PART I

The Measurement Solution Exists

CHAPTER 1

The Challenge of Intangibles

When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the state of science.

—Lord Kelvin (1824–1907), British physicist
and member of the House of Lords

Anything can be measured. If something can be observed in any way at all, it lends itself to some type of measurement method. No matter how "fuzzy" the measurement is, it's still a measurement if it tells you more than you knew before. And those very things most likely to be seen as immeasurable are, virtually always, solved by relatively simple measurement methods. As the title of this book indicates, we will discuss how to find the value of those things often called "intangibles" in business. The reader will also find that the same methods apply outside of business. In fact, my analysts and I have had the opportunity to apply quantitative measurements to problems as diverse as military logistics, government policy, and interventions in Africa for reducing poverty and hunger.

Like many hard problems in business or life in general, seemingly impossible measurements start with asking the right questions. Then, even once questions are framed the right way, managers and analysts may need a practical way to use tools to solve problems that might be perceived as complex. So, in this first chapter, I will propose a way to frame the measurement question and describe a strategy for solving measurement problems with some powerful tools. The end of this chapter will be an outline of the rest of the book—building further on these initial concepts. But first, let's discuss a few examples of these so-called intangibles.

THE ALLEGED INTANGIBLES

There are two common understandings of the word "intangible." It is routinely applied to things that are literally not tangible (i.e., not touchable, physical objects) yet are widely considered to be measurable. Things like time, budget, patent ownership, and so on are good examples of things that you cannot literally touch though they are observable in other ways. In fact, there is a well-established industry around measuring so-called intangibles such as copyright and trademark valuation. But the word "intangible" has also come to mean utterly immeasurable in any way at all, directly or indirectly. It is in this context that I argue that intangibles do not exist—or, at the very least, could have no bearing on practical decisions.

If you are an experienced manager, you've heard of the latter type of "intangibles" in your own organization—things that presumably defy measurement of any type. The presumption of immeasurability is, in fact, so strong that no attempt is even made to make any observation that might tell you something about the alleged immeasurable that you might be surprised to learn. Here are a few examples:

- The "flexibility" to create new products
- The value of information
- The risk of bankruptcy
- Management effectiveness
- The forecasted revenues of a new product
- The public health impact of a new government environmental policy
- The productivity of research
- The chance of a given political party winning the White House
- The risk of failure of an information technology (IT) project
- Quality of customer interactions
- Public image
- The risk of famine in developing countries

Each of these examples can very well be relevant to some major decision an organization must make. The intangible could even be the single most important determinant of success or failure of an expensive new initiative in either business or government. Yet, in many organizations, because intangibles like these were assumed to be immeasurable, the decision was not nearly as informed as it could have been. For many decision makers, it is simply a habit to default to labeling something as intangible when the measurement method isn't immediately