, if you believe that the number presented to you is too large, in making your approximations, you should be generous with your estimates for figures you are unsure about. More generous estimates will enable you to see if it is possible to get close to the presented number. Similarly, if you think the number is too small, be conservative with your estimates. Your goal is to evaluate if that number is possible, not whether it is correct. If you are conducting the

approximation for your own business, for example, to estimate the potential market, be honest with your estimates. If you start choosing generous estimates for each step of the calculation, the errors will compound, not cancel each other, and you will inflate your final estimate, possibly substantially.

If in one of the steps of the estimation you are faced with the need to estimate a number about which you still have little knowledge, use upper and lower bounds for comparatives. For example, if you need to estimate the population of Chicago and you don't know what it is, but you happen to know the population of San Francisco and New York, and you know that Chicago's population lies between the two, take an average of the populations of San Francisco and New York; it will probably get you pretty close.

We have run numerous workshops employing the guesstimation approach to estimate various quantities about which participants had little knowledge (e.g., number of hot dogs consumed at U.S. Major League Baseball games per year, gallons of water flowing through the Niagara Falls in a second). Time after time we are amazed by how close participants are in approximating the numbers using this approach.



# Getting Comfortable with Approximations

If the idea of using a guesstimate in decision-making is making you uncomfortable, we're not surprised. As decision-makers and business leaders, we often frown on rough estimates and approximations. We are wary of inaccuracies. We have been taught from a young age, particularly when it comes to math and numbers, to strive for accuracy. When the projections for next year's revenue figures are presented to us with three digits after the decimal point, we get a feeling of comfort—even though we know we can only realistically hope to project these figures in orders of thousands or tens of thousands at best.

## Consider Approximation in Context

QI informs us that the nature of the decision should determine our approach, not the availability of data. As we see in the farm-stay example, not all problems require accurate figures. Often an approximation is enough.

The type of decision you're making will determine the degree of accuracy you need. When the Food and Drug Administration (FDA) decided to approve the Pfizer and Moderna vaccines for Covid-19, even for emergency use, the numbers from the clinical trials were heavily scrutinized, evaluated, and re-evaluated. However, when the CEO of a startup that's at an early stage of funding is asked by a venture capitalist how many people they expect the company to employ in three years' time, a super accurate response, like 237, wouldn't only sound odd, it would be unnecessarily specific. A rough ballpark range of 200 to 300 would be much more appropriate.

Striving for certainty when only rough estimates are needed is not only inefficient, but it is also risky. The presentation of seemingly precise estimates may give the decision-maker the erroneous perception that they are basing their decisions on certain figures. Consider a spreadsheet providing a projection of next year's sales. Because the numbers are based on many assumptions and multiplication of multiple factors like projected unit sold, price, and conversion rates, the eventual figure is often presented with a few digits after the decimal. This practice should be considered inappropriate. The presentation of a projected number with a high degree of uncertainty around it as a precise estimate is confusing, and even worse, misleading. Instead, we

recommend matching the degree of reporting of figures with the corresponding level of certainty about these figures. Projections for next year's sales that are probably accurate only at the level of tens of thousands of dollars should be rounded to the nearest 10 thousandth.

In our work with business leaders, we often use the T-shirt sizing analogy to help people feel comfortable with guesstimates. The clothing industry has long recognized the need to match the metrics of garment sizing to the customer's need for accuracy. When it comes to clothes like shoes or dress shirts, the customer seeks a high level of accuracy on the fit of the item, and accordingly, the sizing measures are often quite nuanced moving in small increments. However, when choosing which T-shirt to buy, relatively few sizes—small, medium, large, and extra-large—usually suffice.

We should adopt a similar approach to our business decisions. When asked how much time it would require to complete a relatively complex task, an engineer may be reluctant to offer an accurate estimate. It may be too early to tell. And then there are the risks of inaccuracy:

Underestimating the time may result in false expectations and the perception of underperformance, and overestimating may lead to the perception of lowballing. Rephrasing the problem as a T-shirt sizing problem and asking the engineer to categorize the time required as extra small, small, medium, large, or extra-large, could relieve the engineer's fear of being inaccurate. Looking at the problem from the decision-maker's perspective, in many cases, when we ask how long a project would take, the decision at hand is the prioritization of tasks. We need to know whether the task will take hours, days, or weeks. Phrasing the question at the appropriate level of accuracy, for example, “Will this task take you hours, days, or weeks to complete?” will help ensure that you get the answers you need to make decisions in an efficient way.

In weighing the appropriateness of approximation, we should consider the context. In the early stages of a decision-making process, ballpark estimates are particularly useful to help make sense of the problem or evaluate the feasibility of moving forward before committing to bigger time and monetary investments. Approximations can also be used as part of the data interrogation stage, as discussed in [Chapter 4](#), where a ballpark figure can help identify possible problems with the analysis early on, as we see in the farm-stay example. Approximation can be

used in later stages of the decision-making process to better understand the economics behind an overall business. We encourage business leaders to conduct back-of-the-envelope calculations regularly in order to develop their own intuition for numbers and strengthen their critical reasoning and quantitative intuition in the domain in which they operate.

You may have heard data analysts and colleagues who are proficient in statistics often talk about providing precise estimates with tight confidence intervals of 95% or a  $p$ -value of less than 0.05. This means that 1 out of 20 times that you make the statement implied by the data findings, you will be wrong. But applying the QI framework, and the lens of decision-driven journeys, we can recognize that there is no uniform required level of confidence that is independent of the decision at hand.

For many business decisions, such as choosing version A of an ad over version B, being wrong 1 out of 10 times, or even 1 out of 5 times, rather than 1 out of 20 times, would be great. On the other hand, being wrong 1 out of 20 times is obviously too much for a decision such as whether to launch the space shuttle *Challenger* on a night in which the temperature in Florida was unusually cold, at only 26 degrees Fahrenheit. Hopefully, the lesson is clear: the confidence level that you require from the data and analyses should not just be a matter of sample size and statistics. It should also account for the context of the decision and the risk involved in making erroneous decisions. Consideration of context is unlikely to come from the analyst or data scientists. These issues are a matter of deep business understanding, and, as you develop it, of intuition.

In addition to the context of the decision, your experience and intuition should also matter in determining the desired level of accuracy. If a specific analysis provides evidence or insights that point in the same direction as many other pieces of evidence that we have seen before, we will be inclined to act on such insights, even if the statistical confidence level provided for that analysis is rather low. On the other hand, a study that shows single evidence for slower melting of a specific glacier—contradicting years of research and statistical evidence demonstrating the increasing temperature of the earth—would require a higher confidence level to be considered convincing.

## **Statistical Significance Doesn't Mean Managerial Relevance**

You should also consider the difference between statistical significance and managerial relevance. A relationship between two variables can be statistically significant but managerially totally irrelevant, or the other way around, profoundly meaningful even if it does not reach statistical significance. Numerous times analysts have come to us proudly celebrating their achievement of finding a statistically significant relationship between two variables. In many of these cases we have, unfortunately, had to cut the celebration short, informing the analysts that despite the result being most likely true from a statistical point of view, its meaning for the business is minimal, either because the relationship itself does not matter or because the absolute magnitude of the effect is too small to make a real difference.

Consider, for example, exploring the relationship between customer service level and customer retention. Your analyst found a statistically significant relationship between the tenure of the call center agent with the firm and customer retention, concluding that we should work harder to keep our experienced call center agents. But looking beyond the statistical significance, we see that an extra year of tenure of the call center agent is associated with an additional two days of customer lifetime. While the result may be statistically significant it may be managerially irrelevant for several reasons. First, are two extra days of customer lifetime meaningful to the company? Second, even if the increase in customer retention is meaningful, with an average tenure of a call center agent in our company of only three months, can we really hope to increase tenure by a full year? Always look beyond the statistical significance into the effect size and managerial meaning of the findings for the business.

# Guesstimation in the QI Framework

Too often in business we fall into the rabbit hole of striving for certainty, forgetting to weigh the cost of pursuing accuracy against its possible benefit. If you are at a point in your decision-making where you do not need an accurate estimate to make a decision, guesstimating is the most effective and efficient course of action.

We advocate using the guesstimate approach in every step of the QI framework. It can be used in the early stage of the process before any data has been collected to get rough estimates before getting into the analysis. It can be used when interrogating the data to pressure test models or estimate profit projections. It can also be used at the level of synthesis to question numbers presented to us. We have also seen the power of this approach to develop numbers intuition, even in situations and domains where we lack experience. Trusting inaccurate estimates may seem at first to go against everything you have learned in school about math, but as you start seeing the value of this approach, you will develop not only intuition but also greater comfort with approximation and uncertainty. The more you practice guesstimation, the closer you will get to the power of QI.

## Key Learnings - Chapter 5

- Begin by determining the level of accuracy needed for the decision at hand. For many decisions, rough approximations are all you need.
- When evaluating a number presented to you, before jumping into complicated analysis, start by getting a rough estimate for whether the figure is in the ballpark.
- Use back-of-the-envelope calculations to save time and understand the problem.
- Follow Fermi's approach to obtain rough estimates:
  - Break down the problem into small subproblems with factors that are easier to estimate.
  - Start with facts that you may know.
  - For figures you don't know, remember the Goldilocks rule: too small, too big, about right.
  - Assess possible ranges or comparables.
  - Don't worry about small details; you're looking for rough estimates.
  - Use worst-case scenario bounds but be honest with your estimates.



## CHAPTER 6

# From Analysis to Synthesis

*Synthesis—the composition or combination of parts or elements so as to form a whole.*

— ***Merriam-Webster Dictionary***

With the analysis at hand, and hopefully some useful insights, it is time to convert the analysis and insights into actions. The results from the analysis are simply facts or a series of anecdotes. The key ingredient in converting the insights into actions is connecting the dots. This process of connecting the insights, putting them in the context of the business, and pouring in judgment and intuition to convert the insights into actions is the process of synthesis, the third pillar of the Quantitative Intuition (QI)<sup>TM</sup> framework. Synthesis is the transition from analysis (primarily the *Q* in *QI*) to recommendation and action by adding human judgment and putting the analysis in the context of its environment (the *I* in *QI*). But synthesis is often easier said than done. In this chapter, we discuss how to arrive at a synthesis, the possible barriers that cause many to summarize rather than synthesize, and how you and the people you interact with can overcome these barriers.



# The Value of Synthesis

To best understand the value of synthesis, consider the following simple, and likely very familiar, example. You have asked your administrative assistant, Sam, to schedule a meeting with Mrs. Johnson, Mr. Davis, and Mrs. Schwartz. Six hours later you receive the following email from Sam.

Mrs. Johnson called. She said that she can't make it to the meeting on Tuesday at 3 p.m.—any other time this week would be better. Mr. Davis said he doesn't mind moving the meeting either, maybe to Wednesday or Thursday, but not before 10:30 a.m. And Mrs. Schwartz's assistant said his boss won't be back from London until late Wednesday evening. The conference room is already booked for tomorrow, but it's available on Thursday from 11:00 a.m. What do you think?

Now consider an alternative and a clearly better scenario in which, using exactly the same information, Sam composes a different email:

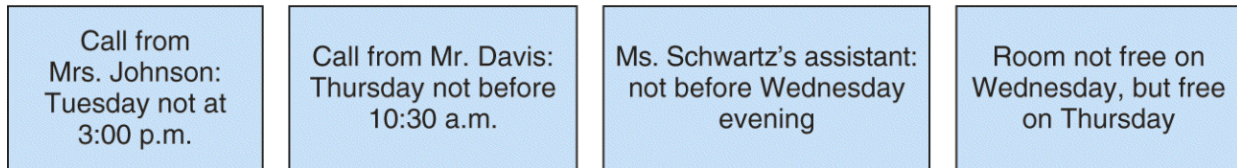
We should reschedule the Tuesday meeting for Thursday at 11:00 a.m.: Mrs. Johnson can't make the original time and Mr. Davis and Mrs. Schwartz would also be able to attend.

While it is clear that we would prefer our assistants to operate more like the employee in the second scenario, to get there it is important to understand the difference between the two scenarios.

The first scenario represents a classic summary of the information. Sam restates the known facts ending with a question “What do you think?” In the second scenario, Sam makes the bottom line the top line. She starts with the decision that the meeting will be rescheduled to Thursday at 11:00 a.m., and then she provides the necessary, and only the necessary, information (that all parties can make it at that time). In that scenario, Sam pours some judgment into her message. Rather than throwing the ball back at her boss, asking “What do you think?” she recommends when the meeting should be (see [Figure 6.1](#) for the difference between a summary and a synthesis in the two

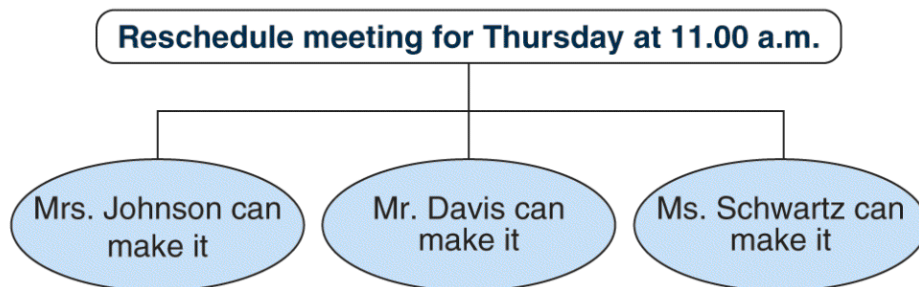
scenarios). This process of taking the pieces of information, connecting them to one another, and to the environment, and adding some judgment are exactly the ingredients needed to move from summary to synthesis.

**Scenario 1: Summary - Information not synthesized**

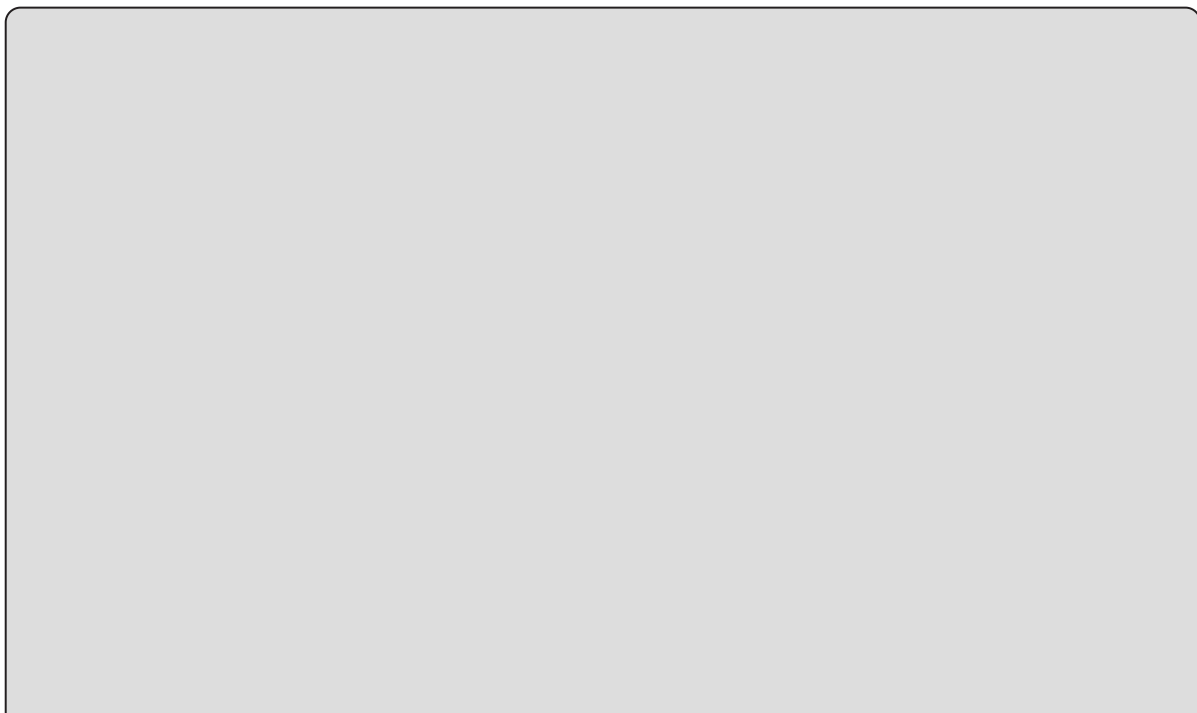


**No synthesis = no key message**

**Scenario 2: Synthesis - Key message placed on top**



**FIGURE 6.1 Summary versus synthesis**



## THE SYNTHESIS OF A SUFFERING BUSINESS

The sentiment in the room was pretty grim when the analyst presented the comparison of the firm's performance this year relative to last year (see [Table 6.1](#)). It was clear that the company was suffering on every single metric. The analyst who presented the results provided their view on the situation. “Sales have dropped 20%. We had a 50K increase in complaints to the call center and a 25% increase in complaints not resolved. We also had a 15% increase in service personnel turnover.”

While the data was quite useful in possibly shedding some light on the company's dire situation, the analyst's simple summary of the information was not helpful. It was a restatement of the facts that the leaders in the room could see for themselves in the table. There was no added value in that statement. What was needed was a synthesis of these data points to better understand what was really going on—a diagnosis of the “illness” the company was suffering from. Luckily a mid-level manager came to the rescue and offered such a synthesis.

**[TABLE 6.1](#) Firm performance in the past two years**

	Last year	This year
Sales	\$10M	\$8M
Call center complaints	100K	150K
Complaints not resolved	20%	45%
Service personnel turnover	10%	25%

The mid-level manager stated, “I am not part of the customer service team, but based on the information presented, what I think may be happening here is that our service level has deteriorated this year. The deterioration may have been due to high turnover in personnel. This, in turn, may have affected our sales.”

“Are you sure this is the problem that caused the decrease in sales?” asked the call center manager.

“How can one be sure?” answered the mid-level manager, “After all, I am not as close as you are to what is happening in the call center, but it is a possible explanation that is consistent with data.”

The call center manager offered an alternative explanation for the declining sales. “Maybe it is not a call center personnel retention problem, but rather a product problem. The product itself has some serious problems. Customers keep calling and complaining about the faulty product. Unfortunately, my call center agents have no way of resolving these product issues, and this frustration with the inability to resolve complaints led many call center agents to leave the company.” There were now two alternative explanations in the room for the declining sales. Neither of the speakers was fully convinced about the accuracy of their proposed explanation as they both had to make some assumptions and go beyond the data presented to arrive at their hypothesized explanation. This is the nature of synthesis, it requires adding some judgment and offering explanations that are uncertain. However, those in the room were so much smarter for having these two explanations on the table.

In fact, an analysis of the recorded customers' calls could easily help us identify whether the problem was customer service or a product problem. These syntheses sparked additional discussion about other possible syntheses like the effect of a recent price increase or changes in consumers' preferences. Even though these syntheses were uncertain, they were much more helpful than the simple summary of the information originally provided by the analyst. Even though they provided opposing views, both managers who proposed the explanations also gained some points and respect from the top leaders who attended the meeting. They clearly pushed the discussion forward.

# Make Your Bottom Line Your Top Line

The process of arriving at a synthesis promotes the notion of making the bottom line the top line. Start with reporting the decision or implications of the analysis followed by the needed facts to support the decision. This approach is commonly taken by top consultants in consulting firms such as McKinsey. At McKinsey, analysts are encouraged to follow the *Pyramid Principle*.<sup>1</sup>

The idea behind the Pyramid Principle is to first take a bottom-up approach of looking at the pieces of information, deriving a series of insights, and then synthesizing them into a conclusion or a recommendation. Once the synthesis has taken place, the communication of the synthesis takes a top-down approach. It starts with reporting the conclusion or recommendation at the title of the communication and then listing the pieces of insights and information needed to support the recommendation and help people understand how you arrived at the recommendation.

Consider, for example, a true case study of a segmentation analysis conducted for a new holistic medical treatment. The analyst preparing the presentation for the client followed the traditional approach of creating a slide with the title “Segmentation Analysis.” The body of the slide included a table with the columns being the three segments identified (“naturals,” “medicators,” and “holistics”), and the rows representing how the segments differ on several dimensions such as demographics, attitude toward the disease, and attitude toward treatment. The analyst didn't even include the conclusion of the segmentation analysis. When prompted about the lack of a bottom line, he included a bullet point at the bottom of the slide saying, “The most appropriate segment to target is the ‘naturals’.”

Unfortunately, many such analyses stop short of a synthesis or a recommendation, simply delivering the summary of the information in terms of the segments found. While agreed with the overall conclusion of the segmentation analysis made sense, the analyst was pushed to redesign the slide, making the bottom line the top line. He was urged to make the title of the slide the recommendation. For example, “We should target the ‘naturals’ segment.” The middle of the

slide would then explain what the natural segment is, how it is different from other segments, and why it is the right segment to target.

There are several reasons why making your bottom line the top line is beneficial. First, it is well known that people have a short attention span. They retain only a small fraction of the written or spoken information presented to them. By making your recommendation the title of your communication, you are more likely to catch people while they are still paying attention. This is particularly true for top leaders who have many other things on their minds. Second, by starting with the recommendation and then presenting why the information supports your recommendation, your argument and line of reasoning are likely to be much more persuasive. The risk of the alternative approach of starting with the information and analysis that leads to a conclusion, is that by the time you reach the recommendation, your audience has so many questions and concerns about the path you have taken to arrive at the conclusion, that they are less likely to trust the recommendation itself. Of course, if your syntheses resulted in the wrong conclusion, the persuasiveness of the approach of making your bottom line your top line may become a double-edged sword.

A good synthesizer does not only synthesize the information by adding judgment and making a recommendation, but they also make the bottom line the top line, leading the communication with the synthesis.

# The Lack of Synthesis

Unfortunately, we suspect that despite our wish to have our colleagues and people who work for us deliver information in a way similar to the previous administrative assistant Sam's scenario 2, many of us see communication similar to scenario 1 much more often. Why is that? If it is clear that synthesis is the desired outcome from the point of view of the receiver, why do those who deliver information often summarize? There are several reasons for this, including the effort required to synthesize, the risk involved in it, and the human desire to demonstrate how hard we worked.

First, relative to a synthesis, a summary is easy. All it takes to summarize is to look through the data and methodically report it piece by piece, as Sam did in scenario 1. A summary is often the first step in the process of synthesis. Synthesis requires the extra step of looking across the data points and asking the difficult question of what it really means. Further, in communicating the synthesis, one needs to decide which pieces of the information from the summary communicate the key message. Thus, while the communication of synthesis is often shorter, as Sam's email in scenario 2 demonstrates, do not confuse that with the ease of writing it. This is a classic example of the famous quote, "If I had more time, I would have written a shorter letter," which in one form or another has been attributed to multiple thinkers including Marcus Tullius Cicero, Blaise Pascal, and Mark Twain. Writing the shorter synthesis of the information and thinking carefully about which ingredients should go into the synthesis require both time and effort.

Second, a synthesis is riskier than a summary. A summary of the information is almost always factual. As long as the underlying information is correct, the summary of it is likely to be true. On the other hand, synthesis requires pouring in some judgment, and judgment, by definition, includes a good deal of uncertainty. For example, when synthesizing, our administrative assistant Sam decided to schedule the meeting at 11:00 a.m. However, there is a chance that Sam's boss forgot to update her calendar and is not available at 11:00 a.m. The alternative scenario of asking "What do you think?" is a safer approach.

The mistake may not be a big risk in the case of scheduling a meeting, but in different contexts, such wrong judgment can be costly. For example, synthesis can be a matter of life and death in hospital settings. The process of looking at data such as vitals and test results and combining it with the patient's background and the physician's medical acumen to arrive at a diagnosis, is the process of synthesis. Residents who are training to become physicians need to learn how to make such syntheses. In emergency rooms (ERs), it is often a medical student or a junior medical resident who is admitting the patient, taking vitals, and doing the tests and then reporting to the attending physician. At this point, the safest path for the resident to take is simply to report the summary of the tests to the attending physician and wait for the experienced physician to make the diagnosis. A skilled attending physician, even in the commotion and stress of the ER environment, would turn back to the resident, and ask "What do you think this patient has?" To reduce the risk, the physician may even empower the resident saying, "You have spent the last 20 minutes with the patient; you are closer to the patient than I am. What do you think the diagnosis is?" Of course, experienced physicians would make their own diagnosis, but they expect their trainee to do so as well. Similarly, we should expect the people we work with to synthesize the information rather than spitting back to us the raw data in a sequence of bullet points.

Third, people tend to report things in chronological order, describing their hard work in the order in which the tasks were performed. Sam's scenario 1 looks exactly like that. It is a chronological report of the phone calls made to schedule the meeting. Synthesis is all but chronological. It is a parallel process of combining pieces of information to arrive at a judgment or a statement and reporting only the relevant information that is needed to justify the decision. Compare scenario 2 to scenario 1 in Sam's task to schedule a meeting. From the email in scenario 1, it is clear that it took Sam a lot of time and effort to schedule this one meeting. If all Sam reports is the synthesis, as in scenario 2, how would her boss appreciate the hard work that went into making this meeting happen? To enable synthesis, we need to free people from the need to show how hard they worked. Instead, we should appreciate the hard work that goes into creating effective information delivery.



# Encouraging Synthesis

It is useful to remember why synthesis is difficult. Synthesis takes more effort, is riskier, and often does not directly demonstrate hard work. To encourage team members to put in the effort needed to synthesize and take the risk involved in adding their own judgment, you should empower them to feel confident in applying their judgments to the data and analyses.

Think about the medical resident in the ER who needs to synthesize the information to arrive at the diagnosis. As we mentioned earlier, the attending physician might encourage the resident by highlighting that the resident has spent more time with the patient than the physician has. Similarly, when it comes to data analysis, when we mentor students or analysts who come to us with a summary of information and ask us what we think, we often respond with something like, “You have spent two weeks with the data, you are much closer to the data than I am; what do you think this analysis means?” Empower the analyst or team member and provide encouragement by showing them that you believe they have what it takes to go the extra mile from summary to synthesis. We should also make a habit of complimenting and praising people who make the effort to synthesize. Even if the synthesis happened to be wrong, the act of synthesis should be applauded as it almost always pushes the discussion forward.

A possibly more difficult barrier to synthesis is the risk involved in synthesizing relative to merely summarizing. Because synthesis requires using judgment and arriving at a recommendation, there is the risk that the assumptions made in making the judgment, or the judgment itself, are wrong. This risk is often higher for junior employees who lack the experience, and possibly the context, to be able to arrive at a sound synthesis.

Several approaches can be used to build the confidence to synthesize. First, the way leaders in the organization react to mistakes or errors in judgment is crucial. To encourage synthesis, it is important to create an environment that is forgiving to erroneous judgments and supportive of taking calculated risks. For example, by realizing that judgment is only a factor in the decision, as opposed to the decision itself, a junior employee may be more likely to take the risk to

synthesize. Instead of immediately pointing out the mistake in the synthesis, the leader could suggest that a particular piece of evidence is possibly inconsistent with the synthesis and ask the junior employee to think about what else could be going on. Another trick that we have found useful to help people make judgments, even if they are uncertain, is to ask them to come up with at least two possible syntheses for a given situation. This frees people from the need to be right, as at least one of the syntheses is likely to be wrong anyway.

You can also encourage synthesis by making summaries less acceptable. For example, going back to Sam's summary in scenario 1, which ended with "What do you think?", the skilled QI manager would point the question back to the assistant and ask, "When do you recommend holding the meeting?" Some organizations even establish norms that prevent their employees from ending their statement or analysis with a question to encourage the process of adding judgment and making a recommendation. For example, several companies instruct employees to not just report problems, but rather report the problem together with possible solutions.

A more formal mechanism to synthesis may include what is commonly known as a *gallery walk*. In a gallery walk, you take the tables and figures generated by the analysis and hang them on the wall as if they were pieces of art in an art gallery. Then, you invite the analysts and middle and top leadership to walk around the room and examine the figures and charts, as they would do in an art gallery, and leave sticky notes with their impressions, conclusions, and questions about each "exhibit." You can even give sticky notes with different colors to people from different parts of the organization to identify where the comments are coming from. This step is likely to primarily lead to a summary of the information, though once people see a few figures, they may even comment on the synthesis of the information across charts.

The next step is crucial to arrive at a synthesis. At this stage, you take the figures, and the corresponding sticky notes, off the wall and spread them on the table, and ask the team members to synthesize the information. What does all of this information, collectively, mean for the organization? The gallery walk is a formal and offline version of a synthesis mechanism. A more digital version of the gallery walk

involves sending the data and analysis to the team and asking them to post any comments or thoughts they have about the analysis prior to the meeting. The meeting is then used, similar to the second step of the gallery walk, to discuss the comments and synthesize the information.

## **“What?”, “So What?”, and “Now What?”**

We have all sat in endless meetings discussing the analyses performed, where different members of the team keep questioning the integrity of the data and accuracy of the analysis. These meetings are often followed up with additional meetings to try and address the questions raised in the previous meeting and possibly raise additional issues. This process often seems like an infinite loop of interrogations where no decisions are made.

Synthesis involves the transition from the analysis, which mainly informs us about what the data points are and possibly what the insights are, to the question of “so what does it mean for us?” Without this important question, even the most insightful analysis is not actionable. We should encourage our teams to not stop at the stage of what the analyses say and inspire them to also think about what this means for them or the organization. An even more aspirational step is the move from “So what?” to “Now what?”, from “What does it mean for us?” to “What are we going to do about it?” This step is akin to a physician moving from the diagnosis of the medical condition toward the possible treatment. While we can and should encourage our analysts or less experienced employees to synthesize and think about the implications of the insights, the transition toward what we should do next is often the role of middle and top management, unless the tasks are fairly trivial or repetitive.

To make sure that we do not stop at the level of (often nonactionable) insights, we often set our alarm to 15 minutes before the end of the meeting. When the alarm buzzes, we turn to our team and say, “We have discussed the data and analysis for the last 45 minutes. We disagreed on many things and the analyst will come back to us with some answers to the good questions and comments raised in this meeting. But, putting aside our questions and our wish to see more data, we will dedicate the last 15 minutes of this meeting to discussing what these analyses mean for us, and what we are going to do about them.”

This pivot in the meeting helps to focus the discussion on making decisions, the main reason we called the meeting in the first place. It frees people from the need to keep scrutinizing the data and strive for certainty, a process that can take forever. As discussed in the Prologue

to this book, certainty is a myth. Decisions need to be made with limited data. Synthesis is a key step in moving from analysis to decisions.

## Key Learnings - Chapter 6

- Synthesize, do not summarize.
- Make your bottom line the top line. Use the Pyramid Principle, synthesizing bottom up from insights to synthesis and communicating top down starting from the synthesis and supporting it with the necessary analyses.
- To encourage a synthesis, create a safe environment that encourages making judgments and taking risks.
- Create a gallery walk or post the analysis prior to the meeting to encourage a synthesis.
- Make every meeting actionable by limiting the time allocated to discussing what is in the data and analysis and moving toward what it means and what we are going to do about it.

## Note

1. Minto, Barbara. *The Minto Pyramid Principle*. Minto International Inc., 1996.





# CHAPTER 7

## The Decision Moment

*For every complex problem there is an answer that is clear, simple, and wrong.*

— **H. L. Mencken**

How do we go from indecision to decision? How are decisions actually made? What happens in the split second when a decision is reached? And what triggers the decision-maker to finalize the actual decision?

Most decisions hinge on a combination of information and instinct. The synergy between those two forms of knowledge is at the heart of Quantitative Intuition (QI)<sup>™</sup>. QI strengthens our gut feeling—like Paul's skepticism about the Silicon Valley startup—and helps us understand whether we have enough information to make a decision.

[Chapters 1–6](#) provide you with the QI tools you need to probe any problem or any presentation of data: powerful questioning, IWIKs<sup>™</sup>, working backward, interrogating the data, using guesstimation to develop numbers intuition, and synthesizing the insight into a recommendation. Now we're ready to examine the decision moment itself.

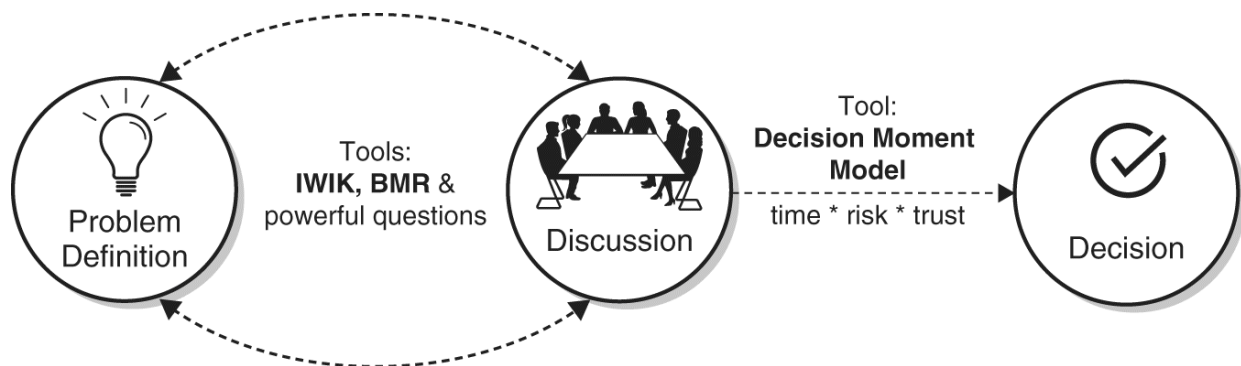
In this chapter, we focus on the decision moment. We deconstruct the main forces that shape and influence that moment: time, risk, trust, and the momentum of the decision-making process itself. We expand on each of these dimensions to sharpen your awareness of these forces and enable you to understand the pressures, the process, and the necessary line of investigation, if more information is needed.

The decision moment itself should be founded in QI—not on the pressures of time, fatigue, or sheer momentum that we often succumb to in business.

# Dimensions of the Decision Moment

If we deconstruct the decision-making journey, we have a process that resembles [Figure 7.1](#). We begin with problem definition or a problem statement, which typically flows into further consideration, discovery of data connecting to a period of discussion and synthesis, which then leads to a decision. Of course, the direction of the process is not one-way: The period of definition and discussion and synthesis often involves an iterative cycle of data and discovery. During this discovery loop, the problem could be redefined, given new insights from the discussion and IWIKs, as is seen in [Chapters 1–6](#).

Inevitably, the discussion fades or ends when time is up, and a stakeholder requests a decision. That moment often occurs when a deadline arises, if the discussion has become a debate that has dragged on longer than warranted, or when no more requests for data and analysis have been made and the decision-makers feel sufficiently informed to reach a decision. In any case, the decision moment occurs when the person or team making the decision has, consciously or subconsciously, weighed three dimensions: time, risk, and trust. Let's look at each of these forces more closely.

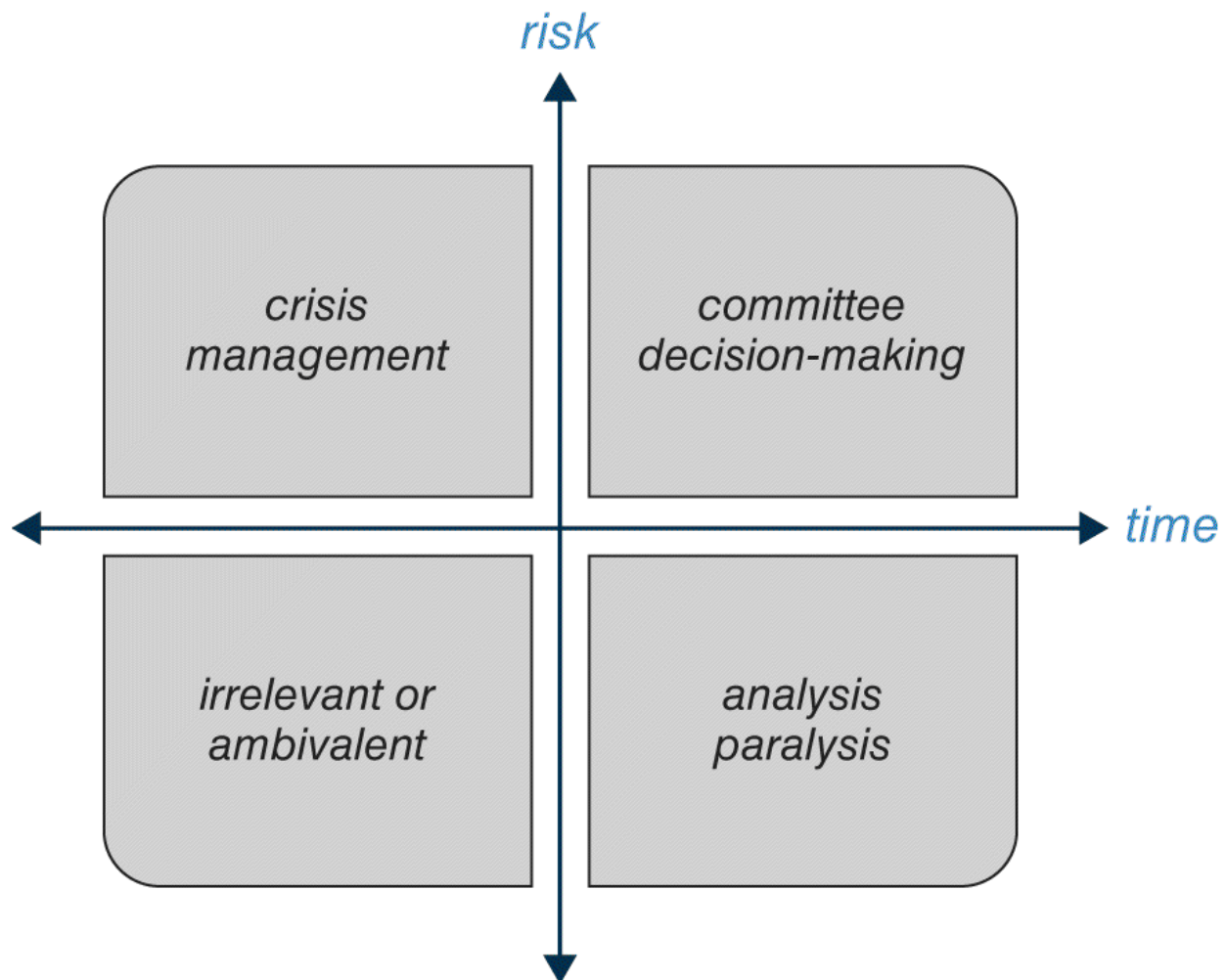


**[FIGURE 7.1](#) The decision-making journey**

## The First Two Dimensions: Time and Risk

Let's start with time and risk. If we consider these two dimensions as axes,  $X$  and  $Y$ , the four quadrants that emerge are indicative of four quintessential operating modes (see [Figure 7.2](#)). These quadrants provide a framework for understanding the nature and pitfalls of these four modes. Later on, we will layer in IWIKs and use the Decision Moment Model mapping to organize areas of investigation and segments to ignore.

Time, the  $X$  axis in the figure, is a straightforward variable. It is often defined by the stakeholder. Do we have a tight time frame allocated, forcing us to a swift decision, or do we have an extended period of time? Is the time period fixed or can we shift it or extend further if need be? A shorter time frame can put constraints on data and discovery; it might limit the range of IWIKs we can get answers to or data we can reasonably request. It could also put constraints on the discussion: Is there enough time for a committee to meet? Can we debate all the particulars that merit attention, and syntheses that are consistent with the data pattern? A longer time frame may seem advantageous, but it can be expensive in terms of opportunity costs or the cost of your team's time and resources.



**FIGURE 7.2 The Decision Moment Model and operating modes**

Risk, the Y axis in the figure, can be evaluated in two ways: situational risk relating to the defined problem being solved or the decision to be made, but also risk to the business or individual, which can have a broader impact on factors like reputation or brand.

Let's step through each quadrant and explore the different kinds of challenges each poses for the decision moment. In each quadrant, we also provide ways that QI can help you overcome the challenges.

The lower left quadrant is where decisions that have to be made quickly but don't come with much risk fall. These are likely to be System 1 thinking decisions (see the Prologue). The danger here is underestimating the risk just because the impact seems trivial and the time is short. Deciding quickly between a soup or salad for lunch

doesn't entail much risk: getting it wrong certainly won't spell disaster. But when a colleague or your team leader asks to borrow your resources for a brief period, you might consider the decision to be simple, then discover that it's actually not. That brief period could easily become an undefined period at your expense and impact the projects that matter to you. Decisions in this quadrant can seem relatively straightforward, but they could also be costly.

The lower right quadrant of low risk with significant, flexible, or unbounded time leads to the enemy of decision-making, analysis paralysis, failure to reach a decision by succumbing to a repetitive loop of over analyzing the virtues and pitfalls of an alternative, and thus never making a choice. Not only is analysis paralysis frustrating, but it can also prove to be costly with every day that passes if opportunities are missed.

Economists refer to this as the opportunity cost: the damage resulting from the loss of potential gains that would be captured from alternatives. The counter to this mindset is the Silicon Valley investor mantra of bias for action. Employing the backward approach to decision-making (see [Chapter 3](#)), starting with the impending decision, and recognizing its low risk and unbounded time frame, may help you identify the unfavorable risk and time trade-off, preventing you from overinvesting in the analysis paralysis path.

The upper right quadrant, with high risk and significant, flexible, or unbounded time is the domain of committee decision-making. In committee situations—across business, government, and even in families—we often see that the number of opinions is exponentially growing with the number of stakeholders involved. Why? Because we are ultimately all lobbyists, and a stakeholder who enters a group with solid conviction in one direction can be swayed to suddenly question their original conviction and start weighing multiple alternatives. The permutations are fantastic. Like a geometrical explosion inside an Escher drawing, the committee discussion descends into an abyss and risks continuing in a useless, tragic loop.

Because of the complexity and time involved in making decisions that are allocated to the upper right quadrant, you should consider carefully which decisions truly belong to this costly quadrant. Ask yourself, can we break down the decision into smaller decisions that

do not require as much time and/or have lower risk in and of themselves? This is where QI comes into play. The tools we develop in [Chapters 1–3](#)—precision questioning, IWIKs, and working backward—can all help break down a large decision or problem into smaller ones.

The upper left quadrant, with high risk and little time, is the realm of crisis management. Crisis experts assess the risk and business impact of an event or new issue through a series of steps: consider contingencies, build an action plan, and then consistently communicate to all parties with an active open feedback loop. This sequence usually works crisply in the military, in an emergency room or a control tower, or with firefighters and first responders. But how exactly do crisis experts decide what plan to build and what action to take? And how do they identify something as a crisis in the first place?

The professionals who step through crises efficiently and with confidence have a playbook born from years of practical experience and the latest best thinking from leaders in their field. Everyone knows their role on the battlefield, in the emergency room, or as a first responder. And they train. Each individual works to develop sharp skills, and then the unit—often a cross-functional team in which each member knows their role—practices planned scenarios and quick alternatives to mitigate sudden surprises. This mode of decision-making that involves building on experience and acumen to synthesize the incoming information in a short time period for detrimental decisions is probably the strongest demonstration of the use of QI skills. Extreme coordination of this sort is epitomized on a football field when a quarterback comes to the line and an audible (an alternative play) is called moments before the play starts. Millions of fans are watching, but only the quarterback and those with a trained eye can see the reason for the audible. The other members of the offensive unit don't stop and debate what each of them need to do for the alternate play; they are trained as a highly functioning unit working together.

One reason why we tend to make misguided decisions and yield to bias, is that we're not considering all the variables that are relevant, which in turn causes us to ignore factors that are important. We lack a frame for our decision-making so we can quickly consider the underlying factors that are likely to be of importance. Such highly

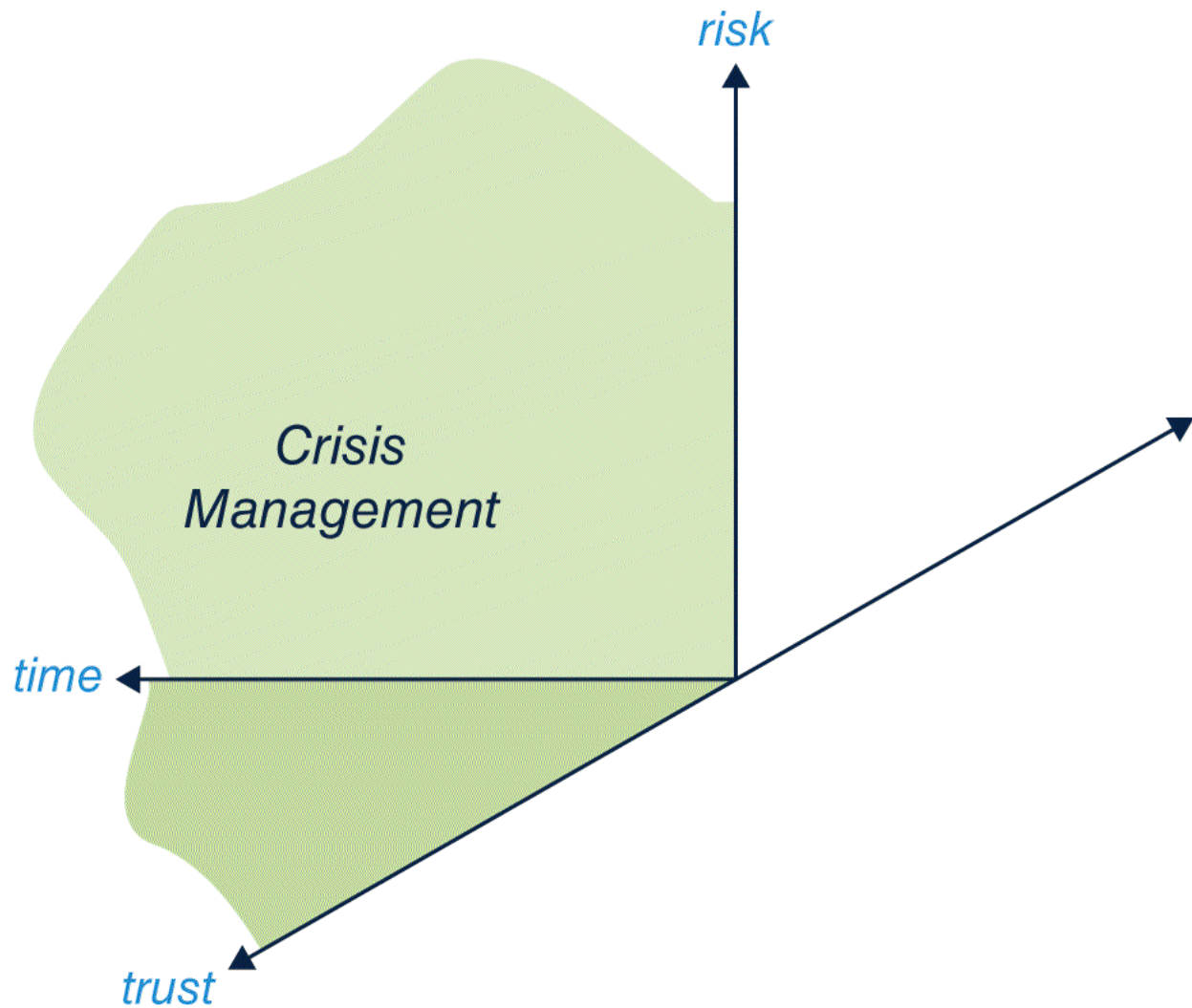
trained, coordinated teamwork should be the goal of general decision-making in business, government, and other loosely affiliated large groups.

We've focused on the dimensions of time and risk in the decision moment, but to understand how teams work efficiently, even in extreme crises, we turn to a third dimension: trust. Trust is a crucial factor for the QI decision-maker—a dimension that calls on our intuition.

## The Third Dimension: Trust

While risk and time are often known, or can be determined, decision-makers usually introduce a third ( $Z$  axis) dimension that gauges trust (see [Figure 7.3](#)). At a basic level, how much do they trust the information? Answering this question involves two forms of trust: one focused on the data itself and the other focused on the individual or organization bringing that information forward. For example, does the data come from a trustworthy source? Does the messenger have a track record of insightful synthesis of data or are they simply passing on raw data? Confidence in the individuals and the data could be gauged by a formal assessment of the data through the set of questions we propose in [Chapter 4](#), or more intuitively, by a subconscious judgment on the quality and accuracy of the data presented.





**FIGURE 7.3 The three dimensions and crisis management**

The triangulation of trust with time and risk is most clearly seen in crisis situations. A *crisis* can be defined as “a time of intense difficulty when an important decision must be made.” Emergency room personnel, first responders, and soldiers on a battlefield have an acute awareness of the risks at hand and the time available, but they also weigh each decision against a measure of trust. Intuition is gained by the data synthesizer from the experience of similar situations as well as training and learning how various scenarios play out. When progressing through a crisis, these experiences are the basis for judgment that the synthesizer factors into the data to form a new synthesis and then take immediate action. Can we learn from those who operate at a highly advanced level in times of crisis and bring that decision-making discipline to noncrisis situations?

As we've demonstrated in [Chapters 4](#) and [5](#), intuition can be developed, and the tools that are presented in those chapters can help make up for a lack of business acumen and experience. But, in the decision moment, how do we weigh the three dimensions? What metrics can we come up with to improve our consistency and, efficient functioning—as individuals and as teams?

# Measuring Time, Risk, and Trust

Against all three dimensions of time, risk, and trust, it may be tempting to put empirical values on a firm rating scale. But we advise you not to do that. Some norms and guardrails are possible and worthwhile, but decision-making is not rigid. The art of decision-making is fluid and involves balancing all three dimensions by using both quantitative skills and intuition aligned with your business goals.

## Allocating Time

Time—whether too little or too much—can be the most stressful and frustrating dimension of the decision moment. Yet, how can we meter the time to what is acceptable, given that the situation of each decision is different?

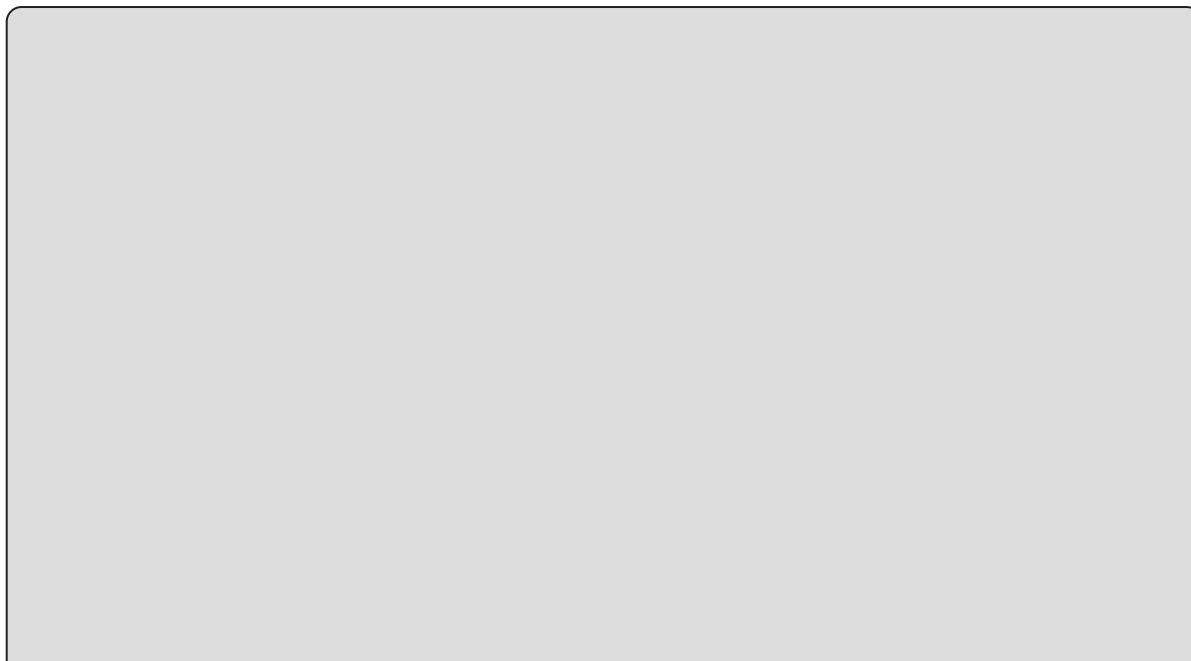
In an emergency room, at NASA, in an air traffic control tower, or on the football field, each of the trained professionals acts within finely tuned, strictly defined intervals of time. Their physical and mental clocks are highly synchronized, and they can count down the seconds that matter.

Time measurement is different in most business decision-making. We rarely meet a situation where it's appropriate to count down the seconds to a decision and final answer. More often, we're given rather tentatively defined or extendable expanses of time. But even if business decisions can't achieve the time precision of rocket launches, we can set effective boundaries. We can box a decision or its subcomponent decisions into agreed-on blocks of time. As discussed in [Chapter 5](#), we should match the level of accuracy of the time measurement units to the type of decision per [Figure 7.2](#). In some cases, a “T-shirt sizing” time measurement assessing whether the decision needs to be made in hours, days, or weeks is all we need. It is critical to have this simple discussion upfront with stakeholders. When is this decision needed? Are we working toward a broader set of milestones or schedules? What is the review cycle? Who needs to review and ratify the recommendations before the final decision? From there a calendar workback plan will show how much actual time is available to work through the problem.

Roles matter as well, so the named person accountable to drive the question to closure must set the tone and the time cadence to push through all the steps in the decision sequence. Strong ownership of the decision process—with a healthy dose of project management technique—can ensure movement in the decision process in days or weeks rather than open-ended time frames.

This should not be confused with the responsibilities of the stakeholders who actually make the decision, rather the decision process owner is just driving the process to meet the timelines. We can borrow the approach from the French culinary *mise en place* or “putting in place.” The concept of this detailed setup to organize and arrange ingredients prior to cooking can be applied to the decision process and arranging the information and pre-reviews to validate recommendations prior to a decision meeting so that the stakeholders—much like chefs—have everything available to make a decision.

It is also valuable to have a diverse group as part of the decision process and ensuring time is allocated to hear from the various voices. The perspectives shared across disciplines allows the working group to avoid blind spots by giving each participant the opportunity to bring their own criteria to the work. A uni-dimensional view reinforced several dozen times by a homogeneous group is simply wasteful compared to incorporating multiple views and diverse perspectives.



## **DINNERS AND DIVERSITY AS A CREATIVE BREEDING GROUND**

While launching a new emerging business practice, Paul assembled a cross-functional team that worked together for nearly two years piloting customer offerings for grid computing. The group had members from IBM technology services, application development, management consulting representing multiple industries, and advanced research. By design, the group also spanned tenure and seniority levels so as to capture any wild new thoughts and ground them against practical experience. Quarterly meetings were rotated between New York, Austin, Tokyo, and several European cities where the team would meet to evangelize new early-adopter customers, train local teams, and brainstorm “what's next” as a group. The brainstorming was in the office and over long dinners with rich debate where creative juices flowed. In a large group meeting in France, the team included Matt, the marketing leader who was well known to the group. During one exchange, a junior member from the application development practice mentioned a product feature that “would be cool.” Cait from IBM Research said, “Oh, I can do that and we can build it into the product easily.” The room stirred. The Distinguished Engineers from technology services and industry consulting each commented how their customers would love to have the feature but assumed it wasn't possible. Cait shrugged and said “Well, it's not that hard and I can teach you.” Matt looked around and said, “This was a worthwhile trip. We can market the heck out of this. It shows incredible business value. When are we going to have this meeting again?”

### **Measuring Risk**

In the decision moment, risk is a crucial factor, and yet again, as each situation is different, a single standard of measurement rarely tells the whole story. Risk can also be bounded, but those boundaries vary widely.

Even so, can't we reap some benefits by attempting to introduce standards of measurement for risk? An example of an inadequate but spectacularly beneficial measurement system can be found in the Apgar score. In 1952, Virginia Apgar, then a Professor of Anesthesiology at Columbia University College of Physicians and Surgeons, was having breakfast in the canteen of the Presbyterian Hospital, where she was the Director of Obstetric Anesthesia, when she was approached by an inquisitive medical student asking what the best way was to assess a newborn baby's well-being.

Instinctively, Apgar pulled out a piece of paper and jotted down the five criteria she deemed most important when determining an infant's health in the minutes after birth: appearance, pulse, muscle tone, reflexes, and respiration.

The bullet points might have seemed simplistic to the student, particularly as Apgar recalled them so briskly and with apparent spontaneity, but her ability to do so was based on many years of treating newborns and becoming attuned to factors indicating that a tiny human might not be okay.

In the years that followed, the Apgar score, as it soon became known, was introduced as a staple part of the medical routine in birthing suites and hospital rooms around the country and later abroad. To determine the score, each of the five criteria is assigned a rating between zero and two. The cumulative figure of between zero and 10 then informs medics how well a baby is doing at one, five, and 10 minutes after birth, with anything below six indicating a need for extra attention or intervention.

As a rating system, the Apgar score is inadequate in many ways—it doesn't measure many significant neonatal issues, and scores in the “normal” range are not, actually, predictive of infant survival or health, yet the practice is brilliant in its effect. The standard use of Apgar has significantly decreased infant mortality rates, saving lives not by accurate or predictive metrics, but by driving doctors and nurses to make a quick risk assessment for each and every baby, and make sure they do so on all five dimensions.

The test is still widely used in hospitals around the world today, and although it's attracted some criticism for its simplicity, it's mostly been praised as ingenious for precisely this reason. Because it's such a

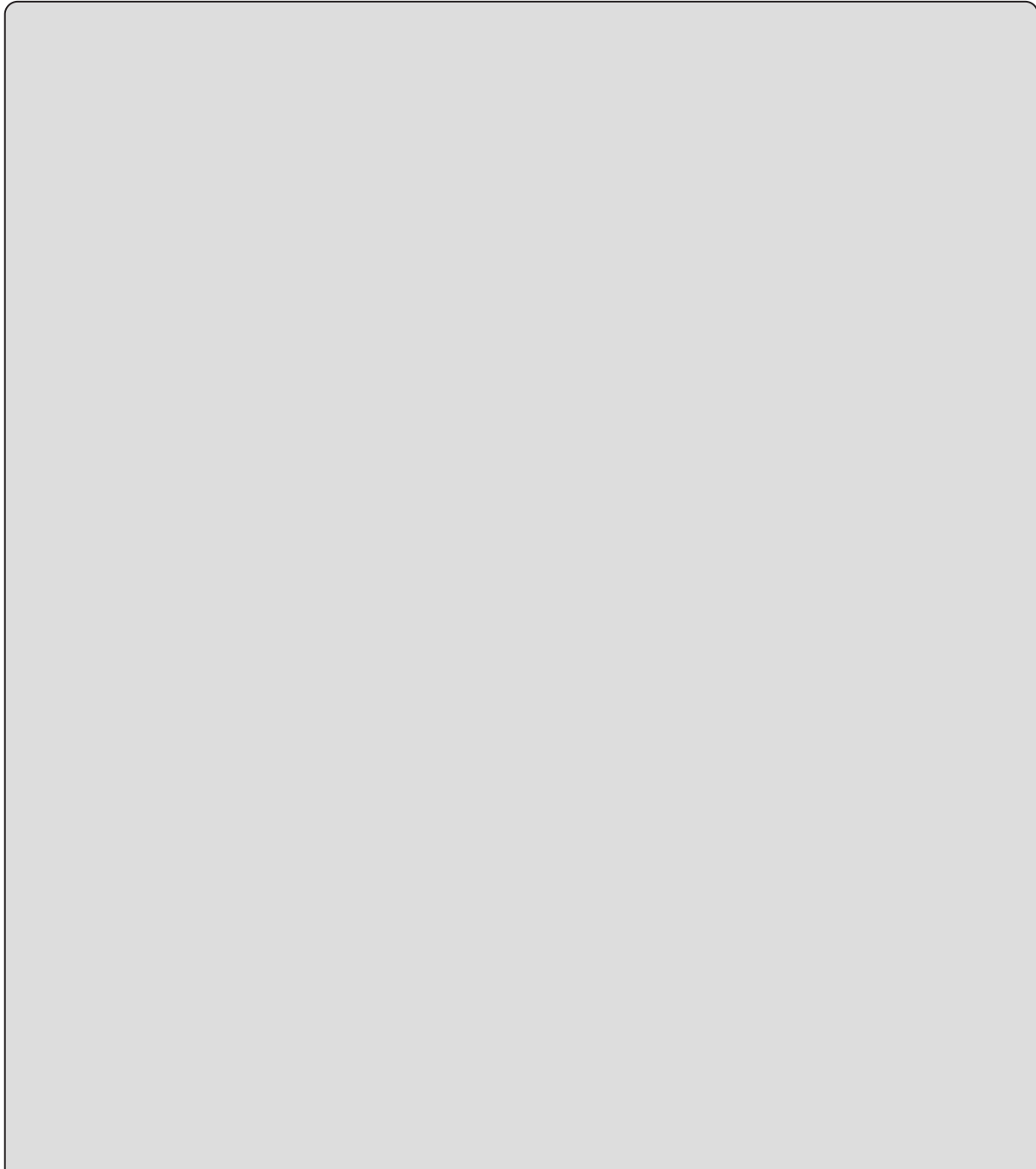
straightforward test, it's extremely quick and easy to execute even at the commission and stress of the delivery room, right after the baby is born. Of course, it's not the optimal model for assessing the health of every single baby that's born—not least because it weights all variables equally—but it's a convenient base test that ensures that medical professionals take the most important variables into account when making their initial assessment and aren't tempted to overlook something because they're distracted. What we've learned is that a system of consistent, close observation and attempted measurement can yield benefits in and of itself.

You could apply an analogous approach to determine qualitative guardrails that would make sense for your business. A widely adopted risk and readiness assessment in sales is the BANT model conceived by IBM in the 1960s to quickly identify high-quality deal prospects. BANT is an acronym for budget, authority, needs, and timeline, and establishes a qualitative framework:

- **Budget:** Does the prospect have the necessary budget allocated for the product or project?
- **Authority:** Does the prospect you are engaged with have the authority to make a purchase decision? If not, is there a clear path and favorable sentiment from those with authority?
- **Needs:** What business problem is being addressed? Does your product or service address the need? Is your offering a better alternative to meet the needs than your competition?
- **Timeline:** When is the prospect ready to execute a contract? What needs to be in place for that timeline to hold?

There is no obvious numeric value for most of the categories so it must reflect the situational awareness of the business. The organization leadership must establish what are the triggers and thresholds that are acceptable. This reflects the organization's overall risk appetite for a product line and the cost of sale (i.e., cost of resources invested to pursue and win a deal) or for the business overall. IBM's BANT framework is a great example for the time, risk, and trust components outlined in [Figure 7.1](#)

GPCT (Goals, Plans, Challenges, Timeline) as conceived by HubSpot is the modern evolution of BANT, and takes a customer-centric approach to understand customers' needs and the business value they seek in selecting a product or a solution. GPCT customer discussions are followed by Budget and Authority clarification in order to complete a business deal. This too blends a quantitative view with the intuition of the team members to determine a path forward on a customer engagement.





## MICROSOFT XBOX

On November 15, 2001, Microsoft launched Xbox as a new entrant competing with Sony's PlayStation 2 and Nintendo's GameCube. Microsoft came from a strong position in the personal computer (PC) market, but it was taking a risk: Would a gaming business be successful, especially against an established market?

Sony had launched the first PlayStation worldwide in 1995 and had sold 100 million units. Nintendo's initial NES (Nintendo Entertainment System) launched in 1983 had sold 61 million units, and the Super NES released in 1990 sold 41 million units by 1993.

In the face of such competitors, each with decades of success, confidence in Microsoft's launch could not be very clear. What was clear, however, was that Sony's gaming-built popularity could pose a threat to Microsoft in the PC market.

Using our framework, the Microsoft IWIK's in 2001 could have been to (1) understand if the gaming community was trending toward higher interest in game titles that could run on a PC platform rather than a dedicated hardware device with cartridges, and (2) ask what unique advantages could Microsoft exploit by offering the PC format to consumers and to game creators who could pioneer new gaming experiences by utilizing a hard disk for storage and traditional network interfaces (for monitors, optical disc, cameras, and printers).

Following the IWIK analysis, Microsoft could have considered its alternatives based on time, risk, and trust. From a time perspective, Sony had already rolled out the PlayStation 2 globally in 2000 and Nintendo was launching the GameCube in the third quarter of 2001. Time to market was compressed and Microsoft, fortunately, could choose between two internal platform options. From the trust dimension, would game developers begin working on a new platform? Would consumers accept Microsoft as a gaming console? In hindsight, developers found the Xbox to be a welcome alternative with new features and a familiar and trusted platform as well. The consumers did not have to trust Microsoft as

much as they needed to be comfortable with the newly launched Xbox brand, which bypassed many concerns about the Microsoft brand with gamers. The risk of launching Xbox was minimal and warranted from a strategic perspective given this was a new market to capture as well as the exact move to simultaneously defend against a new threat to the PC market.

Given Microsoft's financial resources, market position, and available assets to use for a new gaming platform business this became a straightforward “go” decision with emphasis on the “how” to optimize the chances of success.

## Measuring Trust

As with the other two dimensions of the decision moment, trust also presents challenges to measurement. What rating scale would be appropriate to measure trust? Either in an individual or an organization, you could consider their track record of results against objectives over a reasonable period of time. However, applying that track record as a weighting factor might not be predictive. The gymnast scoring a perfect 10, the basketball player shooting 80% at the free throw line, and the .300 hitter in baseball each take their next chance to perform as a new opportunity. Alternatively, you could look at competency: regardless of results, what is the quality of the skills and effort of the individual or team? Finally, trust can be as simple as belief in the reliability and truth coming from your colleague. As every investment prospectus reminds us, past performance is not a prediction of future results, so we need to weigh trust on a case-by-case basis.

Given that each business decision may be unique, using track record as a “trust meter” will likely be less effective than understanding the values and decision process of the individual providing the recommendation and seeking your trust and approval. Deloitte offers a thoughtful framework of four primary “Business Chemistry” types:<sup>1</sup>

- “Pioneers,” who value possibilities and spark energy and imagination. They are creative thinkers who believe big risks can bring great things.

- “Guardians,” who value stability, and bring order and rigor. They are deliberate decision-makers likely to stick with the status quo.
- “Drivers,” who value challenge and generate momentum. They're technical, quantitative, and logical.
- “Integrators,” who value connection and draw teams together. They are attuned to nuance, seeing shades of gray rather than black and white.

As a stakeholder in a decision, it's important to recognize that none of the business chemistry types, or other similar indicators of decision style, is either good or bad. Rather as you evaluate trust in an individual or organization, recognizing the types will be valuable to understanding how you interpret their effectiveness at synthesizing data and providing thoughtful recommendations.

# Decision Reversibility

Closely related to the dimension of risk is reversibility, which needs to be considered as decision-makers begin to settle on a preferred choice, can the decision be reversed? Would it be acceptable and even possible to go back to the original baseline condition? How much would that cost and what would the other implications of doing so be?

In our work, we see individuals and organizations stall daily out of fear of irreversible decisions. They often even fail to consider whether the decisions they stall are reversible or not. But even reversible decisions cause paralysis, for example, over the impact that a reversal could have on reputations or bottom lines.

Amazon refers to the assessment of decision reversibility as the One-way versus Two-way Door decisions. With One-Way Doors, the decision is not easily reversed, has irrevocable consequences, and requires deep consideration. Two-Way Doors have limited consequences and can evolve or be more easily reversed over time.

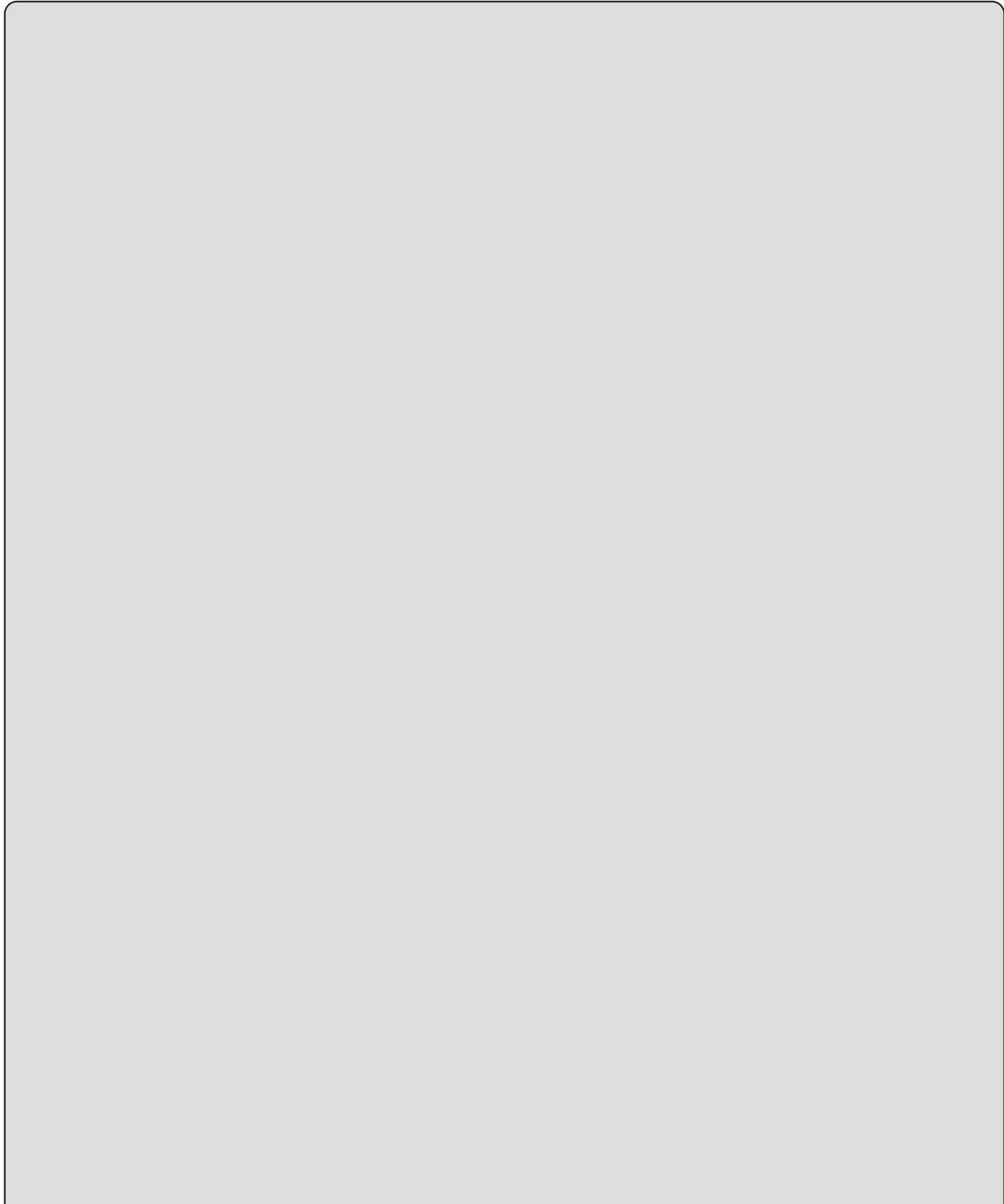
For Two-way Doors, ask what is the worst-case scenario? Is that an acceptable risk? How would the decision be reversed if necessary?

Amazon suggests the “Keys to decision-making at speed”:<sup>2</sup>

- **Recognize Two-way Doors:** While some decisions are One-way Doors, others are Two-way Doors, meaning they are reversible, and you can correct mistakes quickly.
- **Don't wait for all the data:** If you wait until you know everything, you are probably being too slow. Most decisions only need about 70% of the information you wish you had.
- **Disagree and commit:** People can disagree, but once a decision is made, everyone must commit to it. This saves time versus trying to convince each other.

Counterintuitively, walking through either a One or Two-way Door is not based on just economics, but on reputation and trust. It may, in fact, be easier to spend significantly on a Two-way Door and refuse a seemingly less expensive One-way Door request.

Sir Richard Branson has shared that in 1984 he was only able to convince his business partners at Virgin Records to agree to the deal to launch Virgin Airlines after he got Boeing to agree to take back Virgin's one 747 jet after a year if the business wasn't operating as planned. While expensive, this was a classic example of a reversible Two-way Door decision.



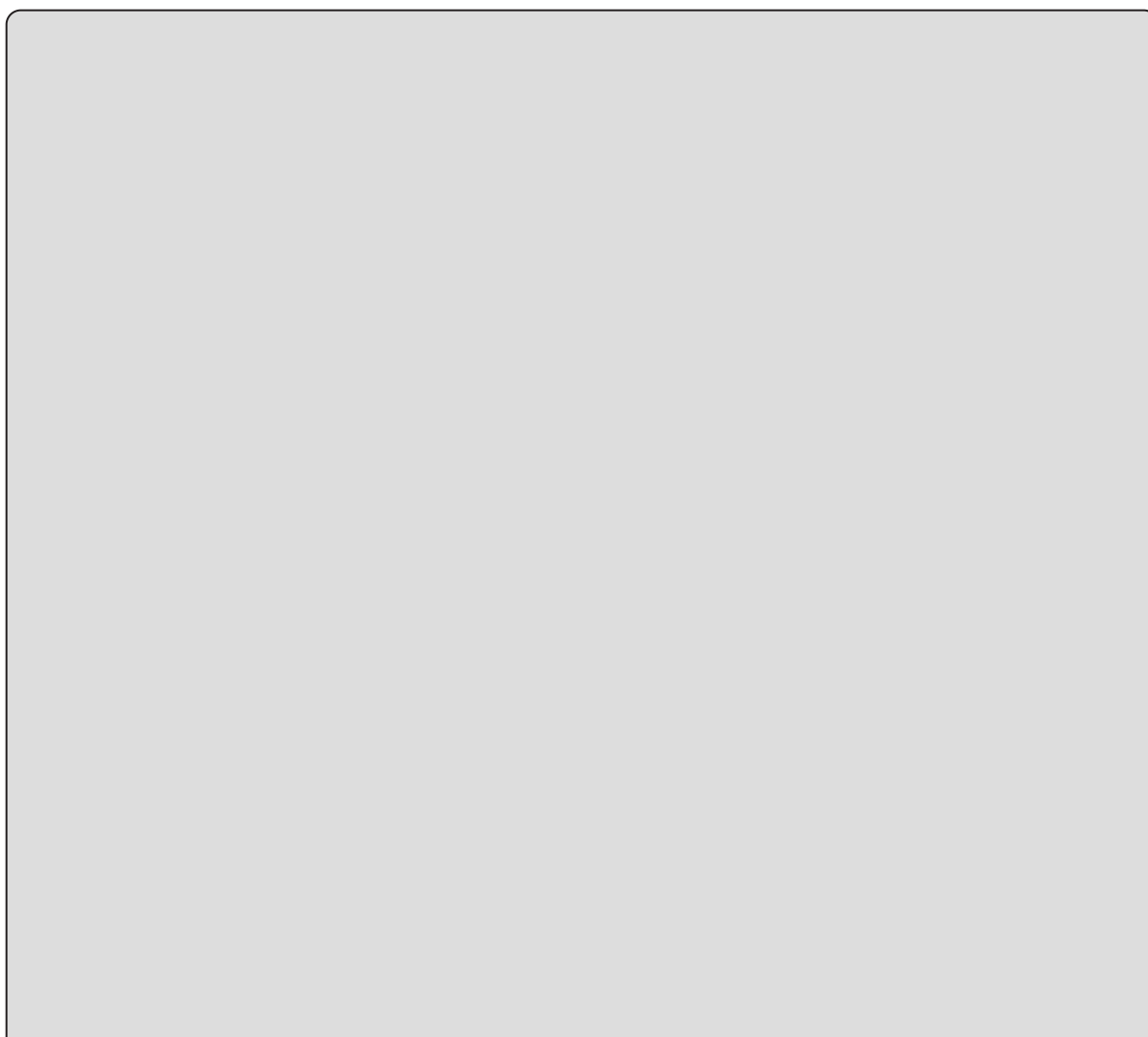
## IBM AND THE ELECTRONIC ELECTION SYSTEM COMPANY

While at IBM, Paul received a call with a request to team with an electronic election system company. The category was very hot given the conflict and political repercussions of the just concluded 2000 Presidential election. Pivoting to an all-electronic and networked national election system was technically possible. Automated teller machine (ATM) systems have high security and are prevalent so voting would be just as secure. Surely, a new robust platform could be assembled for national and regional elections. The system could even be used for private commercial elections like stockholder meetings, thus offering an additional revenue stream while not in an election year.

As Paul recalls: My first action was to inform my leader about the inbound from this company seeking to partner with IBM. Regardless of business potential, this would be politically charged. After several meetings, we understood the business potential and a few technical gaps to solve. Applying our Decision Moment Model, this business proposition was clearly a viable opportunity from a revenue perspective. We had enough time to establish a newly bundled hardware and software solution together. The trust was reasonable as we learned more about the company and saw they were sincere and capable. We then looked at risk in two ways. The first was execution risk. Could we get this done? The answer was a cautious “yes.” We also considered business risk that led to a hard and firm “no go.” In 2000, IBM had the world's third most valued brand behind Coca-Cola and Microsoft according to Interbrand. It was clear to our senior leadership that no single commercial deal was worth doing if it could put the IBM brand reputation at risk. Interestingly, 20 years and five national election cycles later, this remains an open problem to solve. The election company example illustrates a case where the One-way Door risk came not explicitly from the decision itself, but from the potential risk to the brand.

Angst over reversibility drives a lot of useless spinning, especially in large group discussions and decision-making. It can lead to partial action. Decision-makers often want the comfort of feeling that no options are ever really eliminated. This misplaced desire forestalls decisions or belabors the decision process in a waste of time and resources.

Aversion of making an irreversible decision can also inspire the roulette approach of spreading your bets around the table, pursuing multiple alternatives simultaneously. This can feel great and even energizing or empowering at first, especially since everyone gets to continue participating. But don't do it. Launching a fleet of sailboats while feeling entrepreneurial drains an organization's resources and prolongs the actual decision. Instead, consider launching a decision full sail, and correct your course if necessary.



## ELEVEN MADISON PARK

In May 2021, Eleven Madison Park, recognized in 2017 as the world's best restaurant, announced a June reopening following a 15-month Covid-driven closure. The Michelin three-star restaurant, renowned for its extravagant meat and seafood dishes, reopened with an entirely plant-based menu. CEO and Chef Daniel Humm had changed his own diet, reducing his meat consumption, and had determined for his restaurant that the “current food system is simply not sustainable.”

At the time, of all the 136 Michelin three-star restaurants in the world, only one other was vegetarian. Owned by Humm since 2011, Eleven Madison Park had demonstrated remarkably consistent excellence. It has been awarded three Michelin stars from 2012 through 2020. While pivoting to a vegetarian menu was, of course, reversible, the reputational risk was high. Humm was quoted in various media outlets as saying, “I'm not going to lie, at times I'm up in the middle of the night, thinking about the risk we're taking abandoning dishes that once defined us.”

Humm's decision sits in the second quadrant (high risk, significant time), and the committee for making it would have been small: just Humm and his investors. But was his decision driven by data or instinct? Data certainly played a part. Analytics probably projected much higher profits because the cost of ingredients would be significantly lower while the meal would be priced around the same level as before, at about \$335 per person.

But intuition must have played a part too. Humm decided that, to keep the feeling of luxury at his renowned restaurant, prices would have to stay the same. After all, people weren't only paying for the food, but the entire fine dining experience. “It became very clear to me [during the pandemic] that our idea of what luxury is had to change,” Humm told the *New York Times*.

Humm likely considers this a One-way Door as it reflects his personal values. However, in light of history, this could turn out to be a Two-way Door given his reputation as a celebrated perennial Michelin award winner.





# Navigating Ambiguity

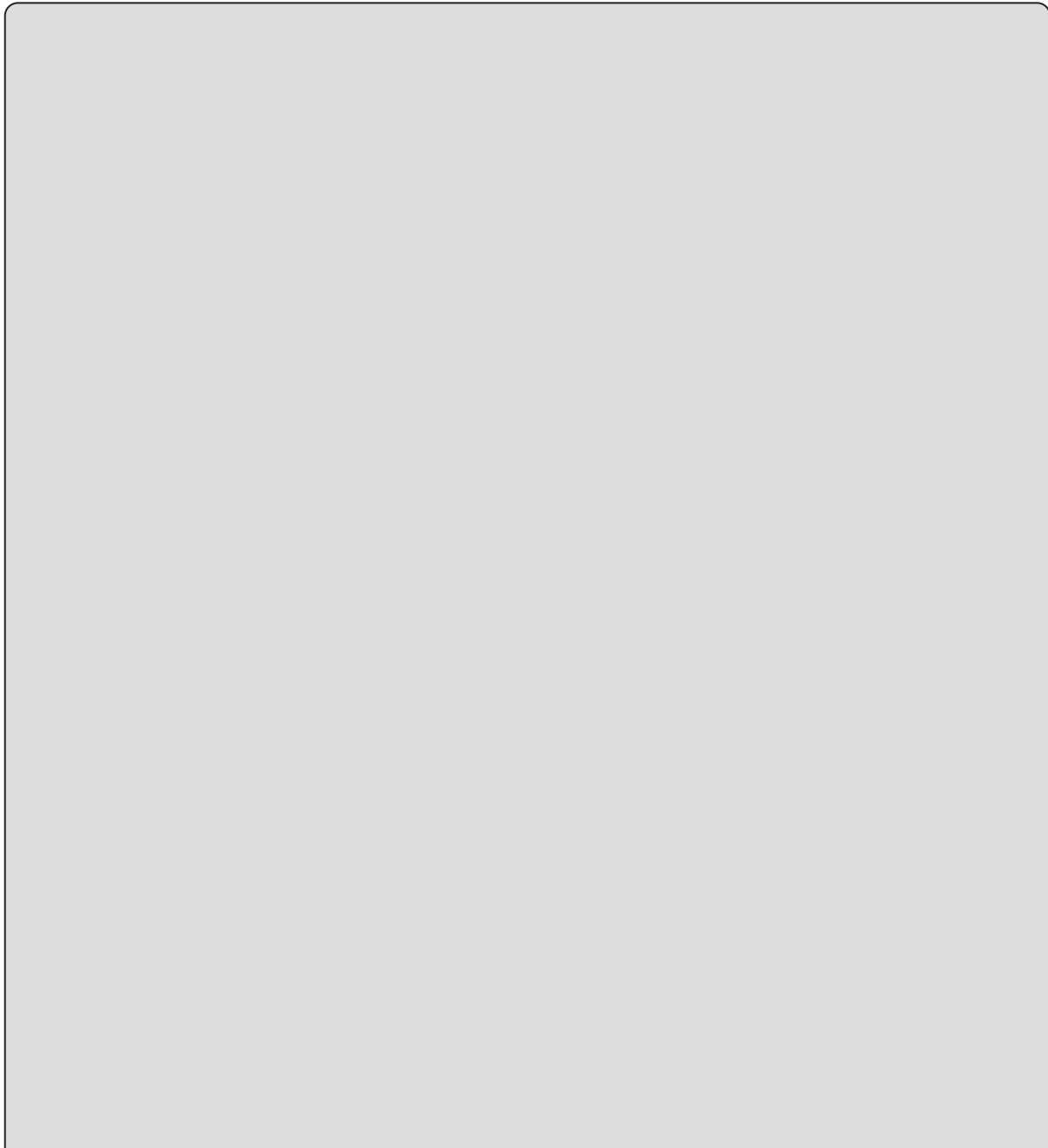
Now that we've explored the dimensions of time, risk, trust, and reversibility, let's move to our final considerations of the decision moment: ambiguity and uncertainty. Like irreversibility, these two conditions seem to cause nearly universal discomfort. In fact, a fundamental distinction of strong decision-makers is the tolerance for ambiguity and the ability to focus on the decision that is possible, rather than lament and lock up over the ambiguous nature of the data or uncertain conditions for the decision.

The common battle cry is “I don't have the data” or “The data is somewhere in my organization or with my suppliers but I can't get to it.” The unspoken concern is “How can I calculate anything meaningful without the right data?” From a data science perspective, there are two alternatives—find more data from adjacent domains or impute the data so as to substitute a reasonable alternative value.

These alternatives are the critical steps to begin pushing through uncertainty. There is likely relevant information reflecting market trends available for your open question or for a related category. This is often the case for new product launches. Even if you are first to market there should be information available about the market characteristics. We can lean on Fermi's method that is discussed in [Chapter 5](#) and some guesstimation to fill in the blanks. Next there is knowable information that can be determined even if it is not known today. To solve for that unknown, you must first identify what you really want to know to close the uncertainty gap. You can turn to IWIKs to directionally orient the discovery effort for what is missing. We can also employ the backward approach to create a set of dummy tables that would help you align on the necessary and only the necessary data to make the decision. With just these few steps you can started to create a frame around the uncertainty not all of which needs to be filled in. The leader will urge the group to fill in just enough to expose a reasonable next step and then repeat the process. Use IWIKs and the backward approach to fill in some of the uncertainty. As you fill the gaps, aim for vaguely right rather than irrelevant but precise information.

In this way, the decision moment triangulates across waves of data analysis filling in gaps between the decision to be made and the trust

in the parties involved who are supplying the previously known or the new data. Further, the data may be emerging and materializing at high velocity, span multiple formats, and may be volatile with inconsistent availability. This is precisely where we can further rely on our QI toolkit: assess the situation and lean on IWIKs; challenge the data, individuals, and organizations to determine trust or at least enough trust within a confidence interval that matched the degree of certainty that is need for the decision at hand; and translate the synthesized views into action.



# EYJAFJALLAJÖKULL

In April 2010, a little-known Icelandic volcano called Eyjafjallajökull briefly became one of the world's most talked-about geographic features.

Following a series of tiny earthquakes in Iceland, Eyjafjallajökull erupted explosively on April 14, spouting ash 30,000 feet into the air and causing severe disruption of global travel. Initially, Belgium, Britain, Denmark, Ireland, the Netherlands, and Sweden grounded all flights, and soon the list of countries had grown significantly. Within four days, 80% of the European air traffic network, encompassing 313 airports, was effectively shut down, leaving 6.8 million passengers stranded globally. But it took nearly a week after the massive eruption for Iceland's Keflavik International airport to finally close. Up until that point, authorities said, local radar stations had not detected an appreciable amount of volcanic ash in the air. On April 16, all international airports in Germany, Austria, and Finland closed, but on the morning of that same day, Irish air space was reopened for domestic flights and westbound transatlantic flights resumed.

Why was there such a discrepancy in the airport closures? How were decisions being made and why were they so disparate? What information was relevant and what could be trusted? What decisions needed to be made in what order to maximize safety and then a rapid return to normalcy?

The London Volcanic Ash Advisory Centre (VAAC) was providing volcanic ash advisories to relevant civil aviation authorities, but each affected country had its own national aviation authority or civil aviation authority. On top of this, the International Air Transport Association was criticizing some country's authorities' efforts to re-open European airspace—just as the European Union transport ministers were agreeing to ease restrictions on flights. Of course, there were opposing agendas at play: public safety and a desire to keep everyone safe versus commercial needs and a focus on limiting financial losses.

The IWIKs that might have been raised here would have been straightforward and revealing. First, where was the ash cloud specifically? On April 17, the president of Air Berlin stated that flight risks were nonexistent because the assessment was based only on the VAAC computer simulation and had not been checked against the likely accuracy of these simulations. At the same time, test flights across Europe had mixed results of engine damage.

And that leads to the second IWIK, what were the planes' levels of tolerance for airborne particles? While this might seem like an obvious question, before Eyjafjallajökull erupted, aircraft engine manufacturers and aviation authorities had not defined specific acceptable particle risk levels. The sky could appear relatively clear but still contain enough microscopic particles to damage an aircraft.

Meaningless information from inaccurate weather models could have been more quickly dismissed while the fundamental issue of safety could have been viewed with accurate data by all parties. The European organizations involved have pulled together in the last decade to produce new monitoring capabilities. In Iceland, researchers now use the Numerical Atmospheric-dispersion Modelling Environment (NAME)<sup>3</sup> ash dispersal model. As of March 2019, development of the National Volcano Early Warning System<sup>4</sup> is underway in the United States.

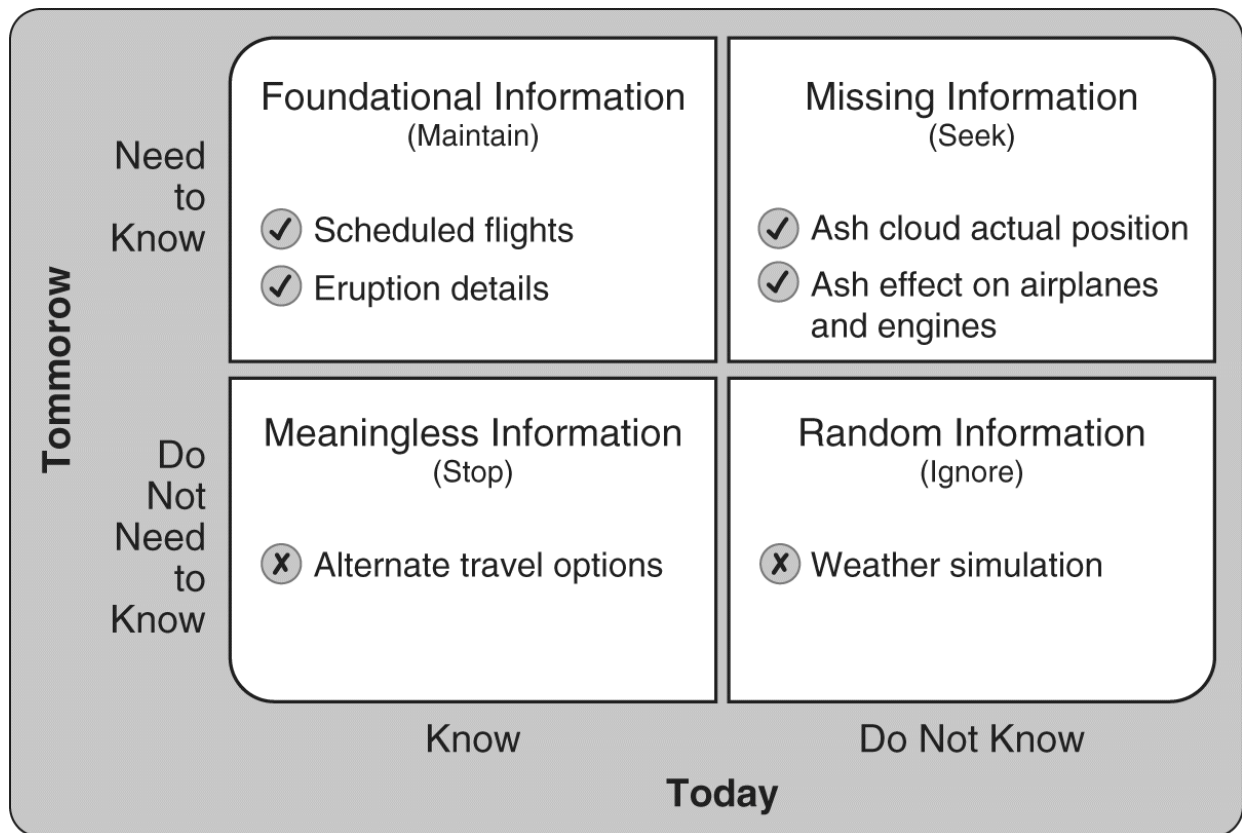
The situation describes a comprehensive failure of decision-making. Not just one but dozens of committees across two dozen countries had focused on meaningless information in the form of theoretical simulations, and each committee had a different agenda and risk tolerance, all compounded by a widespread lack of trust or cooperation. Ultimately, the communication and cross discipline scientific and organizational collaboration brings the most value to volcano safety today.

## From IWIKs™ to Decisions

The journey from open-ended possibilities to a clear decision can be accelerated by stepping through the QI process. Processing that decision is much like assembling a puzzle. This is where we combine the techniques in [Chapters 1–6](#) and lay them against the dimensions of time, risk, and trust. This orientation must guide the decision in order to be efficient with resources and avoid preventable dead ends.

In the example of the Eyjafjallajökull volcano eruption, beginning with the essential question, the IWIKs as guided by awareness of time, risk, and trust, may have revealed that different information sources were being used. It also would have revealed that each country's Transport Association and trade ministers had different views and goals. Mapping the insights to the IWIK Knowledge Matrix would look like [Figure 7.4](#). In addition to the dimensions of knowledge and needs in the Knowledge Matrix, you should also consider time, risk, and trust when evaluating IWIKs. You may find that some IWIKs would take months to find answers to, and hence would be deprioritized in the case of the Eyjafjallajökull volcano eruption. While realizing that uncertainty will always be there, for some IWIKs the level of trust in the data source is likely to be so low that you will not be able to get reliable answers to these IWIKs; again these IWIKs may be deprioritized. Finally, answering some IWIKs may involve risk. For example, in your quest to answer the IWIK, you may be revealing to your competitor that you are looking into this topic.

The essential question to be solved must be balanced against the decision attributes of time, risk, and trust. In physics, Boyle's Law describes the behavior of gases through the relationship between pressure, volume, and temperature. The condition and behavior of the gas is understood based on change in any of the three variables. Similarly, the conditions around a decision are affected by time, risk, and trust. If any dimension changes, it will have an effect on the other two and the decision process. Having clarity on even one or ideally two of the dimensions improves the decision process itself. Clarity on all three will allow the decision-maker to move forward with high confidence.



**FIGURE 7.4 Eyjafjallajökull eruption IWIKs Knowledge Matrix**

## Key Learnings - Chapter 7

- Begin with agreement from stakeholders on the objective, timeline, and who must participate in a decision.
- Understand the elements of time, risk, and trust for both the decision to be made and for the organizational impact.
- Consider whether the decision is reversible or not, and if it is not reversible, can it become reversible.
- If dealing with high levels of ambiguity and uncertainty, document the plan to close those gaps via investigation of adjacent domains to find corollary insights.
- Focus on being vaguely right rather than precisely wrong. Get the best data you can even if it is not perfect. With or without perfect data a decision (and a good one) needs to be made.
- Involve large teams with heterogeneous expertise.



# Notes

1. Deloitte. “About the Business Chemistry Types.” Available at:  
<https://www2.deloitte.com/us/en/blog/business-chemistry/2019/the-4-types.html>.
2. AWS. From “Elements of Amazon's Day 1 Culture.” Available at:  
<https://aws.amazon.com/executive-insights/content/how-amazon-defines-and-operationalizes-a-day-1-culture/>.
3. Available at:  
<https://www.metoffice.gov.uk/research/approach/modelling-systems/dispersion-model>.
4. Available at:  
<https://www.usgs.gov/programs/VHP/comprehensive-monitoring-provides-timely-warnings-volcano-reawakening>.



## CHAPTER 8

# Delivering the Decision

*I saw the angel in the marble and carved until I set him free.*

— **Michelangelo**

Going through the three pillars of the Quantitative Intuition (QI)<sup>™</sup> framework from precision questioning through IWIKs<sup>™</sup> and the backward approach to contextual analysis and finally to a synthesis you have triangulated the intuitive and quantitative signals to reveal a decision. It may have been barely hidden or buried deep, but this new “truth” is now known to you. And right there is the final hurdle. The insight and the recommendation, along with its justification, is known to you or perhaps a few colleagues who have taken this data-driven journey with you. What do you do now to bring along the stakeholders and gain their support?

Reaching a decision can be an accomplishment but taking action on it is the necessary step for the decision to have value. Decisions are often personal but typically involve others at a minimum for awareness and usually engaging stakeholders for cooperation and consent across the organization. This final step of communicating a decision to trigger stakeholder action can be thought of as delivering the decision and if done poorly risks wasting all the preceding effort.

# The Story Arc in Decision-Making

The practice of storytelling is as old as time itself and transcends not only countries and continents but entire historical eras. Humans are one of the few species who tell stories to communicate. It's acknowledged that bees tell stories in some form to their hive to pass on specific details about their wider habitat and how to navigate to pollen sources. Many humans feel their dogs are communicating with them and some even feel the communication is bidirectional. However, humans uniquely use narrative and a story arc, typically with a chronological construct—reaching through the past, present, and projecting the future possibilities—to deliver detailed messages. It helps humans to share their understanding with others, to find meaning in recognizable patterns and to impress important arguments on others in a memorable way. The power of storytelling can hardly be understated, and that's why it's just as important to leverage the power of storytelling in a corporate environment, as it is when trying to get a rambunctious toddler to go to sleep. Our initial messages as cave dwellers were primitive but necessary for survival and helped us form the first tribal communities. Today, storytelling uses layered details, historical perspective, and multimedia forms to create an emotional connection. Storytelling goes beyond entertainment and makes information understandable and memorable.

The story arc reassures the listener by providing a familiar pattern to follow. Joseph Campbell's work on the *Hero's Journey*<sup>1</sup> describes 17 steps in the story arc that can be clustered into three phases. As with a three-act play, the first act or Departure defines the journey ahead. For the purposes of decision-making, the first act can be crafted from IWIKs and the definition of the essential question to frame the problem, a process that is explored in [Chapters 2](#) and [3](#). The second act, which a playwright might think of as the Confrontation or Campbell would call the Initiation, is where the action is explored and we further use interrogation mindset along with guesstimation to put information in context and pressure-test the assumptions and details. The third act is the Resolution or the Return. Here, we draw conclusions and use our synthesis techniques while triangulating the

dimensions and constraints of time, risk, and trust. This is the point at which stakeholders actually reach a decision.

Against the story arc construct, we also recognize personas moving through the stages of decision-making. The key persona is the Hero who is confronted with a Challenge. In business, the Hero is not often your company but rather your customer. The best advertising reflects that focus on the customer rather than the product or service provider. There are exceptions, usually where a community forms around certain lifestyle brands like Apple or Nike, and the storytelling takes on the tone of attachment to the brand as the Hero.

Typically, the customer Hero then encounters a Change Agent who enables a transformation and the completion of the Challenge. The Change Agent is most often you as the product or service provider. The Hero crosses the Finish Line once the key milestone is achieved with help from the Change Agent. From this, Lessons Learned are revealed that expose fundamental truths about the power of the Change Agent and the Hero's ability to persevere and opportunity to further succeed. If this seems familiar, it is. Most children's stories, as well as many novels and movies follow this structure—introduction, conflict, resolution, and then lessons learned. This simple flow is clear and effective for any storytelling to an audience of any age.

Of course, the realities of human communication and the complexity of the information involved can complicate this straightforward construct. The gap to address in business storytelling begins at the inception of the work. Do we have an agreement on the Challenge or problem to solve in detail? Can we describe it clearly? Does the data support the case? Why are we addressing this now and does it fit with our business strategy? Why is this a priority for our customers and for our stakeholders? Do we as the Change Agent (your company's product or service) have brand permission by the customer Hero to help solve their Challenge? And is this a Challenge we as the Change Agent consciously choose to solve (invest in) and around which we want to build a new revenue stream?

These questions may seem overwhelming but are resolved by methodical application of the techniques we have explored beginning with IWIKs and backward approach to define the essential question and correlation with the customer's North Star and the North Star of

our business. Does the audience of stakeholders and influencers agree? Storytelling is the skill set that must take center stage here. What do you recommend the stakeholders and key parties to do? You must make the case for them to care by sharing a clear synthesis of information and intuition, or the decision will be an easy and swift denial to proceed.

# Tuning the Narrative

We all tend to think that we are good storytellers. After all, we tell our own stories to ourselves throughout the day. We narrate for ourselves and look back to the conversation we just had or our interactions with others over time. We exercise our storytelling skill constantly and as our own documentarians, our narrative voice is always there, but is it objective? What details does our narrative focus on—the data, the people, the events, the broader theme of a situation?

While a narrative voice most often amplifies bias, it must also incorporate and value an objective view, balancing quantitative and intuitive insights. This divide is where we begin to see others as either “a numbers person” or “a relationship person.” In reality, we are both. Even those who claim to not be comfortable with math will engage in deep conversation about the meaning and the implication of the numbers. In turn, the data scientist could simply convince themselves based on intuition that their numbers are right. In either case, does our self-evaluation of our storytelling capability match what a listener absorbs?

According to a *BBC Future* report<sup>2</sup> on how geography influences how we think, when asked to name the two related items in a list of words such as “train, bus, track” people in the West might pick “bus” and “train” because they are both types of vehicles. A holistic thinker, in contrast, would say “train” and “track” since they are focusing on the functional relationship between the two—one item is essential for the other's job. Similarly, when a business problem is brought to a range of domain leaders (i.e., finance, marketing, product development), each will draw a different conclusion. They will each interpret the data as they are already inclined to see information. If you are an effective storyteller, this is the opportunity to apply a thoughtful understanding of what your stakeholders will interpret from the story you are about to tell to drive collaboration and consensus across different groups.

Before you get to a room to deliver your synthesis and well-thought-out conclusions, it is crucial that you develop a good understanding of your audience, where they are coming from, and what they are looking for. It is also important to be prepared for the different

personas you are likely to encounter. Your audience also has a set of archetype personalities for you to navigate. Beyond the Deloitte Business Chemistry personality types (explored in [Chapter 7](#)), we see some new friends whom we can refer to as: *Billie Numbers* who is the data analyst or Data Scientist, *Seymour Why* who simply has no limit to their requests to “see more data,” the *Silver Surfer* who is the stakeholder and final decision-maker, and *Chris the Business Case Champion* who is your advocate and very tuned to meeting the exact terms of the business case. Each of these characters could reside in any business function—marketing, finance, product development, sales, operations—but their impact is the same. They are gatekeepers protecting their point of view and it is your job to bring them on board.

Each persona plays a unique role in expediting or tormenting a decision.

- **Billie Numbers** is a spreadsheet and data wizard who must prove value to the senior stakeholder, his boss the Silver Surfer, by driving the interrogation of your presentation and questioning the analytics. There is always another view of the data and another analysis that can be considered regardless of their relevance. Your objective is to prevent Billie Numbers from derailing the conversation from the essential question and toward why you used this three-letter acronym method for the analysis and not the other method that Billie recently learned about in an academic article. Directing Billie Numbers to the detailed appendix that supplements your deck with the data and analyses will help keep Billie Numbers busy exploring the numbers, while you are focusing on your story arc. If you anticipate several Billie Numbers personas in the audience, you may want to bring with you your data analyst who can rigorously handle the questions from Billie Numbers while you are convincing Silver Surfer on the recommendation. It is also important to let Billie Numbers feel reassured that the detailed data questions he asks are important and that fierce interrogation of data is an important step. After all, Billie is not necessarily trying to find holes in your analysis; he is probably mainly just trying to impress his superiors. To keep on his side,



make sure that his questions look good but not risk the integrity of your conclusions.

- **Seymour Why** is the business line manager who has the limitless endurance to ask “why” and “show me the details” at any and all breaks in the conversation. No business case is safe, and Seymour will continue to ask questions, whether they drive the conversation forward or not, until the buzzer for the end of the meeting sounds and sometimes even after that. To manage Seymour, you need to keep pressing the importance of the essential question and the need to find a solution to the problem. Highlight the distinction between the “what?”, the “so what?”, and the “now what?” and that urgency of moving the discussion forward from the “what?” to the “so what?” and eventually to the “now what?” To mitigate Seymour's repeated requests to see more data, demonstrate the false value of obtaining ever more data and demonstrate that the new data, even if obtained, is unlikely to change our course of action toward the essence of the recommendation.
- **Silver Surfer**, our stakeholder, has the attention span of a mosquito and is attached to their iPhone, which they were reluctant to upgrade from their beloved Blackberry. There is a brief moment in the meeting, often early on, where you can get the Silver Surfer's attention and approval, but if that window passes, you are dancing with Billie and Seymour for an hour. Silver Surfer is your key audience. It is crucial that you keep eye contact with Silver Surfer throughout the presentation, particularly as you discuss the main recommendations in the executive summary and elsewhere. Try to assess Silver Surfer's acceptance of the recommendations and probe them directly if needed. Our recommendation in [Chapter 6](#) to make your bottom line your top line as part of your synthesis is particularly important for communicating with Silver Surfer. Don't be discouraged if Silver Surfer is tuning out of the discussion as you get to the nitty-gritty details of your analysis, but make sure to bring them back to the discussion by gently raising your voice and using cues like “going back to the key recommendation for the firm” as you summarize the main recommendations.

- **Chris the Business Case Champion** is the Dean of Discipline and wants everyone to win but only if the business case is fully vetted and the case exceeds expectations. Chris is actually your advocate and coach but is also a disciple of process. Make sure that you make Chris look good when presenting your analysis and recommendation. Chris is the one who often brought you in, and your success is dependent on one another.

There may even be other personas or sets of these personas—imagine a squad of five Billies and two Seymours all about to queue the circus music rather than listen to your thoughtful business case. Rather than confronting their interrogation, a storyteller should anticipate what question each character will ask and plan in advance how to either address each question by incorporating the colleague's perspective, neutralize it with appropriate information in the appendix where they can be sent to read, or respectfully park the line of questioning for another time to redirect the group to return to the essential question and move forward to consider the decision. Even the simple recognition of these personas in the meeting would be a big step forward in advancing your communication objective. You should practice a nonlinear transition among the content, and be prepared to manage questions from the different types, while staying focused on your objective.

We could spend many hours debating the manifold reasons why storytelling is so powerful, but we think that it can be condensed down to one simple truth, which is that deciphering meaning is dependent on dimensions beyond the facts. So, what do we mean by this?

Interpretation is complicated by the emotion and even the intonation attached to specific words. Take the following sentence:

**“I never said she stole my money.”** Consider, for a moment, what you think the overarching message of this statement is.

Now recite the following iterations of the sentence aloud, adding emphasis on the italicized bold word:

“**I** never said she stole my money.”

“I **NEVER** said she stole my money.”

“I never **SAID** she stole my money.”

“I never said **SHE** stole my money.”

“I never said she **STOLE** my money.”

“I never said she stole **MY** money.”

“I never said she stole my **MONEY**.”

Instantly—based on the sound of each sentence, pause, and the word that's emphasized—it's clear that the intended meaning of it—the message that it's designed to convey—varies.

In the first example, the implication is that the speaker is not taking issue with the fact that the money was stolen, but rather with the fact that he or she—the “I” in this case—was not the person who accused “her” of that theft. In the second sentence, the implication is that while she might well have stolen the money, the “I” never said as much in spoken words. In the fifth sentence, the emphasis implies that there's an issue with the word *stole*—perhaps the money was merely borrowed? —while the penultimate phrase seems to imply that the money might not have been mine to start with. The final sentence questions whether the object of the theft really was money at all. Perhaps it was something else entirely.

This example might seem a little simplistic—even whimsical—but psychologists actually use this precise sentence to illustrate that inference really matters: the interplay between the left brain and the right brain is of paramount importance when making decisions, which is perhaps an optimal example of the constant balancing act inherent in Quantitative Intuition. More fundamentally, it illustrates the basic importance of how a story can change a message entirely—revolutionize it, even—depending on how it is told.

Now consider the more realistic and complex situation of delivering a data-driven decision. Looking at the same set of figures different decision-makers may draw different conclusions. Furthermore, the skilled storyteller may emphasize different aspects of the data or analysis to help support their recommendation or decision. This is a double-edged sword as it can be used to support a sound conclusion but also to cherry-pick the emphasis of certain aspects of the data to promote a decision that supports a particular agenda.

Consider the following image depicting the global death from conflicts (see [Figure 8.1](#)) over the past few centuries. Similar to putting the emphasis on different words in a sentence in the preceding example, depending on the point the storyteller wants to emphasize or their inherent level of optimism or pessimism, they may put the emphasis in discussing this figure on the decline in per capita death rates in the past 50+ years, concluding that the world is becoming a safer place. Alternatively, they may emphasize the increased frequency of conflicts in the past century and the increased number of deaths per conflict (the increase in the size of the circles) in the same period, highlighting the increased risk of a conflict with a major number of fatalities. Yet, another presenter may decide to put the focus on what may look like cyclicity in the line graph, highlighting the risk that we may be due for another big conflict. Each of these points of view on the same graph may lead to inherently different conclusions. These different narratives may simply stem from different perspectives taken by the different storytellers. However, in more alarming scenarios, the agenda of the storytellers may guide their point of focus. The fierce interrogator of data would take a broader view of the figure to identify possible alternative narratives.

Despite sophisticated storytelling, we are all surrounded by ambiguity. Whether that's facing challenges with the very meaning of words, the interpretation of a sentence structure or argument, or even the fundamental scope of a concept. Humans often communicate ambiguously, especially via the spoken word so we each tend to feel a compulsion to parse and examine things for exact meaning, often without ever getting close. "We'll do what's right," is tragically ambiguous yet implies comfort and best intentions. "The right thing," is bandied around as a phrase, but never truly defined. Are we referring to the Rule of Law or the Golden Rule? Even in the Hippocratic Oath, can we ever really be entirely sure what "do no harm" actually means?

Further, all listeners, including the different personas we outlined earlier, are not equivalent and may interpret the same information differently. If a seemingly simple sentence can easily be interpreted in multiple ways, the messenger who delivers complex details for a decision to be made is best served simplifying the message and

considering how that information is received by each individual stakeholder. If you are one of a group asked to silently name a flower, you will name the flower that first comes to mind, as will everyone else in the same discussion. Now you have a mixed garden across the listening audience when, in fact, the storyteller may have had a specific flower in mind as a key point of the story. So, if a simple element of a story can be interpreted in multiple ways, consider how a group will evaluate a sales spreadsheet, a financial report, or a medical chart. Much like the task “name a flower” would generate multiple results, an unguided review of a spreadsheet will lead to multiple perspectives and wasted effort addressing less relevant topics that become distractions within the reviewing team.



**FIGURE 8.1** Global deaths in conflicts since the year 1400

The storyteller can control the focus of the discussion by highlighting the truly critical points at several levels of communication. At the outset, as is recommended in [Chapter 6](#), the top line must highlight the bottom-line value of the decision. In journalism this is referred to as “not burying the lead” so as to ensure the primary message or recommendation is clear and is driving the discussion.

Focus on critical elements for consideration in the discussion can also be achieved by amplifying details and examples that support the primary decision to be made. The critical elements are obvious in advertising and marketing communication, but less so when data is incorporated. The advertiser is explicit and has mastery of quickly highlighting issues and attributes. The specific flower—a rose—is called out. Brands lead with “sparklers” that are efficient to absorb, easy to understand, and memorable for the audience. Sparklers offer comparison and context (i.e., “our product is 50% faster, cheaper, better”) and often reflect current issues (i.e., “locally sourced from 100% recyclable material” or “Our mission is to make all of our products sustainably by 2030”).

We see this every quarter on Wall Street where a company having a successful quarter leads with its financial outcomes. Its progress and success is obvious from the data and easily presented. Meanwhile, companies disclosing less than stellar results or nuanced progress against long-term goals begin with a narrative to position their results and circumstances in a favorable light. Under then-Chairman Sam Palmisano, IBM committed to increase earnings per share from \$6 in 2006 to \$10 in 2010 and then double that by 2015. The reliability of the progress and the narrative of financial discipline was attractive to Wall Street, but the storytelling bypassed the challenges it created by diverting funding away from people, products, and future investments.

The effectiveness of the messaging is also related to how the listener is engaged by the use of facts and data, emotions in storytelling, and memorable symbols that reinforce the storyline. *Voice Lessons* by Ron Crossland and *The Leader's Voice* by Boyd Clarke and Ron Crossland address the brain science of engagement and retention. In their work, we see the advantage of utilizing all three—facts (highlighting the quantitative data analysis), emotions (incorporating intuitive analysis), and symbols.

Stories that trigger a particularly strong emotional response from the audience are likely to be the most effective in the sense that they'll be memorable and easy to recall.

The value of symbols in storytelling brings an additional layer to the communication. Broadly speaking, a symbol can be defined as

something visible that stands for, or suggests, something else, by either relationship, association, convention, or even accidental resemblance.

Symbols can be extremely simple but have complex and even controversial associations that are extensive. Take the mathematical symbol for the number pi for example:  $\pi$ .

Some might understand this to simply be a visual representation of a number that can be rounded up to 3.14159 and denotes the ratio of a circle's circumference to its diameter, but others would disagree vehemently. Entire books have been written about how pi also represents society emerging from the Dark Ages and the ensuing conflict between mysticism and science.

Take other examples. A simple image of a lion might evoke the ideas of courage, bravery, and strength, or it might remind you of a brand or company. Other animals will conjure other concepts and ideas that will be different for different people or cultures. The peace sign will be interpreted differently depending on the era and who the viewer is, as will the yin and yang symbol. The peace sign has evolved over the course of five decades from peace to protest against wars to inclusion when it is in a rainbow pattern. A picture of a set of weight scales might relate to buying and selling farm produce for one person but for the majority of people around the world it is the image that best sums up the notion of justice or the legal profession.

In their simplicity, symbols are extremely powerful in that they are memorable, evocative and can often convey information in a far quicker and more succinct way than digits and letters might.

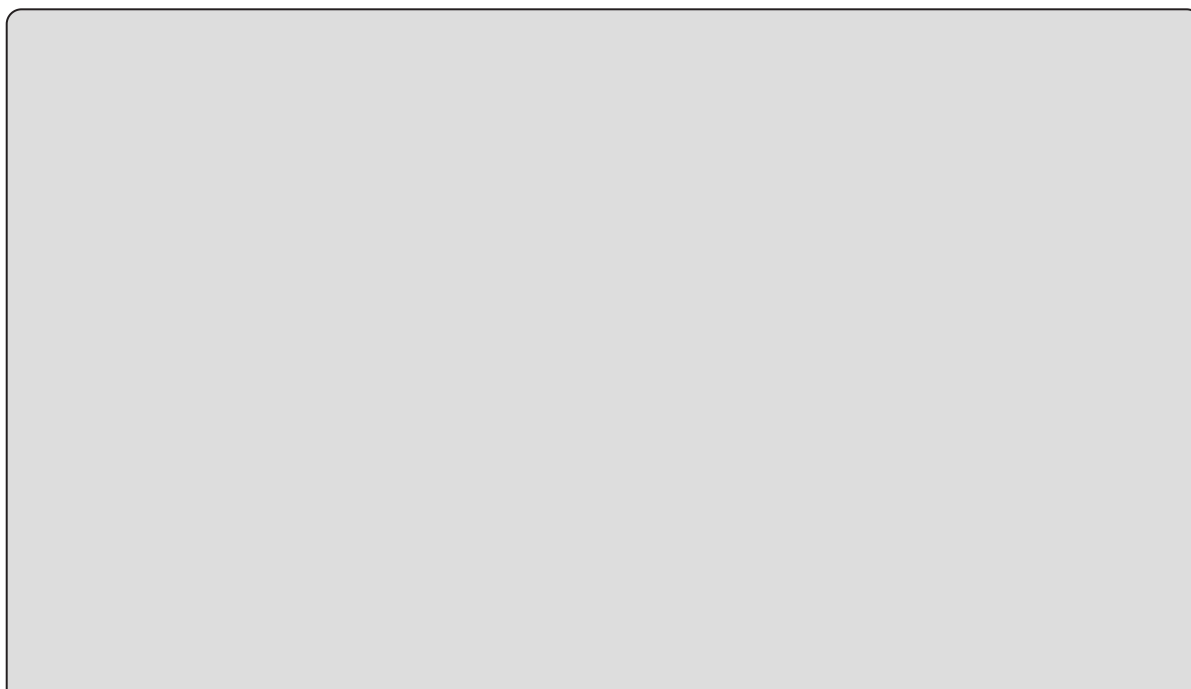
Simply recalling Budweiser's Clydesdale horses reverently pulling an empty wagon and bowing in front of the U.S. flag in a 20th anniversary commemoration of September 11, 2001, evokes a flood of emotion. The Clydesdale becomes a symbol of reverence and respect that reflects the brand value that Budweiser wants to be associated with in the mind of the consumer.

Symbols can also be created in the moment. Showing a personal item such as a pen and telling a story about it or its relevance as a family heirloom can become a memorable touchstone. *Meme* as coined by Richard Dawkins in *The Selfish Gene*<sup>3</sup> was defined as “ideas that



replicate and spread from one mind to the next and now rush through social consciousness given the reach of the internet.” Many of the enduring online memes become symbols at a national or even global level. An internet search for “one does not simply,” “distracted boyfriend,” or “condescending Willy Wonka” reveal thousands of interpretations of those relatable memes as symbols.

We can easily be swayed by a compelling image, so the underlying information must provide a balanced view. An extreme example is the “irrational exuberance” described by former Federal Reserve Chairman Alan Greenspan to address the wave of optimism leading to the early 1990s internet bubble. At the time, reputable journalists would repeat and amplify the promise of “20X future earnings” in a few years for a startup that had yet to ship the breakthrough product it promised. The journalists on morning financial news programs would highlight the potential of certain startups with no meaningful underlying facts supporting a chart showing wild growth that then drove stock prices higher. Their tone was often infused with surprise and the subtle suggestion to join the party, which preyed on “fear of missing out” by the investor. This is dangerous storytelling, but highlights the power of persuasion and emotional engagement. It also speaks to human nature as this exuberance is repeated throughout history from the Tulip Mania during the Dutch Golden Age (1634–1637) to the 1990s internet bubble to the latest run on Wall Street.





## STORYTELLING WITH SENIOR STAKEHOLDERS

Paul's manager at IBM called him into a room and said “You've done a great job with the prior product launch, but you're done with that now. I need you to solve the next problem. Go figure out if there's a business around this.” There was one word on the whiteboard—*grid*—it was a precursor and a component of cloud computing. At the time, it was unproven technology, and IBM wanted to know if there was a viable product and services business based on the new technology. He said, “Let me know when you're done,” and left the room.

As Paul recalls: I had a few months to make the case, so we pulled together a tiger team of experts in product, implementation services, operations and sales to quickly craft a set of rudimentary offerings and test the interest with potential early customers. We also needed to model out the product fit with our existing capabilities and the margin we could expect based on the type of customer deal.

As we spoke to more client prospects and saw patterns develop, we evolved our consulting and system integration, offering storyline for the next set of customers, and quickly identified use cases by industry as well.

A few months later, I was presenting to five stakeholders: four IBM General Managers representing different product and service lines and the VP of Marketing. This was the meeting to seek significant funding based on the learnings. I knew most of the stakeholders well but, more importantly, I knew their goals and had members from each of their teams engaged with our tiger team.

I began by stating the objective, to determine if there was a viable and profitable business with the new technology. I then said: ‘We saw 78 customers across Asia, Europe, North and South America in 120 days. I met with many of them firsthand and discovered the following interests and buying patterns.’ I had their attention. We then walked through one example for each stakeholder and

highlighted the customer need, the issue addressed with the potential new offering, how it was an extension to their existing business line, a verbatim quote from the customer and the context of how that success would project out to the entire customer addressable segment. For each example, it was clear the stakeholders were engaged. They sat forward and their eyes lit up with the customer verbatim quotes (the ‘sparklers’). We concluded with an overview to show context for the business in aggregate and how it would impact financial projections. What would be the implications of doing nothing? How we would operate over the next six months, and then scale out in the next year?

Within 40 minutes, each stakeholder voted “yes” to green light the startup unit and, in fact, increase the investment. In many ways, the meeting was unnecessary. We knew the positive results and we intentionally had key members of each stakeholder's team as part of the tiger team so they could witness the progress directly and validate the recommendations. The meeting was to ratify the final investment ask, highlight surprises we encountered, and allow for any new thoughts to be shared across a talented set of IBM leaders.

## Inform versus Compel

When communicating, there is an implied decision before the discussion begins. Are you seeking to inform others or compel action? While this may seem simple, preparing your audience and stakeholders to make a decision at your next meeting is a completely different task than informing stakeholders or a broader audience about insights and progress. Quite often discussions are not oriented toward either informing or compelling but rather disintegrate into group debate that could be interpreted as decision-making but is not. While there can be value in the open-ended discussion, time must be managed effectively when driving a decision in order to meet deadlines and move the decision forward.

Informing stakeholders requires clearly conveying information for awareness and understanding, while setting the context that their actual vote on the decision will be at a later date. The presenter or project lead is bringing the stakeholders along so as to build familiarity over time, accept feedback on interim course corrections, and avoid surprise when the decision must ultimately be made. In fast-paced businesses, leaders will state they only want to meet to discuss detailed specifics of where they need to take action and do not need to make the time for awareness discussions. However, continuing a project is in itself an action as it translates into ongoing consumption of resources. The feedback or interim course corrections that surface during inform meetings are valuable steps that if skipped can be costly later if projects falter or deviate from the desired path without leadership input.

Communication designed to “compel” decision-making is organized across both quantitative and intuitive dimensions to shape an immediate final decision. The decision can be stand-alone or one in a series of stage gates as part of a larger decision. In either case, the stakeholder should be clearly requested to vote and support the position brought forward by the project lead. If orchestrated properly, the ask for action is not a surprise to the stakeholders. Decisions and discussions are typically most difficult when the decision is to make an investment. Compelling a stakeholder to invest budget, resources, and their own personal time further can be incredibly difficult if the case is not clear. Most organizations have defined criteria and

thresholds for return on investment (ROI), but the actual decision moment itself is often vague or determined after the presentation asking for the funding support. In the lead-up to compel a common question is likely to be were IWIKs addressed? Is it clear the recommended action addresses the essential question initially defined? Have surprises been surfaced along with business benefits? Are important consequences considered? and, can the decision-maker clearly see the “so what?” and “now what?” so as to quickly move to action?

It is incumbent on the presenter or business case owner to drive the clarity through a decision process, including through interim information dissemination meeting and through the final compel meeting where action is requested. The success in driving a decision, then, requires a solid understanding of your audience and how each of them interpret information. This begins with segmenting your audience into the stakeholders, influencers, and distractors, while understanding the fundamentals of storytelling and how to construct a story arc that will ensure action is taken.

## Key Learnings - Chapter 8

Success in driving a decision can be improved with focus on the stakeholder audience and focus on the essential problem to be solved. An effective method is to build a presentation brief for planning purposes:

- Know your audience. Identify project stakeholders, their expectations, and their relationship to each other. Recognize the difference between the true stakeholders and strong influencers.
- Consider how your analysis and insights will be received. Ensure the right level of validated information and memorable details are included to highlight the value and impact of the recommendation.
- Understand immediate and long-term issues and sensitivities. What is the sentiment of the stakeholders and has that changed? Why is this a priority now?
- Deliver a coherent, compelling story with synthesized information that brings forward new insights rather than simply summarizing data. Use data wisely and edit ruthlessly. Don't bury the lead.
- Make your recommendation actionable and clear in an explicit ask that leads to a specific decision with supported outcomes.

# Notes

1. Campbell, Joseph. *The Hero with a Thousand Faces*, 3rd Edition. New World Library, 2008 (originally published in 1949).
2. Robson, David. "How East and West Think in Profoundly Different Ways." *BBC Future*, January 19, 2017. Available at: <https://www.bbc.com/future/article/20170118-how-east-and-west-think-in-profoundly-different-ways>.
3. Dawkins, Richard. *The Selfish Gene*, 2nd Edition. Oxford University Press, October 25, 1990.



## CHAPTER 9

# Chasing the Decision

*People will not resist decisions they believe are in their best interests.*

— Unknown

Do you often feel like you are running all out, but failing to reach the finish line? You bring your full self, but at the end of the week you are exhausted and your to-do list is longer. You're overscheduled for next week, and last week's decisions are still pending. You feel like you are constantly chasing the decision. At some point, a colleague usually says, "Well, making a decision like this is a marathon not a sprint." Frankly, we've never taken comfort in that cliché. Both types of races are challenging in their own right. One is about endurance; the other is about a short burst or maximum speed, and both require commitment to tough training to get in shape mentally and physically. Challenging as both races are, however, they both are only about running, and decision-making is not a single-sport challenge.

Decision-making is more like a triathlon, a multidisciplinary event. Triathlons always start with swimming, followed by cycling and, finally, a run. The swim is first because water poses the greatest threat to a tired athlete—exhaustion could result in drowning. Similarly, the risk from fatigue or error in biking is much higher than in running. Watch the Tour de France, or any competitive bike race, and you'll see a tight pack of riders—a *peloton* (from the French word for *platoon*)—moving as a unit. Each rider conserves energy by "drafting" behind others, but any one rider's single mistake can send the others braking, flailing, and scrambling. Last, you have the run, and its challenge is sheer speed and endurance, keeping the legs strong and the mind focused till you cross the finish line.

To be an effective decision-maker you need to be a triathlete, calling on different abilities and resources for the different events. The discovery phase of decision-making, like swimming, can leave us drowning—not in water but in data. Analysis, like biking, demands precision and coordination, with your team working together for greater power and efficiency. Last, the discussion phase is like



running. It's the final event. You have to battle exhaustion (your own and the team's) and keep your mind and your energy focused on the finish line.

In our work with companies of all sizes, we've studied the problem of chasing the decision. Our research with 2,100 professionals concluded that data in high doses is harmful. It doesn't speed decision-making, improve logic, or enable the smartest decision. In fact, our evidence shows that while data is black and white, the truth is gray. The gray comes from intangibles such as bias, risk appetite, history, stakeholders' conflicting priorities, problem definition, and expectations. Things we can't know through numbers, but only through insight and intuition, which are both aligned with trust.

We've seen it arise from combinations of the following factors: expectation that senior leadership needs to make the decision, too many voices in the room, not the right people, an absence of or weakness in decision rights, multiple claims on decision rights, competing priorities, excessive permission seeking, lack of clarity on what is being decided, misalignment on the definition of the problem, incomplete information, lack of trust in the data or whoever is delivering, new analysis, and resistance to change. While these are real issues, they are also all symptoms of a larger issue: fear.

We are afraid of casting a decision that's not right, not smart, or making a choice that's not perfect. We fear that if we make an imperfect decision, it will impact our personal brand, our performance rating, our next project, or job opportunity. So, we seek the perfect decision. This quest is counterproductive to agile decision-making, yet we deceive ourselves, hoping to attain certainty. As we request more information, one more spreadsheet, additional data, streams of data, we end up with countless meetings. Too frequently, we find ourselves spinning. The discussion becomes a debate and drags on, sapping our vitality. And so, we prolong the process, seeking more data. We make slow decisions, misguided decisions, and—sometimes—no decisions.

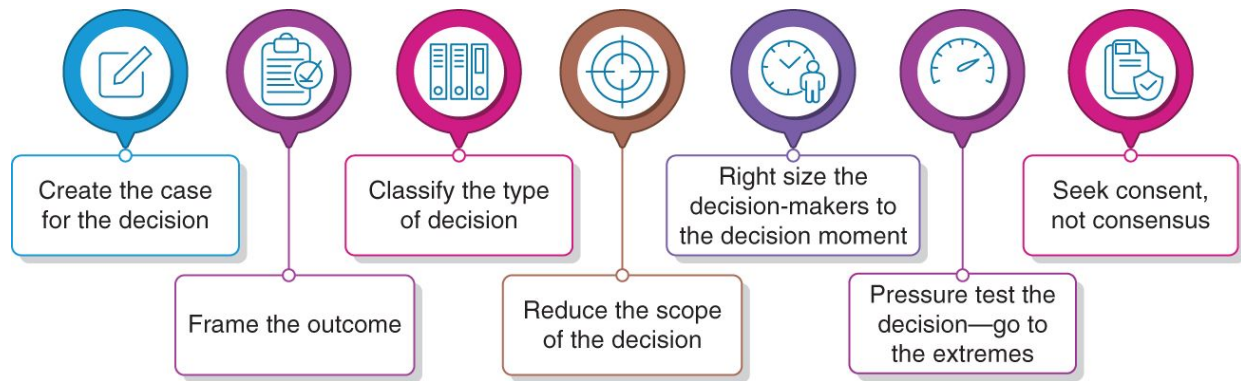
This chapter provides seven practical strategies to help you stop chasing the decision. It is a synthesis of many of the strategies and techniques we discuss throughout the book. To make effective decisions across teams of different size, different types of decisions,

and with varying amounts of data, we developed seven lessons to better faster decisions.

Before we look at each of these strategies, we want to emphasize they do not have to be applied in order. It is *not* a waterfall approach but more like jazz. Depending on your situation, these techniques have been designed to enable you to jump around. You may apply Strategy No. 6 and then jump to No. 4, and back to No. 7. [Figure 9.1](#) shows the seven strategies covered in this chapter.



To fully understand each strategy, you need to look at its underlying principle, show it in action through an example, and then offer tips on why, when, and how you can immediately apply the strategy.



**FIGURE 9.1** Seven strategies for making faster and better decisions

Source: Frank, Christopher, Paul Magnone, and Oded Netzer. *Decisions Over Decimals*, 1st ed. J.W. Wiley, October 2022. Quantitative Intuition<sup>TM</sup>.

# Strategy 1: Create the Case for the Decision

A decision represents a change—a moment in time when you are asked to consider a different path. Humans are not wired for change, and we think it's important to grasp this: organizations do not resist change—people do. Human resistance weighs heavily on the decision-making process. Therefore, you need to create the case for the decision in a way that resonates with individual stakeholders, to navigate and overcome people's natural resistance for change.<sup>1</sup>

Management literature offers an extensive array of change models, and in our work and our teaching, we have considered many of the top models, including Lewin's change management model, the McKinsey 7-S framework, Kotter's 8-Step Process, the ADKAR (Awareness, Desire, Knowledge, Ability, and Reinforcement) model, Nudge theory, the Bridges Transition Model, the Kübler-Ross Change Curve model, and the Satir Change Model. For our purposes in creating the case for the decision, we prefer the Beckhard and Harris model. Devised by management consultant David Gleicher and further refined by Richard Beckhard and Reuben T. Harris, the model is brilliantly simple to apply, easily scalable to different sized organizations, and appropriate for many leadership styles, and varying sizes and types of decisions.

The Beckhard and Harris Model<sup>2</sup> considers four factors necessary for change to take place: dissatisfaction, vision, first steps, and resistance.<sup>3</sup> The first three factors must be sufficiently strong if resistance is to be overcome. Let's unpack each and then discuss how turning these dials will improve decision-making.

## Dissatisfaction (D)

Dissatisfaction with the current state is core for a decision to occur as the pain of not changing must be greater than the uncertainty that comes with change. The level of dissatisfaction can vary from acknowledgment to acceptance to fully embracing the need to move to something different. At a minimum, there must be an acknowledgment of the need to change. The people who will be impacted must be motivated to make the change; therefore, it is imperative to make it clear why the current state needs to change.

## **Vision (V)**

There needs to be a clear and shared picture of the future. The vision creates an image of the ideal state when the decision is made. This is a core part of effective decision-making as it connects with people on an emotional level. As discussed in [Chapter 8](#), emotions have a 2–3× greater impact on decisions than rational features and benefits. Emotions matter as they not only govern the nature of a decision but the speed of the decision. A clearly articulated vision should evoke emotions such as security, comfort, aspiration, inspiration, or a sense of control. Keep in mind that anxiety is a natural part of any decision as change represents an unknown, but that anxiety is short-term if the emotional payoff of the future state is positive.

## **First steps (F)**

The first practical step to achieve the vision can seem unattainable by the broader team, so it needs to be broken down into smaller work streams, projects, decisions, or initiatives. Individuals must see how the vision is attainable and, more importantly, understand the specific role they will play in making the vision a reality. The initial steps must be clear and easy to generate high engagement.

## **Resistance (R)**

As discussed earlier, Resistance is always a factor of change.<sup>4</sup> People are not wired for change, so resistance must be overcome for a decision to be successful. To overcome resistance, it's crucial to understand the main reasons why people resist change:

- Fear of the unknown
- Lack of understanding of the need for change
- Fear of losing status, security, belonging, or competence
- Emotional connection to the current state
- Lack of trust in those promoting or driving the change
- Insufficient knowledge about the proposed change and its implications
- Lack of belief that change will lead to a better state

These conditions give rise to a change formula:

$$D \times V \times F > R$$

The three components on the left must be present in sufficient quantity to overcome the inherent, natural resistance to change. This algorithm will not yield a mathematical result, but it serves as a guide to creating a meaningful and efficient decision-making process.

## **Applying This Step**

In creating the case and reasserting it at key moments in any process, as the leader, you want to observe if any of the three factors are present in the decision process and at what levels. Start by doing a quick self-assessment to see if you are overdelivering on one of these three. Are you anchored in diagnosing the current state? Have you spent too much time getting the team excited by the vision? Is your comfort zone in the details and workplan?

Similarly, you can do a quick check-in with your team by asking three questions:

1. Is it clearly agreed why this issue must be addressed now?
2. Is the outcome superior and distinct compared to the current situation?
3. Does everyone understand your role and the impact this change could have on you?

Are all three factors present? If the answer to any of these questions indicates that all three factors of dissatisfaction, vision, and first steps are not present, you can easily course correct. Keep in mind these questions are not limited to the start of a project, but should be used to periodically check in. As you get into analysis, production, or various work streams, people may lose sight of the vision or get caught up in the details. Regularly reinforcing why you are working toward a decision will overcome any natural resistance that could surface.

Are you over indexing on any of the three factors? It's important to understand the dangers of neglecting or over indexing on any one factor. A common mistake we observed is that leaders tend to over

indexes on one of the elements on the left, ignoring the other two. This may unintentionally be driven by the leader's personal style, the company culture, or environmental conditions such as crisis management or time pressures.

### ***What Does Over Indexing on Dissatisfaction (D) Look Like?***

Leaders, teams, or individuals who focus on what is broken, are pessimistic, or are highly critical regardless of the proposed solution. They have a difficult time seeing past the current situation. This intense focus on what is not working leads to frustration or cynicism, serving as a headwind to decision-making. While it is important to have a realistic view of the current state of affairs, intensely focusing on what is wrong is analogous to wearing earplugs and blinders. You cannot see or hear anything else clearly.

### ***What Does Over Indexing on Vision (V) Look Like?***

Some leaders are great visionaries. They thrive in articulating what the future will look like. They do not focus much on dissatisfaction (D) as it may be perceived as looking in the rearview mirror, assuming the pain with the current state is well understood. Any first steps (F), to this type of leader, might feel too process-oriented and weighted down. These leaders tend to overlook the fact that dissatisfaction (D) is a necessary motivator for others to accept change, and first steps (F) are a means of communicating how the vision can be attained and clarifying everyone's roles. Visionaries see three steps ahead, and the future is bright, exciting, and inspiring for them. They are pioneers. They challenge the status quo. They are creative thinkers, seeing around corners, and pushing to innovate, constantly looking ahead, and putting forward an ambitious agenda. They do this either because ambition is innate or they feel it would be motivating to the team. Visionary leaders are essential. The best visionary leaders can harness dissatisfaction and build a team that excels at process and operations.

### ***What Does Over Indexing on First (F) Steps Look Like?***

There is an overreliance on work streams, assignments, and steps. The majority of the discussion is on process, with a focus on the near term. These types of leaders aim for efficiency and feel they are being

“buttoned-up.” They strive toward ensuring they do not waste time, the job to be done is clear and the role and responsibility are laid out, and no time is wasted. There is minimal connection or discussion to the outcome. Similar to a macro camera lens, the focus is extremely close to a subject so that is all that appears in the viewfinder. That is all the team can see. When a step does not go as planned, the work comes to a halt as subsequent steps are dependent on the execution of the previous step. At best, if everything progresses without a hiccup, the intense focus on the first steps means that once they are complete, the team has to stop to regroup and outline the next steps. This impacts agility and nimbleness. Over indexing on first steps also runs the risk of de-energizing the team because its connection to the vision is missing.

The three factors are like any kind of competency: when it is overdone, it can turn into a negative. Too much of a good thing can be harmful or excessive as the quality of something is relative to its quantity. This is true in the decision-making process given that you need to overcome people's natural resistance to change. To hasten the decision timing, all three factors must be present to effectively create the case for the decision to make sure your colleagues engage in a productive way.



## Strategy 2: Frame the Outcome

Absolute clarity on the outcome is foundational to effective decision-making. The challenge occurs when there are varying definitions of what success looks like. Your business partner may only need a simple answer, a quick analysis or one number as the speed of the decision is what is most important. In your effort to overdeliver, you generated a pivot table, supported by a set of slides, and wrote a synthesis of your analysis. While it is a robust answer, you actually underperformed, causing delays. If you took the time up front to frame what was needed as is suggested in [Chapters 2](#) and [3](#), you would have invested less time and had greater success.

A frame is a guide. It shows where to focus by highlighting particular aspects and eliminating others. Framing provides boundaries to help interpret what you see, while being clear on what you need to deliver and guiding how you spend your time. Most teams or clients have little trouble articulating what they don't want. They easily discuss wide-ranging pain points, but struggle with clearly defining where they want to go. If you show a panoramic picture to a group, the group members will focus on different aspects while all viewing the same picture. They will wind up with a wide range of interpretations of the same photo.

When discussing an outcome of a project, there are typically two extreme scenarios. First, the goal is very clear to the leader. The leader inherently understands what success looks like as they played a significant role in shaping the project. The second scenario is the leader has a vague notion of the final deliverable as they have not invested the time thinking through the outcome or have been asked to take on an assignment without the full context. These polar opposite scenarios lead to the same situation—a vague description of the goal where minimal time is spent discussing what success looks like. Too often in decision-making disparate views on what is needed are at the root of the endless race to make a decision as people work toward different standards. The team mistakes action for outcomes, failing to ensure it has a common definition of *winning*. Once a decision is made, it misses the mark or a larger opportunity is missed.

Therefore, it is imperative to define what success looks like and then educate and evangelize the outcome. In military scenarios, there is a

concept called *victory conditions*—conditions by which one wins. The successful leader clearly outlines what is needed to move forward. They break down a complex campaign to the essence, using the simplest terms, thereby ensuring clarity so the entire unit works as one to move forward.

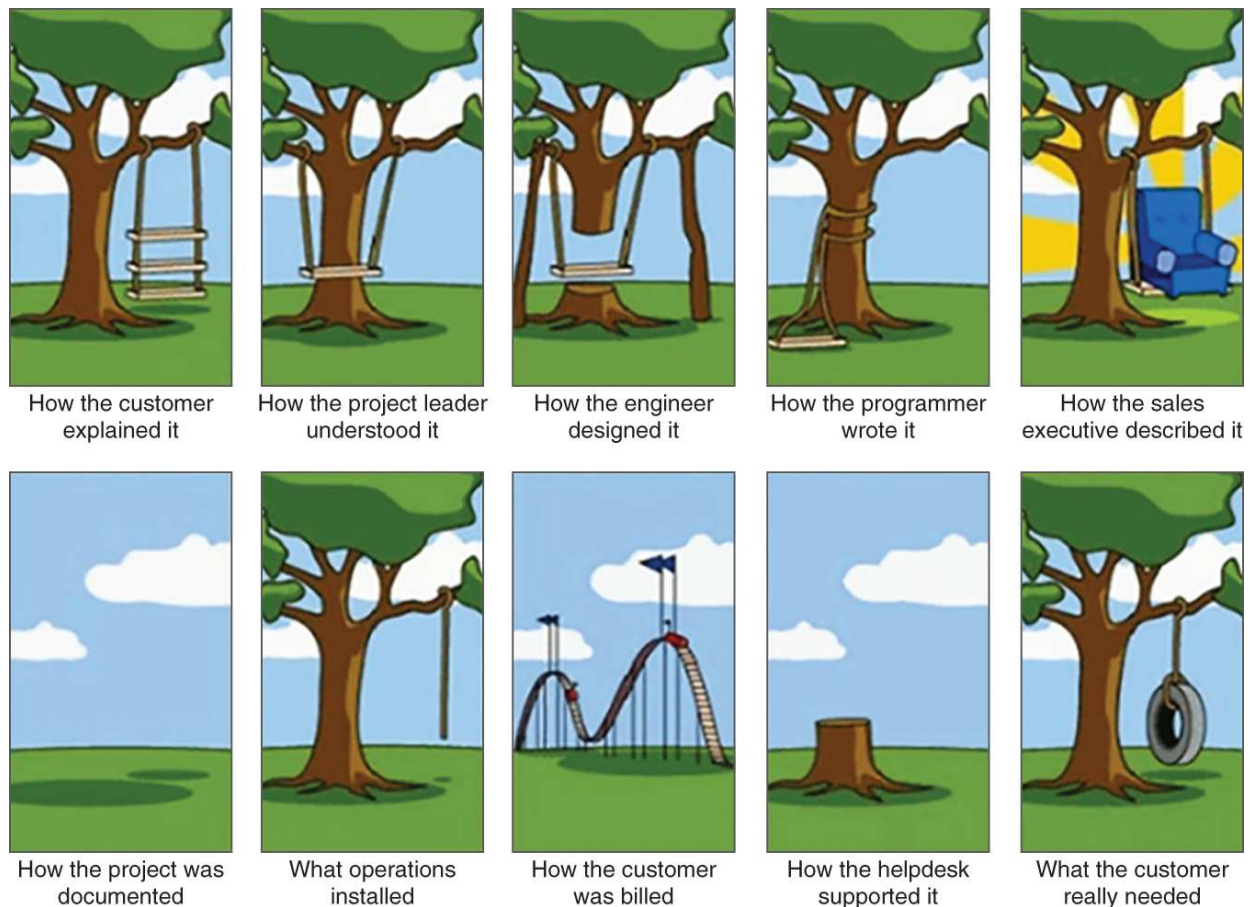
## Applying This Step

The concept of victory conditions can be applied to any team environment, whether it be a school project, volunteer group, or workplace. It is as simple as asking:

1. What does winning look like?
2. Do you need a gold, silver, or bronze solution?
3. What is the essential piece of information you need to make a decision?

Going back to our panoramic picture, think of the victory condition conversation as a technique to crop the picture to remove the unwanted outer areas. Understanding what success looks like helps you to frame the picture. It focuses the team on the data that is needed, what analysis is required, and the decision(s) that are required (see the Working Backward approach in [Chapter 3](#)). Pausing to have this conversation ensures the effort reflects the need. We frequently use the expression “Don't build a rocket ship when a bicycle can get you there.” Don't create more complexity than is needed.

According to the *Merriam-Webster Dictionary*, *overengineering* is the act of designing a product or providing a solution to a problem in an elaborate or complicated manner, where a simpler solution can be demonstrated to exist with the same efficiency and effectiveness as that of the original design (see [Figure 9.2](#)).



**FIGURE 9.2 Overengineering**

*Image Source:* <https://hackernoon.com/how-to-accept-over-engineering-for-what-it-really-is-6fca9a919263>.

In decision-making, the goal is to match the need with the appropriate outcomes. Overengineering the decision wastes resources and depletes energy. Overengineering a decision can be draining to the team, as it is often tasked to solve tertiary problems in addition to the primary objective. There is also a downstream effect as it dilutes the team's focus from working on other projects. Clarity on the outcome will foster speed of decision and have a positive halo to other aspects of the business.

## Strategy 3: Classify the Type of Decision

Humans do not want to fail. While this is an aspirational goal, it inhibits agile decision-making. This fear of failing is tied to the feeling that once a decision is made it is not reversible. With this in mind, Amazon approaches the decision-making process by categorizing decisions as Type 1 or Type 2. In a shareholder letter, Jeff Bezos discussed this decision-making mindset.<sup>5</sup>

- **Type 1 Decisions:** Almost impossible to reverse. Think of decisions as doors. A Type 1 decision is a door that only permits passage in one direction. Since Type 1 decisions are difficult to reverse, they are heavyweight decisions that will take a great effort to undo, such as deciding to open a manufacturing facility, shutting down a product line, or entering into a merger.
- **Type 2 Decisions:** Easy to reverse. These decisions are doors that permit two-way traffic. The majority of decisions are Type 2 and can be reversed.

[Chapter 7](#) discusses how the reversibility of the decision relates to the assessment of the risk dimension of the decision at the decision moment.

### Applying This Step

While this is a useful taxonomy to bucket decisions, how do you actually classify a decision as reversible or not?

When faced with a decision, consider how easily you could modify the decision. What will it take to change the decision once it is made? Consider if there is some point when it becomes irreversible. Is this a lightweight decision that is reversible or a heavyweight decision that is irreversible?

You will often find that the majority of decisions are reversible. If you find that many of the decisions are falling into the irreversible category, reduce the scope of the decision, which is the subject of the next strategy.

## Strategy 4: Reduce the Scope of the Decision

The larger the decision is, the greater its impact. In our quest to make a fast decision we often strive to move from point A to B. In early childhood we were taught that the shortest distance between two points is a straight line. That knowledge is based on the work of Archimedes of Syracuse.

Not wanting to challenge a notable Greek philosopher, but mathematicians, rightly so, have countered this argument. Basic geometry shows the shortest distance between points A and B depends on the underlying geometry. If the landscape is perfectly flat, then a straight line represents the shortest distance. In decision-making, much like in nature, the landscape is rarely flat and unencumbered.

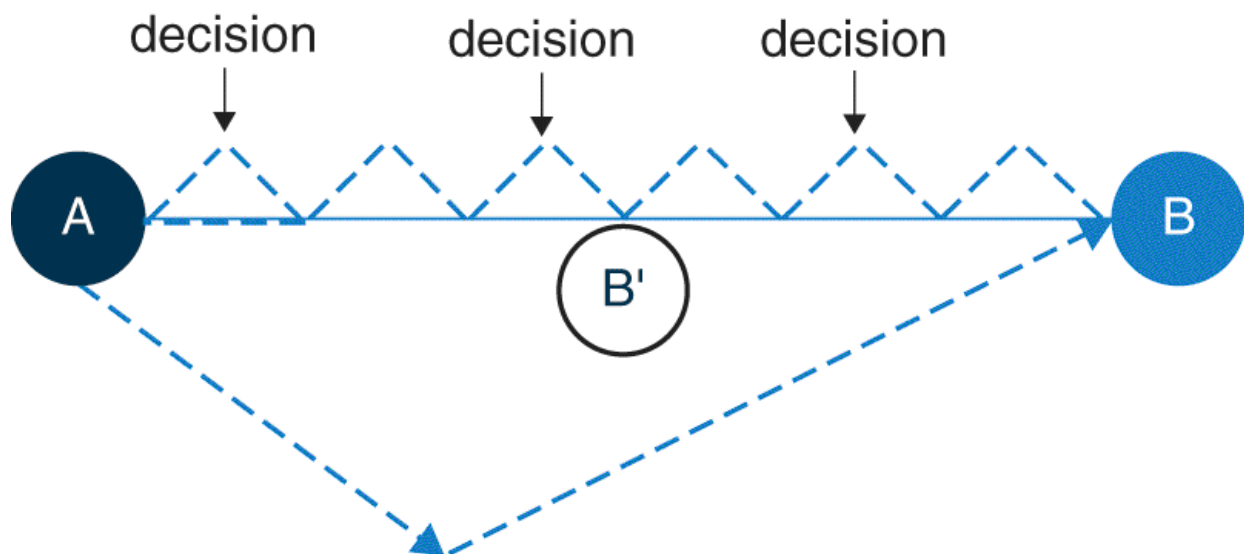
Big decisions typically involve a broad set of stakeholders, more inputs to consider, or the need to optimize for multiple outcomes. The decision landscape is therefore “curved.” In addition to the landscape, as we have shared throughout this book, there are many headwinds that could shift your plan, much like in sailing.

If you have ever sailed or observed sailing competitions, the destination is established but the journey is never a straight line. The longitudinal and latitudinal coordinates are known, but on any given day there are ancillary factors such as wind speed, tides, obstacles, crew skill, and weather that the skipper at the helm must navigate. No sailboat can sail directly straight as the wind coming head-on would flow around the boat preventing the sails from filling. However, by harnessing the forces created by air and water and constantly making adjustments to capture the wind, the boat moves rapidly forward. These adjustments are a sailing maneuver called *tacking*. Tacking looks like a series of sawtooth movements that take advantage of the wind while moving closer to the destination. Regularly assessing the wind leads to minor refinements, ensuring the boat remains on a favorable tack. Though these periodic adjustments may add distance, the result is a faster trip with less wasted effort.

### Applying This Step

The experienced decision-maker applies the concept of tacking (see [Figure 9.3](#)) by breaking the larger decision into smaller steps. The focus is on resolving these micro-decisions to demonstrate progress and enable real-time adjustments to the headwinds. These headwinds could be new data, change of priorities, shifting timelines, or competitor actions. The headwinds represent factors that must be navigated to make a decision. By working on bite-size decisions, the impact of these headwinds is minimal as the redirections are smaller and the change to the overall decision is smaller.

To become a skilled decision-maker, avoid mapping a direct path from A to B, but instead break down the overall decision into micro-decisions that require less time and/or have lower risk. You then assess the headwinds and gauge impact on the micro-decision. If the headwinds are constant and your work streams are moving forward, you are on a favorable tack. Keep going. If you determine you need to reverse direction or course correct it is much easier. This is a fundamental change in the decision-making approach. Micro-decisions need fewer people, require less effort, and limited inputs. Your ability to veer off course is contained. By reducing the scope of the decision, the speed of decision-making increases as people have the confidence to make a small decision as the risk of failure is reduced.



**[FIGURE 9.3](#) Decision-making via tacking**

A key part of this technique is to regularly assess progress and communicate to the team. Communication is essential to link and label the small decisions to the larger goal as the small decisions may not be perceived as a forward motion. Recall that a person's natural inclination is to reach the destination. Their definition of success is black and white—did we achieve the goal or not. Through frequent communication, you reinforce that you have not lost sight of the goal and all the tasks are moving toward accomplishing the objective. The communications should be open and transparent. Even when you need to redirect and change course, this should be discussed. By bringing along the team and putting the changes in context of the larger goal, team members will see how they are in service of achieving the overall outcome.

## **Strategy 5: Right Size the Decision**

If you've ever watched young kids play soccer, it is like watching bees flying from one flower to the next. The whistle blows, the ball is kicked, and the kids fly off chasing the ball. The parents start yelling with verve and vigor. The coach brings fantastic energy encouraging the team. With so much going on, you lose sight of the ball. Then a flicker of the ball is seen. The group pauses, disbands, and then starts running all out. Everyone is aiming for the ball. Kids are running. Parents are jumping up and down. The coach is hooting and hollering. The energy is contagious. For 50 minutes this goes on.

The goal is clear. Literally, there is a goal. The objective is well understood: get the ball into the net. There is encouragement, perseverance, and high energy. There are adults with different levels of experience, skills, and knowledge. Yet we all know how the game ends. Everyone is exhausted from running all out, the score is usually a tie, and there is a treat for all the effort.

As the kids grow older and coaching becomes more seasoned, the shape of the game changes. The games become more competitive. A few teams break out and make it to tournaments, division events, or playoffs. They gain skills through learning valuable lessons about passing and assisting, and they learn to play to their positions. They substitute players based on the competitor, score, and skill set. The energy matches the moment. Sometimes they win; other times they lose, but they are competitive. The games move fast. Whether you play a sport or enjoy watching it, you've observed these types of games.

These are valuable work lessons that enable faster decision-making. When a new project is launched, team members pounce on the ball with positive intent. Additional colleagues are brought in. As the decision looms, the number of voices in and outside the room increases. Activity is often confused with outcomes as people are jumping from one meeting to the next, emails are flying, slides are being developed, data is being pulled, and conversations are occurring. At the end, people are fatigued, and there may be a good decision, a poor decision, or no decision at all.

### **Applying This Step**

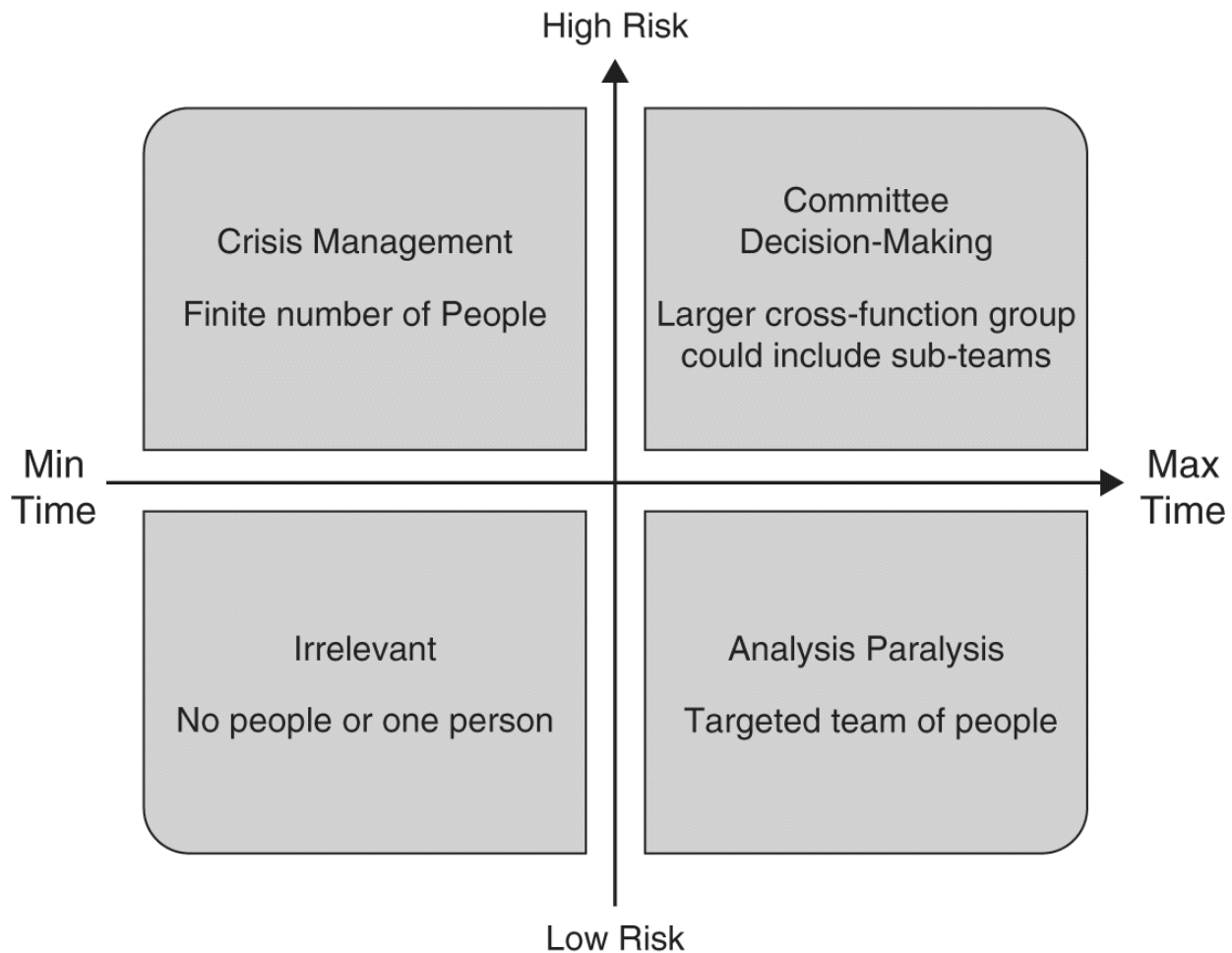


The goal is to avoid chasing soccer balls. The tendency is to jump in, assemble a team, and start working. All decisions are not created equally. When we stop to consider this, it is obvious, but teams do not operate accordingly. Often all decisions are treated with the same level of intensity. In reality, different decisions require different skills, people, and timing. The following steps detail a reimagined approach to right sizing the decision-maker to the decision moment.

1. **Classify the Decision:** Consider the two factors that are discussed in [Chapter 7](#): time and risk.
  - a. High Risk/Minimal Time = Crisis decision situation. Finite number of people.
  - b. High Risk/Maximum Time = Committee decision situation. Larger team.
  - c. Low Risk/Minimal Time = Irrelevant decision. Limited to no or one person.
  - d. Low Risk/Maximum Time = Highly analyzed decision. Targeted team of people.

[Figure 9.4](#) illustrates the following formula:

Less space = Less time = Less People = Quicker decisions



**FIGURE 9.4 Decision situational quadrant**

2. **Assess Skill:** When a new initiative presents itself, start by outlining what expertise or experiences are essential to making the decision, independent of specific people. Essentiality is a key consideration as you are trying to assemble the smallest, high-caliber team needed to be effective.
3. **Identify People:** While the reality is you need to consider people's bandwidth and availability, what often happens is you have too many people or you do not have the right people. When you do not have the right people, the risk is you bring in more people thinking the volume will close the skill gap.
4. **Choose a Leader:** Selecting the right leader needs to be considered after you complete steps 1, 2, and 3. If you have a high-performing team with the right expertise, then you may want a leader with strong organizational skills. If you have a large,

inexperienced team with skills gaps, assign a seasoned leader with direct or related experience to the decision. A strong leader can close the gap. If this leader does not excel at planning, be sure to designate team members who can lead the operations.

5. **Assign Roles:** At the project launch, it is important everyone is aware of the goal, but clearly defining each person's role relative to the goal will save a lot of effort. The team leader needs to go beyond simply assigning a responsibility to a colleague and should invest in defining what success looks like and share personal expectations. Ask team members to play it back to you in their own words so they are clear on their position and what they need to deliver. As in sports, “playing to your position” makes it easier to have clear structure and an orderly process, making it easier to complete a task. Each person will be able to deliver at a high level as well as to make course corrections easier while making the translation of effort toward the goal with a high degree of success.

Many companies make fast decisions in a crisis situation. They may not make the perfect decision, but they make decisions quickly. There are some lessons to extrapolate from crisis decision-making. Less time and higher risk creates a tight space at a fast pace. Team members quickly focus to adapt to a fast pace. Creating small teams with short timelines focuses their effort on improving nimbleness.

## Strategy 6: Pressure Test the Decision—Go to the Extremes

It is essential to know the strengths and weaknesses of a decision so that you can prepare accordingly. The concept is analogous to that of pushing a solution or a product to its limits—a common and best practice in engineering. The objective is to measure, in a controlled environment, the maximum stress that a material can withstand before breaking. This guides the manufacturer on product design, usage, and features to optimize performance and avoid failure. It occurs across industries from automobiles, appliances, tools, and toys to software, websites, and mobile applications. The tests are known by various names such as stress testing, load bearing, or line testing, but they all refer to understanding the limits of the design.

When applied to evaluating management strategies it is called *war gaming* where elaborate simulations mimic competitors, trends, technologies, customer needs, and market dynamics. During a single day or over a series of days, various models are run to provide different views. Variables are adjusted, teams role play competitors, and a range of potential responses are enacted. At the conclusion, the company has a deeper appreciation of the points of superiority, inferiority, and gaps in the strategy. War gaming is a powerful tool, but it demands a fair bit of time and effort. Since its value is proportional to the effort invested, it is only done infrequently, typically being reserved for major initiatives or long-term strategic planning.

The reality is the majority of decisions occur on a daily basis. It is estimated the average American makes make 70 decisions per day, according to Sheena S. Iyengar,<sup>6</sup> Professor of Business in the Management Department at Columbia Business School. Given the number of decisions that happen frequently the real need is for a technique to quickly expose unidentified risks and to uncover potential opportunities. Any tool would have to be simple, scalable, and fast.

To meet these parameters, we started by deconstructing various testing techniques when a common trait became obvious. Many of the approaches to stress testing systems are designed to look at

performance over many points and a broad spectrum of conditions. They cast a wide net to capture performance during a simulated life cycle. However, daily decisions do not require that level of rigor. The techniques that are discussed in [Chapter 4](#) posit that if you consider how a decision will perform at the extreme scenarios, you would be able to quickly assess the viability of the decision, while validating the underlying evidence supporting the recommendation.

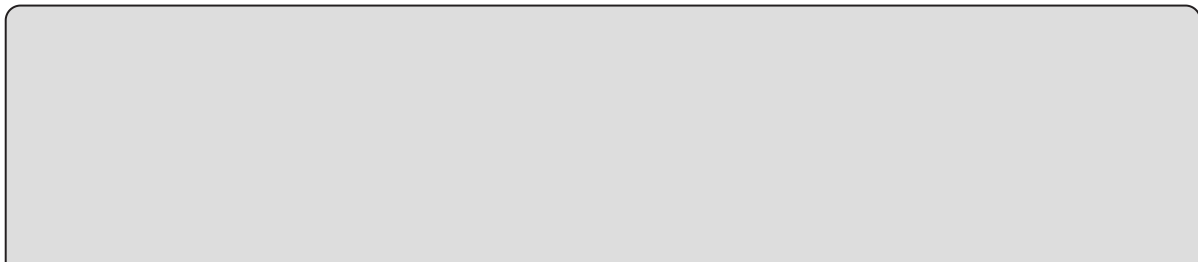
But first, let's discuss what we mean by *extreme scenarios*. An extreme scenario is when you understand a decision/solution/recommendation at their limits. In the auto industry, engineers test the maximum car engine speed that an internal combustion engine is designed to operate without causing damage to any internal components.

In decision-making, these extremes can be defined by the following examples:

1. If you were given 2× more budget than you are asking for, what would you do?
2. What would success look like from a pilot program?
3. Who will you hear from if you stop this program?

These three examples illustrate how to quickly apply the concept of stress testing to daily decisions. Each case represents an extreme point, the end point, where you would need to provide a response. This does not mean you would get double the funding or that a program would be shut down, but lack of a well thought-out answer highlights a gap in thinking and analysis. It is a simple way to evaluate if the logic to arrive at the decision is comprehensive.

This tool is particularly effective during budget planning. We have seen the application of this many times in large and small investment requests.



## Case Study: \$300-Million Decision

A few years back, we witnessed the \$300-million dollar request to start a new retail operation. There were store mock-ups, demographic studies, foot traffic analysis, zoning requirements, competitive studies, store projections, break-even analysis, build-out costs, and operating needs. There was an ecommerce aspect to complement the brick-and-mortar storefronts. The presentation looked like a real-life scene from the Arlo Guthrie song “Alice’s Restaurant Massacree” with “twenty-seven eight-by-ten color glossy pictures with circles and arrows and a paragraph on the back of each one.” As the team launched into its presentation, the senior leader held out his hand indicating for the team to pause. He said, “I have one question: ‘What happens if you are wildly successful? What happens if you have people lined up outside the store or demand is three times what you projected?’” A hush descended onto the room. This was not what they rehearsed. This was not in their talking points. The analysis accounted for 5-10-15% growth or for a longer break-even time. They were not ready for the “wild growth” question. They did not think through how the call center would scale, what shipping capacity would be at extreme levels, or how they would ramp up staffing. There wasn’t anything they could do at that moment. The CEO was not going to look at the “twenty seven eight-by-ten color glossy pictures with the circles and arrows and a paragraph on the back of each.” The three-hour presentation turned into a 30-minute meeting. The leader said he would welcome a part two meeting when their analysis is completed.

With one question the leader stressed tested their logic. He pressured their request by pushing it to the breaking point. To conclude this case, they returned to the board room. They retooled their presentation, thought through all scenarios, modified their request, adjusted their implementation plans and staffing requirements, and were successfully funded. The stores launched and had a successful 11-year run, opening 116 stores in 4 countries.

## Case Study: \$2-Million Decision

It was annual budget planning and resources were tight. We had a limited budget, an ambitious agenda to build a new digital platform running into a corporate directive that the year-over-year budget had to be flat. There was only one solution if the leader was committed to implementing his plan: he would need to reallocate money across the team. He made the tough decision to shift \$2 million from one VPs \$5-million budget line to that new project, reducing the VPs budget by 40%. After he flashed this on the screen, he was quiet. You can tell he was tentative, waiting for the backlash, for the push back. The other three VPs who were not impacted sunk into their chairs. It was the proverbial quiet before the storm. The VP who was being impacted cleared his throat, leaned in, placed his elbows on the table and asked, “What would be the impact if we increased the budget to \$4 million for the new digital implementation?” The GM assigned to the new digital platform did not know what to say. He was not ready for the 2× increase in funding question. The VP went on to explain that if we believed in the vision, shouldn't we explore all options. That single question changed not only the tone of the meeting, but also sparked a rich dialogue around investing in innovation, challenging the status quo, and changing the shape of our new hire profile in the future.

Another form of pressure testing decisions is called the “zero” version, where someone asks if we decide not to move forward or if we stop a research project, shut down a program, or stop delivering a report, “Who is going to miss it? Who will I hear from?” If the answer is no one or only a few people, it is an indicator that the value of the program may have reached the end of its life cycle or resources would be better spent on other work streams.

Each of these examples expose incomplete thinking. By pressure testing a decision at the extreme points, you can self-diagnose your logic. When you share your decision with a stakeholder or client, you will become more confident, demonstrate comprehensive thinking, and ensure your team is well prepared.





## Strategy 7: Seek Consent Not Consensus

Smart decisions reflect diverse opinions across disciplines, experiences, and outcomes. In today's collaborative mindset culture, teams strive to optimize each of these inputs. We listen to everyone's input and respond to it. We seek to bring everyone along. Everyone is treated as having an equal voice in the decision. Agility is compromised when people believe they need to make decisions together. In the end, the process is exhausting, and the decision is vanilla.

As you chase the decision, you are seeking consensus by trying to get to general permission by addressing all inputs. Consensus is where everyone's opinions are understood and a solution is created that respects those opinions. Consensus results in a solution that the group can achieve at the time.<sup>7</sup> Note that it may not be the best solution as it is looking to accommodate everyone's input at a point in time. Majority approval often leads to minority decisions.

Some of the inputs are facts based on expertise, while many are opinions, a view, or judgment not necessarily based on knowledge. They are delivered with conviction or take on added weight based on positional authority. You will save time and effort by discounting this type of input.

Input is valuable. You should actively seek feedback, but that does not mean you need to act on all suggestions. As the decision owner, you have the right to consider, accept, or reject any input. Make sure to close the loop with whomever invested the time to share meaningful feedback. At a minimum, acknowledge and thank them for their contributions. Even better, go one step further to let them know you considered their input but are not going to take action on all of their feedback due to other factors you need to balance. This is perfectly acceptable. This is not only respectful but strategic as you are bringing people along. What you will find is that stakeholders often simply want to know they were heard. By bringing people along in this way you open up a dialogue and increase the likelihood they will support or at a minimum not object to the decision. It will achieve your goal of collaboration and minimize the headwinds when you share the final decision.

This alternate path leads to consent. Consent is about making a fast, smart decision informed by facts. Consent serves as a fast filter when considering feedback to identify major risks. This will not result in the perfect decision but in a faster decision. You can work through minor changes as you move forward by applying the concept of tacking that is discussed earlier in this chapter.

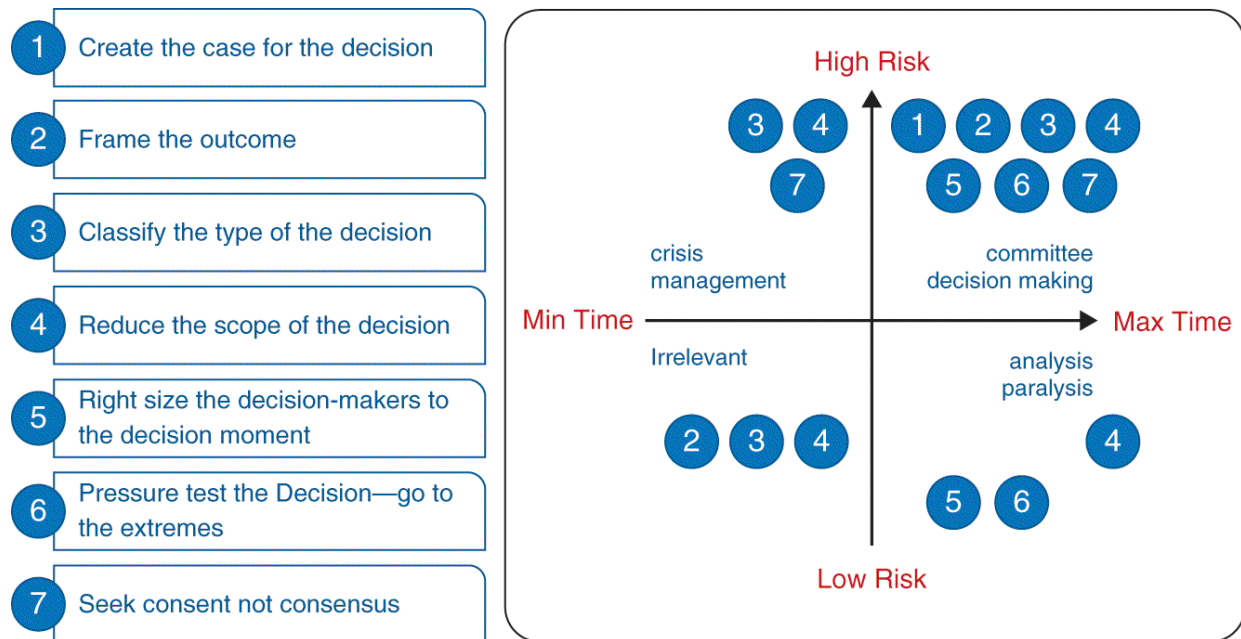
## **Applying This Step**

We are talking about a quick two-step process:

1. Evaluate the quality of the feedback. Is the input based on facts or is it an opinion or judgment?
2. Risk-assess the input. Assess if the fact-based input is a high, medium, or low risk to achieving the outcome.

# The Perfect Decision Is an Illusion

The perfect decision does not exist. There is an inherent desire to make the perfect decision. We incorrectly believe the path to certainty is the data, but people are not rational, hence this perpetuates the chase. Being a poor decision-maker will have a greater negative impact on your career than someone who can make decisions, learn, and course correct.



**FIGURE 9.5 Mapping the steps to the decision moment**

The seven-step approach that is outlined in this chapter has been designed to be inherently followed in order. To stop chasing the decision, you should apply the appropriate steps to the situation at hand (see [Figure 9.5](#)).

Being an agile decision-maker is essential to success. The speed of the decision is determined by both the decision-maker and the decision-requester. A good decision today is better than a perfect decision tomorrow.

## Key Learnings - Chapter 9

- Remember, Questions are king.
- Invest time framing the problem and defining success.
- Saying “yes” to one choice, means saying “no” to something else
- Recieving fast “no” is better than a slow “yes.”
- Realize no decision is a decision.

# Notes

1. Ospina Avendano, D. (2020). Available at: [www.toolshero.com/change-management/beckhard-harris-change-model](http://www.toolshero.com/change-management/beckhard-harris-change-model).
2. Beckhard, Richard, and Reuben T. Harris. *Organizational Transitions: Managing Complex Change*. Reading, MA: Addison-Wesley Publishing Company, 1987.
3. Available at: <http://pastatenaacp.org/wp-content/uploads/2017/03/Beckhard-Harris-Change-Model-DVF.pdf>.
4. Mdletye, Mbongeni, Jos Coetzee, and Wilfred Ukpere. "The Reality of Resistance to Change Behaviour at the Department of Correctional Services of South Africa." University of Johannesburg, *Mediterranean Journal of Social Sciences*. 5(3): 548. doi:10.5901/mjss.2014.v5n3p548.
5. Available at: <https://www.sec.gov/Archives/edgar/data/1018724/000119312516530910/d168744dex991.htm>.
6. Iyengar, Sheena. *The Art of Choosing*, Paperback, Twelve; Reprint Edition. March 9, 2011.
7. Available at: <https://circleforward.us/consent-is-a-third-option/>.



## CHAPTER 10

# Creating a Quantitative Intuition™ Culture

*At the end of the day you bet on people, not on strategies.*

— **Lawrence Bossidy**

Growing and building a team is one of the most essential leadership skills you can develop. As Walt Disney believed you can dream, create, design, and build the most wonderful place in the world but it requires people to make the dream a reality. Consider the great innovators and pioneers from Olive Ann Beech, Henry Ford, Katharine Graham, Steve Jobs, Bill Gates, Jeff Bezos, William Procter, Asa Candler, or Madam C.J. Walker. All were leaders who asserted a compelling vision that redefined or created new industries. In each case, they spent a considerable amount of time building teams to turn their vision into a reality.

Questions you may be asking yourself at this point, after equipping yourself with the Quantitative Intuition (QI)™ skills discussed in the previous chapters: How do I hire for QI? What are individual skills I should be looking for, and what is the ideal composition of the team?

Identifying top talent is the first hurdle. You then need to successfully recruit A-list talent and/or subject matter experts. To further complicate the process, this task is often done under time constraints as you need to quickly fill a position. Finally, you need to create an environment where this top talent is motivated to work as a collective yet feel valued and recognized for their contribution.

Essentially you are deciding whom you want to marry after a few dates and under an artificial environment. This makes hiring one of the hardest competencies to master, yet the most strategic because the impact on the business is significant when correctly done. A McKinsey study, “War for Talent,” quantified that superior talent is up to eight times more productive than lower quality talent, showing the relationship between quality of talent and business performance is dramatic.

In 2011, McKinsey & Company study asserted: “By 2018, the United States alone could face a shortage of 140,000 to 190,000 people with deep analytical skills.” This sense of urgency around the incoming shortage in analytics which began in 2010 has created a big push in the United States and the rest of the developed world's education system to focus on science, technology, engineering, and math (STEM). This has led to curriculum changes in high school and college education systems, and the opening of a host of data science and analytics graduate programs in many academic institutions. This, in turn, has created a flood of people with strong analytics backgrounds entering the workforce. If in the past people with these skills were primarily hired in the tech industry; we are now seeing more traditional industries like consumer packaged goods, and B2B (business-to-business) organizations hiring data scientists and data engineers. Indeed, a decade after the 2011 McKinsey report, the World Economic Forum

(WEF) in *The Future of Jobs Report* surveyed executives from more than 350 employers across nine industries in 15 of the world's largest economies and found the No. 1 position increasing in demand will be Data Analysts and Scientists, followed by AI, Machine Learning Specialists, and Big Data Specialists. The U.S. Bureau of Labor Statistics predicts that the data science field will grow 28% through 2026.

However, if across industries from tech to finance to education and consumer package goods firms are increasingly hiring data analysts and data scientists with deep analytical skills, what about the leadership in these firms? These leaders would make decisions leveraging the data and analytics produced by these new analytics hires. Indeed, the same 2011 McKinsey & Company study stated that by 2018 we would have a shortage of “1.5 million managers and analysts with the know-how to use the analysis of Big Data to make effective decisions.” Thus, the shortage of managers to make decisions with analytics versus data scientists was predicted to be 10:1. This gap is exactly where QI plays an important role in filling this leadership gap by combining business acumen and intuition with data to make smarter and more confident decisions.



# Recruiting for the Quantitative Intuition™ Skill Set

At the start of the book, we argued that you don't need to be a math whiz to make decisions with data or become a QI decision maker. However, this does not mean that there aren't important skills needed to become a QI team leader.

The typical tools—writing a job description, rounds of interviews, a series of discussions, candidate-supplied references, and inconsistent questions across a range of interviewers—are necessary but not sufficient. You should consider adding alternate methods of interacting with candidates to uncover their intrinsic strengths, preferred ways of working, and whether they can think like QI decision maker. These alternative methods include exercises or nonstandard questions. Why? Leaders must bring answers that don't fit a formula. Reactivity, insight, and ingenuity are the needed attributes. Can you drive rapid growth and deal with ambiguity? Can you respond effectively to crisis situations? Agile decision-making requires you to be a growth champion, truth teller, customer stewards, and insight creators. The person who can conceptualize the problem, define the situation, and ask smarter questions will outperform those relying on textbook answers. We can define these necessary skills using the three pillars of QI (see Prologue [Figure P.1](#)).

**Precision questioning skills:** This set of skills involves asking smart and precise questions. As discussed in [Chapter 1](#), questions can be extremely powerful. A good QI leader is inquisitive and makes sure to understand the essential question before diving into the data or analytics. In hiring interviews, many interviewers focus on asking questions, testing the interviewee on their ability to excel in answering these questions. We encourage hiring managers to consider reversing this process and examine candidates' ability to ask good questions and quickly focus on the essential question. For example, the interviewer can pose to the candidate a real-world situation and rather than ask them to analyze the situation or offer a solution, ask them what questions they would ask to help them better understand the situation.

**Contextual analysis skills:** These skills involve becoming a fierce interrogator of data. As discussed in [Chapter 4](#), the focus in becoming a fierce interrogator of data is not to assess whether this or the other analysis tool was used to analyze the data or whether the right statistical procedure was used. These are important and common skills that people learn in statistics or data science courses and are often needed for data science and analyst roles. The focus here is on data contextualization. Ask: How does the data fit in the context of the company or the environment? What surprised you in that analysis? Or conduct a set of Fermi approximations (see [Chapter 5](#)). These are often included in management consulting type job interviews. These skills are at the heart of contextualizing data. To test for this skill, an interviewer could, for example, confront a candidate with a scenario involving some numerical figures and ask the candidate how they would assess if the number is in the right ballpark. The market sizing analysis for

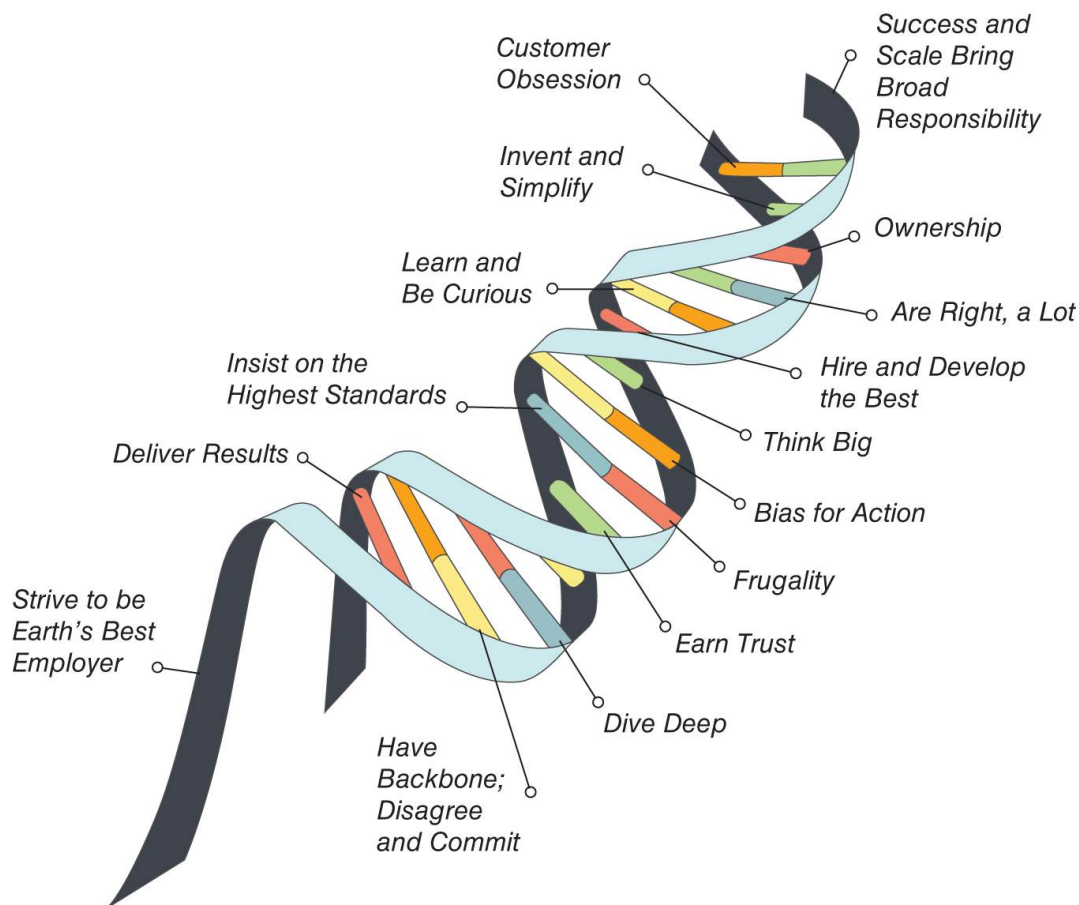
a farm-stay in Guatemala that is discussed in [Chapter 5](#) is a good example of such a scenario.

**Synthesizing skills:** This set of skills is extremely important and tends to be missing, particularly among junior employees. It is the ability to connect the dots and synthesize the information rather than merely summarizing the information and verbally reporting back the information presented in a table or a figure. This skill requires pouring judgment into the analysis of data. Unfortunately, this skill is rarely taught in any data analysis course. In an interview, the interviewer could present a table that describes a situation (e.g., [Table 6.1](#) in [Chapter 6](#)) and ask the candidate what conclusions they would draw from the scenario. The key here is to examine whether the candidate gets stuck in a simple summary of “what?” is in the table, or do they take the extra step to also pour some judgment synthesize the information and discuss the “so what?” and “now what?” implications of the numbers. This pillar also involves delivery and storytelling skills that are discussed in [Chapter 8](#). These skills are often easier to assess when asking candidates open-ended questions during an interview. In listening to the candidate's response, interviewers should pay attention to communication skills, the use of story arcs, symbols, emotions, and understanding of the audience (often the interviewer) and what they are looking for.

Depending on their background and education, a person may be stronger in quantitative skills and weaker in intuition, or the other way around. Accordingly, different pillars and different skills of each pillar need to be emphasized. In our years of teaching QI to thousands of executives, we have seen decision-makers seeking to acquire different QI skills. These tend to come from almost every industry and rank within the organization. For example, engineers or data scientists attending our QI workshops tend to have strong quantitative skills and focus on strengthening their intuition skills. These participants often ask: How do we make sure that we clarify and focus on the essential question before diving into the analysis? How do we work with top leadership to make sure they help us clarify the essential question? How do we interrogate data not from a statistical perspective, but a business perspective to make sure we deliver sound analysis. These quantitatively apt decision-makers often struggle with how to deliver the information in an actionable manner so that top leadership can understand and act on the information.

Other participants often come with a strong sense of business intuition and seek to understand how to use data to make better decisions. These participants often dread the analytical aspects of data-driven decision-making. The realization that the skills needed to become a QI decision-maker rarely involve analytical skills per se is a big relief. This type of decision-makers benefit from learning how to leverage their strong business knowledge and intuition to put the data in the context of the business and make sure that the data is useful for their decision-making. They also learn the importance of maintaining close collaboration with the analytics team, particularly at the step of problem definition and the synthesis of the information to make sure the analysis is actionable.

One exercise to use during the hiring process is to ask the candidate to build a business. If money were not any object, what business would you start? What is the first role you would hire for? How would you structure their team? How would you define success? How would you ensure customer satisfaction? How would you approach building their product? The type of business is not relevant. Again, you are looking to identify the candidate's strengths. Their answers will start to reveal where they naturally gravitate. Do they focus on operations or marketing? Do they want to lead a large or small team?

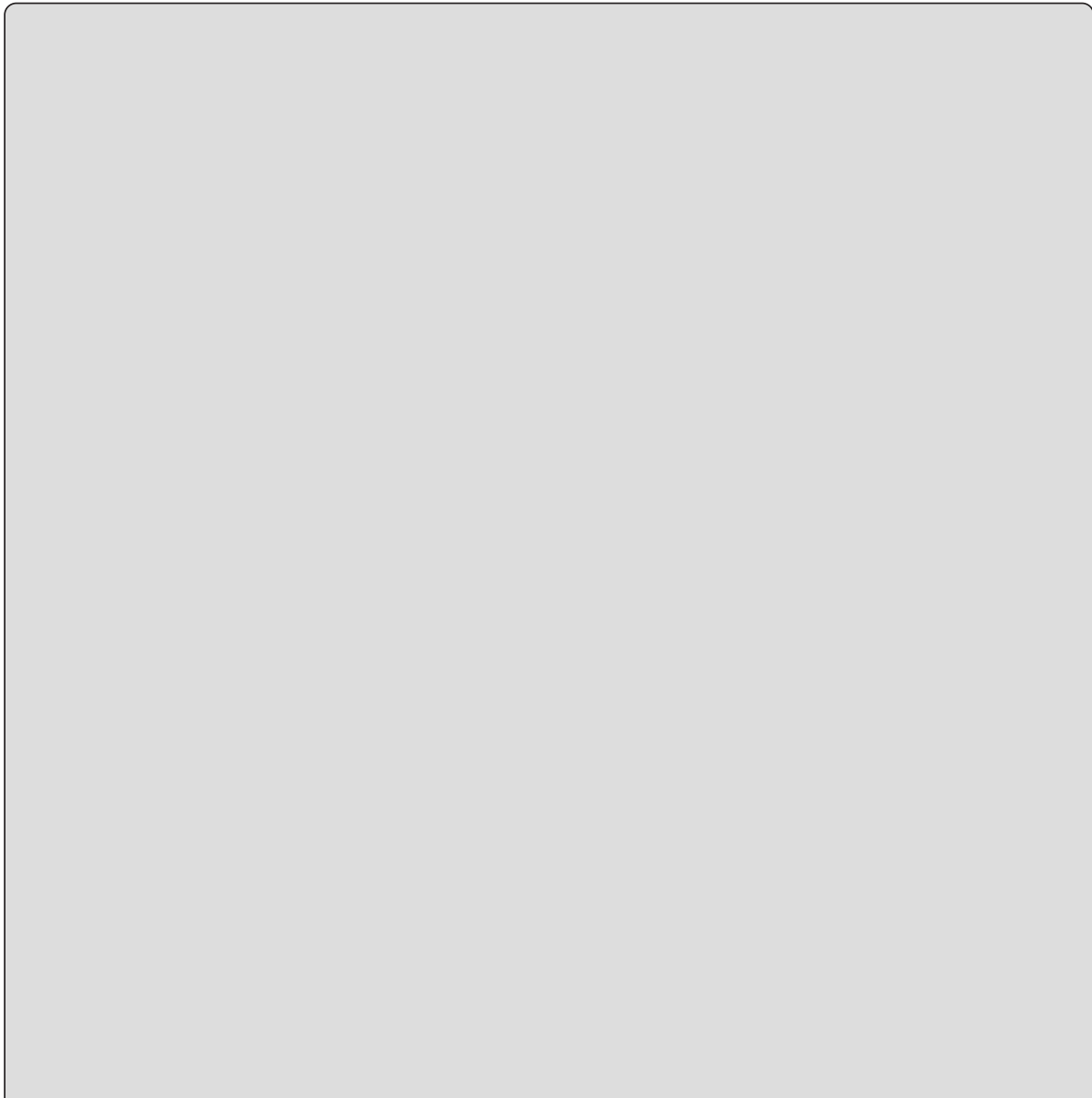


**FIGURE 10.1 Amazon's Leadership Principles**

It bears repeating that the challenge in today's world is not the lack of information but the judgment to use it. The hiring exercises you conduct (see [Figure 10.2](#) in “The 5-Dot Interviewing Exercise” call-out box) should be designed to show to what degree candidates demonstrate judgment. Using such exercises, a candidate who shows judgment will distinguish themselves from other candidates. We operate in a culture that worships numbers, and rightly so because facts and figures hold weight. We have become a world of data hounds. Independent of the business size—small or large, well-funded start-up or garage-based—all businesses have one recurring theme: Everyone suffers from information overload. We have seen innovations missed, opportunities passed by, and customers lost because people do not know how to discover the relevant

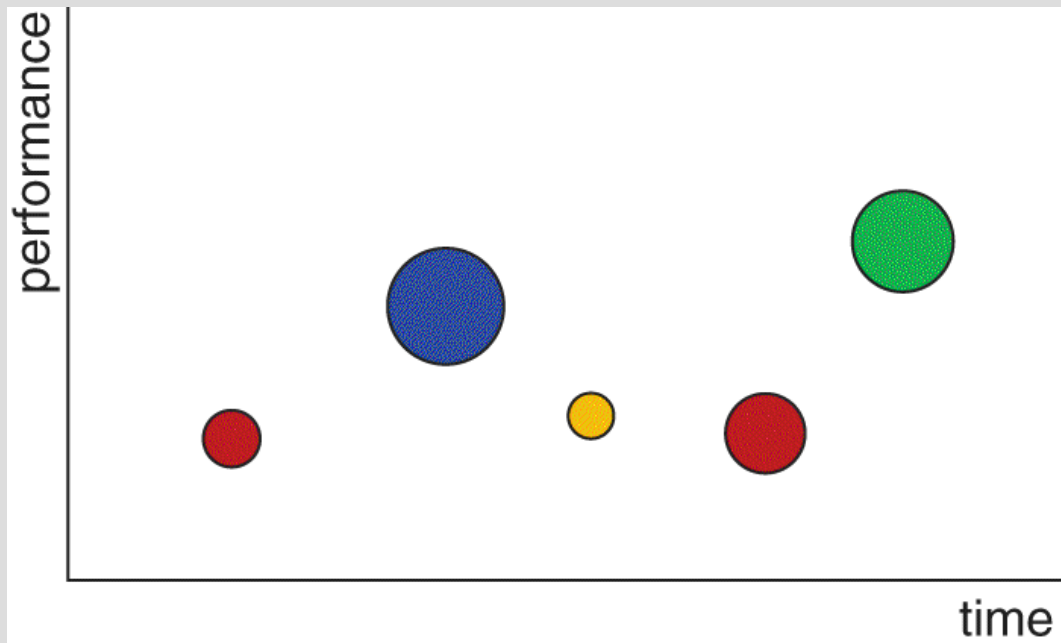
facts, develop insights, and deliver them with impact. A select few understand the power of data, know the questions to ask, connect it to their larger business strategy, and use it to engage customers and achieve revenue objectives. Successful leaders build a team of talented colleagues who bring judgment, critical thinking, and creativity.

In many instances, building a set of QI skills is not about building individual skills, but creating the right mindset or new ways of working. Amazon is a great example of this. Jeff Bezos did this repeatedly by defining 16 leadership principles (see [Figure 10.1](#)) such as “learn and be curious” and “insist on the highest standards.” Embed the “Day 1” philosophy. At Amazon, “Day 1 is both a culture and an operating model that puts the customer at the center of everything Amazon does...Day 1 is about being constantly curious, nimble, and experimental.”



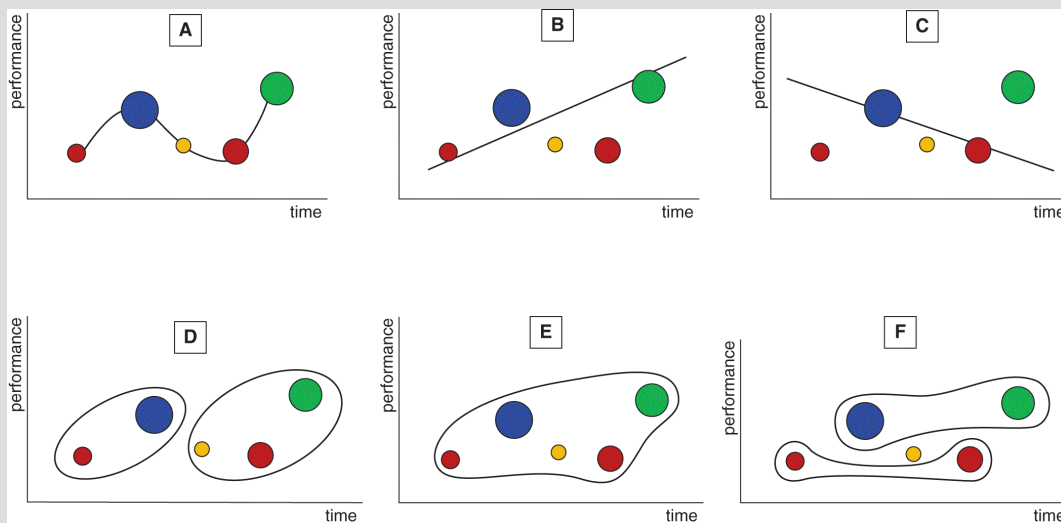
## THE 5-DOT INTERVIEWING EXERCISE

The following is one exercise we use (see [Figure 10.2](#)), which asks the candidate to graphically relate the dots.



**FIGURE 10.2** QI hiring exercise

There is typically a wide range of answers (see [Figure 10.3](#)). Some demonstrate a rational, logical connection with a single line (A). A second group draws a straight line to indicate an average (B and C), while a third cohort demonstrates creativity by grouping the dots to graphically relate them (D, E, F).



**FIGURE 10.3** QI hiring exercise: Possible solutions

There is no correct answer. In reality, we are not looking for a line of best fit or how quickly someone can draw a line. It is not a speed test. It is not a logic test. It is not a spatial reasoning assessment to see if the candidate can manipulate objects in three dimensions. We are looking for how the individual approaches a task with this exercise. Do they jump right in or do they pause to ask a question? Do they “interrogate” the data?

The five circles are data points that lack numbers; they represent information that they should look to understand before working with the data. Do the different sizes indicate something? Are the shades of the circles relevant? Are the scales consistent on the  $x$ - and  $y$ -axis? What matters more “performance” or “time”? We have repeated this exercise in the classroom with experienced professionals and a similar pattern emerges. People have a bias for action. This is analogous to behaviors we see when people are given a data set. They dive into the data without framing the issue, fail to put the data in context, or pause to understand the desired outcome.

## Building a Quantitative Intuition™ Team

While almost every organization and any position within the organization can benefit from learning QI skills, not all of the skills can exist within a single person. Effective leaders in fast-growth companies realize the ability to tackle problems for optimal results occurs by having the right team. What is the “right team”? The “right team” can see a situation as a whole, without constraint, while mitigating bias leading to creative solutions that are embraced. These solutions may be simple, bold, or provocative, but they result in sustained impact that effectively addresses the original problem. Most importantly they causes people to take action ranging from reassessing their thinking to adopting the recommendation.

As you understand by now, QI skills are a blend of data intelligence and human judgment. From our research these are found in four roles—data scientist, data engineer, data translator, and data artist—that form the cornerstone of the QI team. This QI team is composed of a mix of backgrounds, experiences, expertise, and tenure that works as a unit to achieve the desired outcome. Easier said than done. Successful leaders navigate these hurdles while rallying the troops to create a culture where this mix of talent thrives, making this a rare and valuable skill. This should be our starting point as we consider how to hire for QI skills.

**Data Scientists:** Data scientists are equivalent to architects. They develop the blueprint that serves as the scaffolding to build insights. Hal Varian, the chief economist at Google called the role of a data scientist “The Sexiest Job of the 21st Century.”<sup>1</sup> These individuals can coax treasure out of messy, unstructured data. They are deeply knowledgeable in tools and techniques such as conjoint analysis, TURF (Total Unduplicated Reach and Frequency) analysis, text analysis regression, neural networks, predictive machine learning tools, and cohort analysis, to name just a few. By applying these tools data scientists help organize structured and unstructured data into slices to show a clearer picture of the information.

It is important to note these blueprints may be developed at the start of a project to guide how to capture the information or at the back end once you have a data cube. The determinant on when and where a data scientist engages deepens on the complexity of the question. Straightforward questions that are simple to answer, requiring limited inputs, do not require the robustness of a blueprint to answer. For more complex problems, data scientists play a vital role in analyzing a data cube by tapping into specific skills in data modeling, relational databases, and statistics as they approach problems systematically and methodically. As artificial intelligence and machine learning become ubiquitous in business processes, the demand for data scientists will increase as they are at the intersection of methods, algorithms, and techniques to build models to generate insights. With a mix of math, statistics, and computer science skills, they bring the technical knowledge to answer complex questions.



**Data Engineers:** Data engineers put the pipes in place to enable the data to flow. Using an analogy of building a house data engineers would be equivalent to plumbers or electricians. The **first step** for data engineers is to ingest the data. They bring the essential skills to connect the data from disparate sources such as websites, mobile phones, cloud-based systems, surveys, GPS, or transactional data. Given the variety, velocity, volume, and veracity of the inputs, the **second step** for data engineers is to harmonize the data by designing rules to create a schema to combine data from different sources. These rules define how to name, convert, process, and merge the data to provide a consistent view of the data. This is a complex process requiring judgment, technology, and business knowledge. Since this data can come from anywhere, it must be stored in a single location to make it usable. There is often an erroneous belief that the value of Big Data comes from how long the data set is, from how many observations we have, or from whether we observe hundreds of thousands of customers or millions of transactions. But the real value of Big Data comes from connected data, from many variables observed on every single data unit. From the width rather than the length of data. Harmonized data provides organizations with a 360° view of their business. Connecting attitudinal, sales, operational, financial, and marketing data into a single view improves agility, quality, and speed of decision-making. The **third step** is to house the data in a data cube so the aggregated data has a place to live. A data cube, at its core, is a database of rows and columns. The simplest form is an Excel spreadsheet but can go up too much more complex relational databases that categorize, group, and map the relationships among the data. An important role of data engineers is to ensure data interoperability. Making sure that data can be moved from one system to another is connected across systems and over time as systems are being upgraded or even replaced altogether. Probably the most common cause for the loss of historical data is the change of the data input or storage systems. Data engineers enable data scientists and data translators to do their jobs. Data scientists cannot build models without the data cube and data translators would not be able to translate the raw data into insights.

**Data Translators (mix of data and intuition skills):** Data translators answer specific business questions. They bring both the quantitative and intuition skills. The most effective translators approach their roles as a translator between the business stakeholders, data scientists, data engineers, and data artists. They bridge the language of business and data to enable data-driven decisions. Data translators frame the problem by asking questions, fiercely interrogate the data, put the data in the context of the problem, and synthesize the information leading to an effective decision. Inherent in the data translator's role is the need to be grounded in the business priorities with a laser focus on driving outcomes. Data analysis is a means to an end. The successful data translator looks at the problem as a whole and uses a range of analytic tools to influence the business strategy. Data translators have an innate curiosity and constantly ask: “Why?” or “So what?” The “so what?” (see [Chapter 6](#) for a detailed



discussion) is a discussion about what the data really means by putting it in the business context. They wallow in the data to test, measure, learn, and iterate.

Successful data translators have an analytical mindset. This is very different from learning analytic tools and methods. An analytical mindset is a skill that almost every leader seeks, and many are missing. Being good in analytics or math doesn't necessarily give you the analytical mindset. We have seen plenty of very smart quant Ph.D.'s who have deep analytical skills but do not have an analytical mindset. Thinking analytically includes being clear about the purpose of the essential question rather than wondering in the forest of data; being inquisitive about the data and analytics, not from a statistical perspective but from a face validity perspective; and being able to connect the dots via synthesis, and eventually being able to tell an informed story that is based on fact rather than just opinions, or merely restating the facts. Often the greatest value consultants and the best data translators bring to companies is thinking analytically and structurally. Data translators often embody within a single person most of the skills discussed earlier as necessary for a QI leader, which makes them one of the most critical roles in the QI team and, at the same time, hard to find.

**Data Artists (intuition skills):** Data artists create graphs, charts, infographics, and other visualizations so people can quickly understand complex data. Data artists have many of the delivery skills that are discussed in [Chapter 8](#). Great visualizations expand the dialogue by bringing more people into the conversation. The outcome is faster and better decisions. One myth about data visualization is that you must be extraordinarily creative to truly master it. We fundamentally disagree with that assertion. When people hear about data artists and minimize the time allocated for data visualization, it is due to a profound lack of understanding of this discipline or a skill gap. Often when people hear about data visualization, they may think it is about arts and crafts. This could not be further from the truth. There is an insightful quote by Ron Crossland in *Voice Lessons: Applying Science to the Art of Leadership Communication*: “Facts alone seldom persuade and rarely inspire.” Content matters. Full stop. Visualization will enable you to inspire people to act on your content and recommendation. Visualization serves other purposes too. Because of the way our brains are wired, humans tend to remember the average rather than the sum of what they're told. Data visualization allows us to prominently highlight important summaries of the data and cut through the noise.

At the highest level of mastery, the data artist's role combines the expertise of a data scientist with the skills of a graphic designer. However, like any skill, there is a range of proficiencies with data visualization. By consistently applying a set of core principles you will immediately uplevel your presentation. These foundational principles include: (1) Embrace white space, (2) One thought per page, (3) Large font, (4) Limit color usage, and (5) Synthesize don't summarize. A rich resource is the chart chooser available at Extreme Presentation™ Method. If you are looking for inspiration, a current day pioneer in data artistry is David McCandless, who turns complex data sets into simple visualizations to uncover

unseen connections and patterns. Remember your goal is to persuade not present.

While we have discussed these roles as four distinct ones (see [Table 10.1](#)), there is an overlap in skills, approach, training, and experience. You can major in one of the roles, minor in a second, and take “electives” in the other. For example, you do not need to be a graphic designer to do great data visualization. The successful professional will have a blend of these skills.

You can help your team build QI skills to “force” a conversation. Do this during a low-risk scenario, for example, when you are in a one-on-one meeting or doing a dry run of a presentation. The intent is to create a safe space for learning. Request that the presenter keeps the presentation closed. Ask them to discuss the results. Inquire about outliers or any findings that could not be explained. Watch how much richer the conversation becomes after the initial shock wears off by removing the crutch known as slides. Did they demonstrate mastery of the information? Do they offer a point of view on the problem? Can they talk about the implications relative to the business challenge? If they can't, that is okay. You are identifying areas of development. As you repeat this exercise with your team, team members will be increasingly prepared. They will develop confidence over time. This will set them on the path to driving action from their analysis.

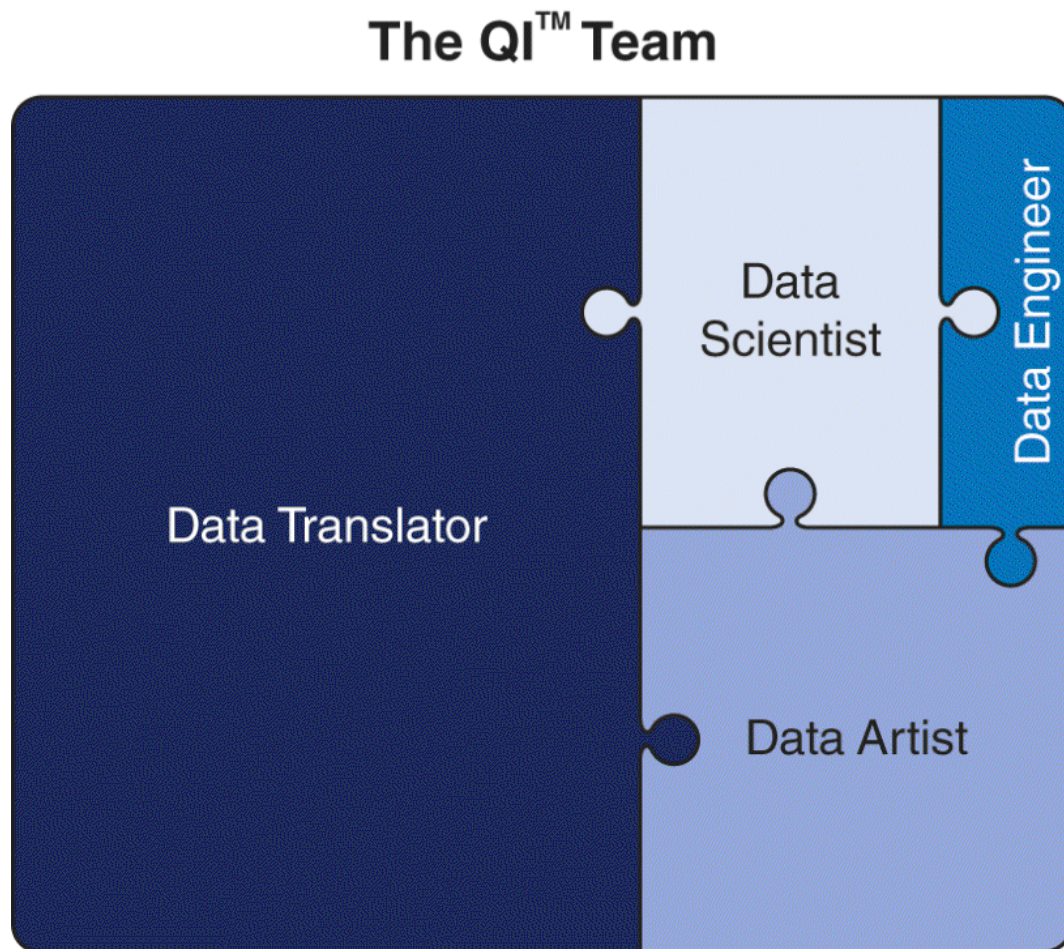
**TABLE 10.1** QI roles and skills

	<b>Data Scientist</b>	<b>Data Engineer</b>	<b>Data Translator</b>	<b>Data Artist</b>
<b>Role</b>	Architect	Infrastructure	Connector	Visualization
<b>Tools</b>	Advanced analytic techniques, e.g., conjoint analysis, TURF, text analysis, regression, machine learning neural networks, factor analysis	SQL, AWS, Spark, Hadoop	Microsoft Excel, Python, Tableau	Presentation software, e.g., Microsoft PowerPoint, Google Slides, Adobe, Tableau
<b>Skills</b>	Statistics, math, communication	Programming	Quantitative, synthesis, business, communications, programming	Data analyst to scientist; Graphic design
<b>Approach</b>	Systematic, methodical	Detail-oriented; operations and quality	Focused but parallel; works across units	Broad
<b>Output</b>	Blueprint or model to analyze data	Build the pipes/infrastructure to deliver the data	Answer specific business questions	Engage and persuade. Compel people to act.

Now that you understand the essential skills and how they manifest themselves in the four roles, it is important to discuss the composition of the team. While the four roles are critical, they are not needed in equal parts (see [Figure 10.4](#)). There is no precise ratio as it varies based on your size of business, amount of information, and industry. Conceptually from largest to smallest, you need data translators to interpret the data, data artists to help engage and persuade, data scientists to build models, and data engineers to ensure the data continues to flow.

## Cultivating a Quantitative Intuition™ Organization

As you grow your QI team, it's best to understand the relation between your approach to QI and the readiness of your organization to make decisions under uncertainty. This can be mapped into the beginning of a maturity model for yourself and your team.



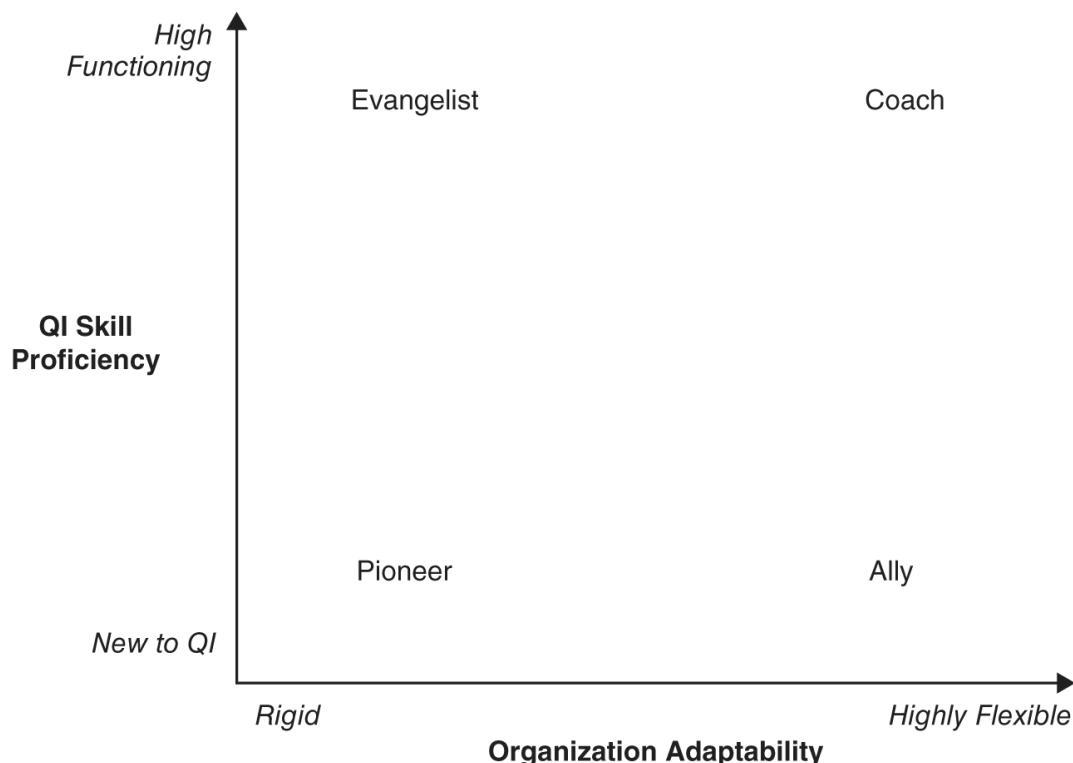
**FIGURE 10.4** Structuring the QI team (sample ratio)

As with any data, put your QI skills in perspective. Are you new to working under uncertainty and applying both quantitative and intuitive lenses? Have you previously bridged deep analytics and human insight into a solid decision process? Or are you “high functioning” with QI bridging information and intuition, while bringing your organization along to do so as well?

Turning to your organization, consider the culture and the organizational maturity. Is the organization highly flexible, cautious but open to evolve, or significantly rigid and slow to navigate uncertainty?

Mapping that to a simple matrix (see [Figure 10.5](#)) could look like the following:

As a QI champion, you will see yourself in the top row, but what about your organization? We find 100-year-old companies that are highly flexible and startups that are rigid, so the labels can be deceiving and require an honest assessment of an organization's true culture and direction. Once your organization's appetite for change is understood, you may determine if you are collaborating with like-minded decision-makers or if you are an evangelist moving a rigid organization forward. It will be valuable to understand your role in an evolving organization to absorb and eventually adopt better decision-making under uncertainty.



**FIGURE 10.5** Your role in QI adoption within the organization

We live in a time when information is exploding and often feels invasive or intimidating. In reality, we are fortunate to have this staggering amount of information. The right team with the core skills will be the pioneers in transforming business and provide foresight on key areas for growth. At the end of the day, a select few understand the power of data, know the questions to ask, connect it to their larger business strategy, and use it to engage customers and achieve revenue objectives. By embracing the four roles, organizations will make faster, more productive decisions.



## Key Learnings - Chapter 10

- The current gap in the workforce is less about people with deep analytical skills, and more about leaders who can lead them and make better decisions with analytics.
- In hiring individuals, look for the QI skills along QI's three pillars: precision questioning, contextualizing data, and synthesizing.
- In interviews, focus on people's ability to move from the “what?” to the “so what?” and “now what?”.
- Build a team composed of the four roles: data scientists, data engineers, data translators, and data artists.
- Invest time and energy in visualization. Hire data artists.
- Data translators should make up the majority of your team.

## Note

1. Davenport, T. H., and Patil, D. J. “Data Scientist.” *Harvard Business Review*, 2012, 90(5): 70–76.





## CHAPTER 11

# The Future of Data-Driven Decision-Making

*Never let the future disturb you. You will meet it, if you have to, with the same weapons of reason which today arm you against the present.*

— **Marcus Aurelius**

Staying ahead in the increasingly complex domain of data-driven decision-making requires leaders to make nimble and informed decisions at an ever-increasing rate. At the beginning of the Big Data era, the discussion centered on the “3Vs” of volume, velocity, and variety. Two additional “Vs”—volatility (i.e., is the data consistently available) and verity or truth (i.e., data integrity)—have been added. Leaders with data literacy are now expected to absorb, consider, and pass judgment on a massive flow of signals broadly described by the 5Vs that are simply too much for a single mind to interpret in real time.

Fortunately, as discussed in the previous chapters, decision-making is a team sport and an increasing array of tools and techniques coming from industry leaders and academia will aid decision-making over the next decade. As the speed of computation increases and the sophistication of artificial intelligence (AI) methods advances, new extensions to decision capabilities will help business leaders address the increasing complexity of the decision-making environment. Automation tools are being developed to replace repetitive decision-making such as interpretation of medical imaging, stock trading, or pricing decisions, and serve as decision-support tools to complement human decision-making in a hybrid automation manner. Advances in computing power and speed of calculations permit more advanced predictive analytics and simulation methods like the Digital Twin models. These trends require adjustments in leaders’ approach to data to accept not only human probabilistic or uncertain thinking, but also the probabilistic nature of machine predictions and uncertainty. The resulting decision-making environment could be even deeper adoption of quantitative techniques that will replace many of the traditional quantitative tasks like data collection and

analysis by machine, but increase even further the proportion of human engagement needed to balance the deeper analytics with intuition and business acumen. Ironically with more data and automation the role of I and QI may take the lead.

# Automation and Human Judgement

Automation has changed the labor market by substituting predictable and repetitive human tasks in the past century. Possibly the earliest application of automation was the mass production of Olds-mobile cars using an assembly line in Olds Motor Vehicle Company factory in 1901. This was improved on and scaled when Henry Ford launched his assembly line in 1913. Next in line for automation were the processing of data and analysis. Recent advances in computational methods and AI have enabled the automation of nonroutine tasks that involve judgment, creativity, synthesis, and social intelligence.<sup>1</sup>

Whereas leadership and business decision-making are probably the last task to be fully automated, the decision moment is often preceded and followed by a pattern of relatively consistent and repetitive activities. Once defined, these repeatable patterns can be codified into a workflow that includes a combination of human engagement and automated tasks. One of the biggest benefits of automating repetitive tasks is reliability and efficiency. Given the same input machine, unlike humans, produce the same results every time.

With defined parameters and workflows, we can turn to computer automation to meet the 5Vs challenges and accelerate the decision-making process. The value of automation is realized when it is not only applied to the software routines and computing calculations, but rather to the entire end-to-end business process. In a certain task that is likely to be completely repetitive, automation can complete the entire task; in other tasks that require more judgment and synthesis, a hybrid solution or a decision support system that provides recommendations, the decision-maker is likely to be the preferred mode of automation.

As Gartner defines it, *Business Process Automation* (BPA) goes beyond conventional data manipulation and record-keeping activities to focus on “run the business” as opposed to “count the business” types of automation efforts. This type of automation often deals with event-driven, mission-critical, core processes.

In any application of automation, the business leader needs to determine which of their business objectives and key performance indicators (KPIs) can be decomposed into repetitive tasks that can be automated versus processes that require human decision-making. Claims processing, accounts receivable, purchase order processing, customer service desk interaction, and many human resources (HR) functions such as payroll adjustments can see value from this form of system acceleration. It's important to recognize that decision-making is not abdicated, but rather delegated under supervised criteria.

Take, for example, a call center. The business leader with a quantitative view will look for a reduction in call times by applying automation to customer service desk interaction. While often unappealing, the user sees value in an efficient interaction (i.e., “Press 1 to confirm your balance and process a payment through your registered payment method”). However, there is more value to be had. Automating most inbound calls (i.e., the Pareto Principle that 80% of the calls will take 20% of the effort) will free up staff time to address the truly unique remaining inbound calls. This will also mean that the call center agents will need to have higher expertise in the business domain as they will be handling more complex calls. The shift to a more interactive and complex engagement has driven the category name change from call center to contact center, reflecting the deeper engagement with end customers.

Additionally, dealing with varying and more advanced issues rather than mundane tasks may help with employee satisfaction and retention. Indeed, when a major U.S. health insurance company added an online self-service channel, the number of calls to its call center increased rather than decreased, but the nature of the call changed. The online channel exposed customers to a vast amount of information about its health policy, claims, and coverage, leading consumers to ask more sophisticated questions about the health insurance terms.<sup>2</sup>

Similarly, Economist David Autor discusses the effect of the introduction of automated teller machines (ATMs) on the banking industry.<sup>3</sup> Given that ATMs replaced bank tellers, one would have expected that after the introduction of ATMs, the number of bank

branches and bank tellers would decrease. However, the opposite effect happened. With ATMs in place, banks were able to expand their business, focusing on more complex and more profitable businesses like credit cards and mortgages, opening more bank branches, and hiring more tellers. In this new world, tellers deal with more complex customer interactions making them more rather than less valuable. In the post-automation era, the tellers use more judgment and intuition, and are responsible for more business decisions.

Finally, claims processing for healthcare payors or auto insurance providers has begun to shift away from labor-intensive workflows with bureaucratic delays for unnecessary review cycles. Modern automation efficiently processes a claim in minutes rather than weeks, focusing on the experience of the end patient or customer. Processes and deeper quantitative analysis can simultaneously be used to catch hidden patterns to guard against fraud. The savvy business leader understands that the majority of claims are routine, fit within clear guidelines and the claim execution can be expedited. This again allows for a labor shift to the complex business challenges of unique claims where deeper human judgment is needed.

As with any tool or method, automation should be applied thoughtfully. Automating the wrong process or already inefficient processes compounds the misconception that runaway technology doing more damage than good is inevitable. With this understanding, business leaders can apply their resources more efficiently to maximize their information technology investment return and optimize the activities of their talent pool. Sadly, we often see the brightest minds still doing routine tasks that can be automated. This is a waste of resources and restricts an organization from tapping the potential of their most valuable asset—their people who can apply judgment, use their business acumen and instincts to correlate across data and intuition to address what is unexpected and requires new interpretation.

Much like our QI framework that combines data and analysis with human judgment, the best practices of automation lead to a hybrid automation approach. In a hybrid automation approach mundane tasks are automated, but more complex or nuanced tasks are left to

the human experts. In fact, in the future, automation will replace human decision-making for more repeated tasks like where to route a call and decide when to automate the task and when to send the task to a human. Take a case study of automation of one of the most relationship-based judgment professions—the salesperson. Salespeople are known for their ability to create long-lasting relationships with clients and benefit from the important skills of salesmanship. Oded, together with a colleague, Professor Yael Karlinsky-Shichor, have worked with a mid-sized U.S.-based metal retailer to automate their salesforce pricing decisions.<sup>4</sup> They have created a model that uses each salesperson's past pricing decisions to predict the pricing of future quotes requests from customers. They then ran a field experiment in which, for randomly selected price quotes, salespeople saw the model created price, which is based on their past pricing decisions, before they priced the quote. They found that showing salespeople a “robot version” of themselves helped them make more consistent decisions and increased profitability. Informing salespeople about how an automated version of themselves would have priced the quote helped salespeople avoid biases like overreacting to whether the previous price quote they priced was accepted or rejected. It could also indicate their current level of fatigue or attention as pricing deviated from the best model. However, there were certainly cases where the salesperson had valuable information that the model did not know, such as the customer's level of urgency or their price sensitivity for the particular quote. In such cases, following human intuition and judgment rather than the model pricing would be beneficial. The researchers found that the optimal automation strategy would be to design a hybrid automation system where some quote requests are handled by the automated model and others by the salespeople. Specifically, they found that the more complex quote requests or those coming from new clients that require human judgment should be allocated to salespeople and more typical quote requests can be handled by the automated model. In fact, they proposed a two-level automation system. First, the model predicts whether it can do a better job than the human in pricing the specific quote. If it predicts that it can, the model prices the quote, if it predicts that the quote would benefit from human judgment, it sends it to an experienced salesperson.

Thus, one could think about automation as not only making a discrete decision, but also recommending the allocation of tasks to humans, when such tasks could benefit from human judgment.

An additional benefit of the salesforce automation study was that automation helped to keep institutional knowledge and salespeople's intuition in the system. Salespeople's reaction to the automation system was that it is useful to have a model that “replicates” them when they are out of the office and someone else is taking their client's calls. Such an automation system may allow employees to keep their knowledge and judgment in the firm when they are forced to stay at home due to illness or a maternity/paternity leave and allow them to take such needed time off more peacefully. It would also permit easier transition when employees leave the company and others take over their tasks by keeping the experts' judgment and intuition in the system while training the new recruits.

Ironically, the advance in quantitative methods, which will lead to greater automation of tasks, may allow leaders to focus less on quantitative tools as many of the more quantitative tasks like data collection and data analysis will be automated. This will allow leaders to focus on the most important and challenging tasks that require more synthesis, judgment, acumen, intuition, and decision-making and less with traditional quantitative skills. In other words, we expect that automation will lead to a decrease in the role of *Q* and an increase in the role of *I* in the QI leader.

# Predictions and the Digital Twin

All levels across an organization from senior leaders to operational staff have interest in getting value from automation, but there remain conflicting views on the true value of automation. According to IDC, “Most organizations are focused on automation within the organization, which does lead to productivity gains. But to unlock business agility and flexibility, businesses must think about automation beyond their own four walls and across industry ecosystems.”<sup>5</sup>

The reluctance for deeper use of automation remains until the realization that the business leader can define the areas where human intervention is required. Automated systems can speed up the processing of information and still have the human in the workflow to make the most critical choices. With the enhanced speed of automated systems, a business can be structured to quickly calculate alternatives in real time and offer choices to the decision-maker.

In the past, the value of examining alternatives could be seen in a sensitivity analysis given the relationships between inputs and outputs in a system or model were understood. While valuable to a decision-maker, any such sensitivity analysis of automated processes was relatively static. Simulations, agent-based models, and the Digital Twin allow now for dynamics sensitivity analyses that permit the calculations of what-if scenarios. These simulations generate a real-time, event-driven model of a full process or even the entire business. The Digital Twin is a detailed virtual model of a physical entity (e.g., a motor or manufacturing line) or an entire business process (e.g., a supply chain) to run simulations, understand performance issues and generate recommended improvements. This allows decision makers to pressure test their decision as discussed in [Chapter 7](#).

The heritage of Digital Twin systems goes back to NASA crafting replicas (“an Analog Twin”) on earth of each vehicle in space. In the 1960s, even without deep computing capability, the Analog Twin on earth allowed for simulation and examination of alternatives to be recommended by the Flight Director to mission astronauts.



Similarly, business leaders today will see value in insights from complex, real-time views and subsequent modeling of their business—not just during a pandemic, natural disasters, or military conflicts. The business leader will want to weigh alternatives by balancing real-time data, analytic insight, and their intuition to shift plans in real time so that manufacturing lines keep running and shelves are stocked for their customers. With the adoption of a Digital Twin for critical processes, the business leader can more readily operate in real time and navigate the 5Vs with increased confidence to determine alternatives as live events unfold.

Consider any retailer with tight scheduling windows and even tighter profit margins. Every opportunity to optimize their supply chain will improve their profit. The creation of a Digital Twin to model the supply chain provides visibility into the detailed interaction of assets. Adding the two-way flow of information synchronizing internal systems such as the manufacturing line and shipping information correlated with external systems like real-time traffic, weather, and regional alerts will establish a real-time view of how your supply chain is affected minute by minute. The business leader can then see delays in one part of the system (main transportation paths are suddenly unavailable) driven by external factors (storms have blocked the roads and airports) and use predictive modeling to recommend alternatives (pivot the goods in transit to an optimized set of new locations and shift to a secondary supplier in a different region for the next two weeks). Rather than guesswork, leaders can balance data-driven insight and their instincts about their business to make better choices quickly and clearly.

With vast computing power, interoperability with new and legacy systems, high-speed networking, and high-definition video capability available in homes and mobile devices, the Digital Twin is poised to take on a more significant role in healthcare via a digital patient twin. With the proliferation of mobile health trackers and increasingly sophisticated sensors, a real-time virtual doctor visit can go well beyond the early telemedicine experiences today that have been slightly better than a video phone call. In the near future, the digital patient twin can meet the virtual doctor in a shared metaverse or virtual space. While the actual patient and the real-life doctor

speak from miles away, the doctor will see in real time the full model and metrics of the patient with signals coming from the sensors feeding the digital patient twin. Doctors have always discounted false signals (i.e., “yes, I feel okay”) and had to correlate data and intuition about a patient's real status all during a brief visit. With a virtual digital patient twin visit, the doctor will see the electrical signals of pain radiating in nerve endings in real time via sensors and compare that to a longitudinal view of critical signals (cardiac, activity, sleep patterns, blood tests, and other biometric views) over the past relevant period—30 days, across months, and perhaps across the patient's lifetime. The doctor may still say, “Sure, I know you're working to get better” as the patient may not articulate what they really feel. But the data analysis from the patient's Digital Twin can be balanced with the doctor's intuition about the patient, and their medical acumen, in order to make a proper recommendation.

# Probabilistic versus Deterministic Thinking

We are formally taught from an early age that there is a right and wrong answer to most question. In fact, we are conditioned to believe there is one right answer. In the absence of the one absolute answer, we freeze. Individuals, families, businesses, and entire economies can grind to a halt when seeking one elusive answer that cannot be determined.

In mathematics and computer science, if an initial state or a specific input were known exactly, then the future state of a well-defined system could be calculated and we would always see the same answer. This deterministic thinking, while comforting, is illusive in the real world where we increasingly deal with randomness and ranges of alternatives. The precision necessary in deterministic thinking also does not match how we are truly wired as humans. We inherently understand that there are many shades of gray to most questions—for example, have we exceeded the levels of no return to reverse climate damage? When is Covid over? Can such questions be answered with an absolute number and high confidence?

We persist in seeking an algebraic and empirical single answer to any question that should be 100% true. This can be considered as authenticated data—names, facts, and truths we can all know. Consider the simple question of how many people can a restaurant seat at one time? There is one single true answer to the restaurant seating capacity. However, it's obviously more complicated when asked if you think the restaurant can handle a table for you for 6 people at 8 p.m. on Saturday. We know that a deterministic absolute answer may be unattainable, so we pivot to our intuition as our escape from the confinement of what seems unanswerable. First, gather more absolute data—the restaurant doesn't take reservations and has some open capacity and no wait list for the 8 p.m. seating. Then factor in the probabilistic insights—light snow is forecast; however, we're in Manhattan in the theater district during the holiday season and shows start before the 8 p.m. seating. There are no more facts, and you can think through the probabilities, so does your intuition tell you seating should be available or do you look for another restaurant?

The human experience and our interactions are a series of activities blending facts with a sequence of observations or expectations of events best described as a distribution of alternatives. This probabilistic view is the opposite of the absolute answers we seek. Yet, it is the most realistic way to model the real world. A probabilistic approach seeks to determine what is plausible while accounting for uncertainty in the model (i.e., the question) and uncertainty in the data.

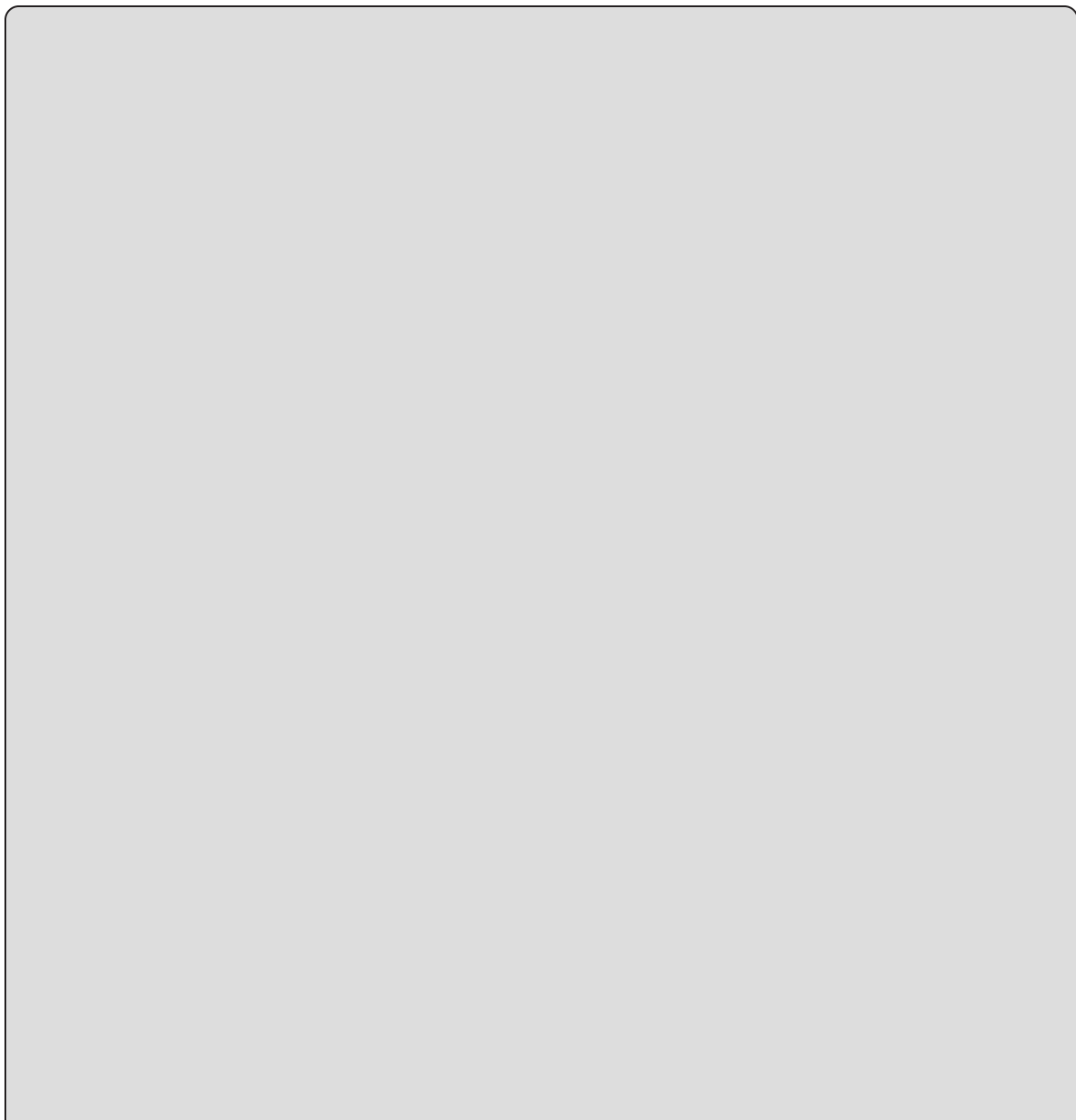
An advantage of machine learning predictive models and the Digital Twins discussed earlier is that they are well equipped to handle such stochasticity, produce possibilistic predictions, and what-if scenarios. Such tools, make it easier for us to quantify the degree of uncertainty and its implications on decision-making. As business leaders without a Ph.D. in AI, the key is to recognize that inference or deduction from a hypothesis (a question) is programmable and explainable. Simply put, your business can apply probability to your business logic and available data to reduce the uncertainty and predict an outcome.

The business leader grounded in QI will correlate the data and make recommendations provided by probabilistic AI models with their business acumen and intuition to understand what is not just doable but, more importantly what is acceptable for their business and for their customers. The future AI leader will be able to not only reduce uncertainty by using data, but also use simulations and Digital Twins to examine the outcomes under alternative scenarios.

Given the belief—as often reinforced by Hollywood—that all new technology could be destructive, leaders who are early adopters would be wise to ensure a focus on safety and security. Leaders can rely on advanced organizations studying the future of decision-making for guidance in how to utilize the proliferation of new methods and tooling in decision-making. Beyond advanced analytics and AI system controls is the need for a governance framework that establishes the structure and norms to apply AI safely and equitably with accountability and transparency. At the time of *Decisions Over Decimals* publication, the National Institute of Standards and Technology (NIST) is reviewing the AI Risk Management Framework for Winter 2022/23 release. NIST AI RMF's goal<sup>6</sup> is “to better manage risks to individuals, organizations, and society associated

with artificial intelligence (AI), and to improve the ability to incorporate trustworthiness considerations into the design, development, use, and evaluation of AI products, services, and systems.”

Current Trustworthy AI commercial frameworks from Deloitte and IBM, among many to choose from, provide the guidance for AI privacy, agility, explainability, and adherence to emerging regulations. Future leaders will recognize in these frameworks the QI balance of uniting data intelligence with human judgment to get to action.



# TRUSTWORTHY AI FRAMEWORKS

Deloitte offers its Trustworthy AI™ Framework<sup>7</sup> describing six domains:

- **Fair and impartial:** Assess whether AI systems include internal and external checks to help enable equitable application across all participants.
- **Transparent and explainable:** Help participants understand how their data can be used and how AI systems make decisions. Algorithms, attributes, and correlations are open to inspection.
- **Responsible and accountable:** Put an organizational structure and policies in place that can help clearly determine who is responsible for the output of AI system decisions.
- **Robust and reliable:** Confirm that AI systems have the ability to learn from humans and other systems and produce consistent and reliable outputs.
- **Respectful of privacy:** Respect data privacy and avoid using AI to leverage customer data beyond its intended and stated use. Allow customers to opt in and out of sharing their data.
- **Safe and secure:** Protect AI systems from potential risks (including cyber risks) that may cause physical and digital harm.

Similarly, IBM's human- centered approach to Trustworthy AI suggests:<sup>8</sup>

- **Explainability:** Trust comes through understanding. How AI-led decisions are made and what determining factors were included are crucial to understand.
- **Fairness:** Ensuring proper monitoring and safeguards are in place to mitigate bias and drift leads to fairer, more equitable treatment for all.

- **Robustness:** Trustworthy AI at scale guards against adversarial threats and potential incursions to keep systems healthy.
- **Transparency:** Transparency reinforces trust and sharing information with stakeholders of varying roles engenders further trust.
- **Privacy:** AI systems safeguard data through the entire life cycle from training to production and governance.

# Found Time for More Decisions

The progression from automation to predictions and Digital Twin systems to the adoption of probabilistic thinking and AI lead to a final question. What do we as humans do with the extra capacity we will have as these and many other newer methods and technologies proliferate?

Optimistically, we can plan for additional time to focus on what matters once the mundane is expedited and managed. We could actually focus on creativity. Ironically, as we automate more and apply ever complex technology we may find time to discuss what matters more at a human level. The business leaders in the next several decades will have to continue to balance deep quantitative understanding with an intuitive mindset. In fact, significantly more intuition or human consideration may be required to counterbalance the pace and complexity of quantitative analysis.

If we are able to monitor, manage, and trust the accelerating data-driven and AI domains, it may be possible that individuals and businesses may also trust each other more given true transparency of information and better collaboration of interdependent systems and organizations.

What could result? The rapid pace of innovation may increase with the removal of constraints given that systems can address the fundamentals of decision processes. The vast effort, resources, and creativity applied today to simply manage untamed, siloed, and uncertain information flows could be redirected to rapidly grow new business, evolve operating models, and launch new innovative products.

Smart people—grounded in QI—with more time to think strategically may be the path to solve the next wave of great challenges and put decisions over decimals.



# Notes

1. Chui, M., J. Manyika, and M. Miremadi. “Where Machines Could Replace Humans—and Where They Can't (Yet).” McKinsey Quarterly, July 2016. Available at: <https://www.mckinsey.com/~media/mckinsey/business%2ofunctions/mckinsey%2odigital/our%2oinsights/where%2omachines%2ocould%2oreplace%2ohumans%2oand%2owhere%2othey%2ocant/where-machines-could-replace-humans-and-where-they-cant-yet.pdf>.
2. Kumar, A., and R. Telang. “Does the Web Reduce Customer Service Cost? Empirical Evidence from a Call Center. *Information Systems Research*, 2012, 23(3-part-1): 721–737.
3. Frank, M. R., D. Autor, J. E. Bessen, E. Brynjolfsson, M. Cebrian, D. J. Deming, ... and I. Rahwan. “Toward Understanding the Impact of Artificial Intelligence on Labor.” *Proceedings of the National Academy of Sciences*, 2019, 116(14): 6531–6539.
4. Karlinsky-Shichor, Y., and O. Netzer. “Automating the B2B Salesperson Pricing Decisions: a Human-Machine Hybrid Approach.” SSRN. Presented May 6, 2019. Last revised November 18, 2020. Available at: [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3368402](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3368402).
5. Lava, Shari. “Why Automation Leveraging Shared Expertise and Operations Is the Future of Industry Ecosystems.” IDC, 2022. Available at: <https://www.idc.com/getdoc.jsp?containerId=US48969222>.
6. Available at: <https://www.nist.gov/itl/ai-risk-management-framework>.
7. Available at: <https://www2.deloitte.com/us/en/pages/about-deloitte/articles/press-releases/deloitte-introduces-trustworthy-ai-framework.html>.
8. Available at: <https://www.ibm.com/watson/trustworthy-ai>.



# Epilogue

*What people think of as the moment of discovery is really the discovery of the question.*

— Jonas Salk

As we are at the end of the book, it is helpful to go back to the beginning. What is a decision? At the core a decision represents “change”—a point in time when you are asked to consider doing something differently. As individuals we are not wired for change. We resist change. Your role is to bring along your clients, colleagues, or stakeholders to become comfortable with change.

You may be asking yourself where do I begin? Some aspects of the book seem obvious ex-post, but ask yourself if have you been using techniques like IWIKs™, backward thinking, or the Fermi method? If you want to be a better decision-maker start with building two skills—interrogation + intuition—or as discussed in [Chapters 1, 4, and 5](#), “surprise” and “context.” The combination will enable you to bring others along to drive action.

The next time an analyst comes to you ready to go through the 30 pages of tables and text-filled slides they produced over the last three weeks of analyses, you should taking a detour. While you are interested in seeing what they have to share—and they are certainly excited to show their work—we recommend asking a simple question, “What surprised you?” “What are one or two things that surprised you as you have been working on the data?” There are often two typical outcomes to this question. Either you find the mistakes in the analysis as their surprise may be easily explained by some contextual observation, which the analyst may not be aware of, or you discover something interesting and unexpected together. Either way you moved the conversation forward. This is less about them being a dutiful analyst pouring through granular details, and more about opening a thoughtful conversation and elevated discussion about issues that truly matter. The analyst begins to be a strategist. This is about helping your analyst build their translator skills as discussed in [Chapter 10](#). The simple question “What surprised you?” cuts straight to the chase, uncovering the useful

insights and relieving the analyst from walking you through all their slides. As a leader, be open to the surprise—the new learning and the unexplained data points. There is often rich learning in what other people call outliers. Create that space for a different dialogue. Let them share what was unexpected, as it may spark new learning.

Related to this new learning is context. Humans are very good in identifying patterns and recognizing similarities and dissimilarities. We are not very good at assessing things in absolute. Hence, as discussed in [Chapter 4](#), ask for context when presented with a number. Triangulate each data point—discuss it in absolute, over time, and relative to a competitor or benchmark. Data must always be put in context if you want to compel people to act. You can even try this at home—judiciously—when you hear “would you believe ... ?” Probe for context and see how the conversation evolves and becomes richer.

Driving action is what we care about. While we are authors and academics, we are practitioners first. *Decisions Over Decimals* was borne from working on the frontlines of business. We learned along the way, from gathering the data and wallowing in spreadsheets to growing and leading teams that have developed winning strategies. We have been on the receiving end of tough discussions, participants in challenging meetings, and have been interrogated by the some of the most brilliant, successful leaders in business.

We listened and observed. We became fascinated in decoding the underlying dynamics of people, initiatives, and meetings that lead to better decisions. We have had insatiable curiosity to understand why certain decisions were adopted and others rejected. Then Big Data exploded. We swam in data lakes, strolled around data warehouses, and turned data cubes. We thought this was going to be the answer. Data-driven decisions would be the salve. Shockingly, that was not the true answer. People felt like they were drinking from the firehose.

Fuzzy at first, the picture slowly started to develop. Data is essential, but there was more. It was the balance between data intelligence and human judgment. We started researching, formulating, testing how to strike the right balance. We refined the techniques and key questions and taught them to people across industries, companies and with varied experience. Over seven years of teaching QI at

Columbia University, we asked one question to understand the gaps in the process: “What is your biggest challenge related to decision-making?” The consistent answer was not around data discovery, but interrogation and action. We developed the concept of Quantitative Intuition (QI)<sup>™</sup> to codify our many lessons and years of research to enable leaders to make faster, higher quality decisions, and to help others build agile teams that move forward with confidence in the face of incomplete information.

The practical lessons came first, this book second. What we discuss is not a formulaic method you need to follow with precision, but a series of techniques that you can easily apply as needed. QI is a set of rapid response tools. More jazz than waterfall—start where it makes sense, then explore the adjacent questions or techniques in order. Observe how these moves the insights forward and perhaps revisit the theme to reset the frame of what matters. At the start it may take effort to master some of the tools, but as you keep using them you will reach the level of unconscious competence (see Prologue [Figure P.2](#)) where these tools will become engrained in your daily routine and organization; they will become intuitive. Think of *Decision Over Decimals* as a reference manual, something you go back to again and again.

By applying the approaches shared, you will raise the power of your team's thinking, spark a different dialogue, and begin asking questions to build winning strategies. Realize you play an essential role to help your organization grow by driving clear and better decisions. Today's digital age demands faster decisions; however, decisions are often made by consensus, reflecting a flight to safety rather than being a catalyst for change. This data-hungry environment fuels the moon-shot mentality for the perfect data, the perfect analysis, and the perfect decision while racing past nuance and insights and eliminating a balanced view of alternatives. Growth rarely follows despite the proliferation of data and an insatiable appetite to interrogate ever more data in the quest to eliminate uncertainty. We question the data we have, keep asking for more or better data and analyses, and are often frustrated with inaction when we know what should be done in our gut. Insightful leaders know this is a flawed approach. You cannot grow a business with zero risk. You cannot make the perfect decision with data alone.

To be a better decision-maker don't just become a better analyst. This notion is at the heart of QI. Analysis is the detailed assessment of the components to better understand a complex issue. This is necessary but insufficient to compel action. To compel action, you need to rally your stakeholders around a decision not data. You need to engage them in the decision moment not the analytic model. You need to provide context rather than diving into the components. You need to synthesize not summarize.

The world we live in—one of information overload, constant connectivity, and digital future—is a breeding ground for confusion and doubt. We lose the thread of the issues that matter in favor of pursuing more data and perfect answers. You play an essential role in changing the dialogue. Break the pattern. Forge the alliance between the context and surprise. And forge the partnership between your line business and your research/insights team. Buy them a coffee. Make the space. Let the insights come forward.

We end with one of our favorite quotes from Andrew Lang, “He uses statistics as a drunken man uses lampposts ... for support rather than illumination.” We have all encountered these situations where people use data for support rather than illumination. QI will enable you to raise the awareness of the power of thinking beyond Big Data without neglecting it and chasing the perfect decision while appreciating that no such thing can ever really exist. The result will be decisions that illuminate the path forward. They may not be perfect, but they will enable you to move forward. The key is to be open to test and learn, to course correct in the same way a sailor adjusts to the changing winds while progressing.



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Any significant endeavor, done well, is never done alone. What made this journey of discovery and creativity a reality was the support and coaching of many people. Before we acknowledge these individuals who personally impacted each of us, we would like to express our thanks, gratitude, and appreciation to a select group of folks who played a role in shaping this book. We want to start with Josie Cox, a journalist, editor, and broadcaster who acted as a sounding board at the inception of this book. She was there in the early days listening to our stream of consciousness that led to the early chapters. We are grateful to Josie for keeping us aligned in the messy, early creative days while ensuring each of our ideas were amplified. She not only served as our first editor but has turned into a friend. We also want to thank Karen Vrotsos, an editor who sharpened our thinking and ensured our message was clear, persuasive, and engaging.

Writing a book is a major undertaking. The blank page is both daunting and exciting as it represents possibilities. We decided to ease the challenge by having three authors. Three voices needed to weave into one. A range of ideas had to harmonize. We feel fortunate to have discovered and formed our QI Jazz Trio where each could express personal thoughts and flourish while aligning to an underlying pulse of familiar shared views. What you've just read is the latest result of three people teaching together for the past seven years, and we hope you heard the harmony.

Adding to the symphony, many friends and colleagues were generous with their time to guest lecture in the QI program at Columbia. We are deeply appreciative to Traci Gusher, Eric Koivisto, Todd Traut, Scott Penberthy, Tracie Kambies, Tom Galizia, Tanneasha Gordon, Peter Vanderslice, Lisa Noon, Asif Hasan, Barrett Lester, Max Kirby, and Chris Davey. We are also grateful to Katie Buckley, Brant Cruz, Sarah Guggino, Hitendra Wadhwa, Mattias Birk, Paul Ingram, David Rogers, Nicolas Padilla, and Rick Lake, who all provided rich input and support in many ways, reviewing proposal drafts and the catalog copy and helping work through various aspects of this book. Each was there for us at critical decision moments, never hesitating to



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We would like to conclude with a few personal notes and acknowledgments:

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## **Paul Magnone**

As the son of immigrants who had little education, it has not escaped me how fortunate I have been to receive a top education and work in ever-increasing cathedrals of industry and academia. And yet, common sense often guides best, so I'm thankful for my parents Alberto and Grazia, who instilled in me curiosity, diligence, and good judgment. What further grounds me is the love and support of my wife Suzanne and the beautifully creative and inquiring minds of my children, Luke and Eve. As they begin their journey, we sometimes revisit lessons from my childhood, yet we all know the best is yet to come.

## Oded Netzer

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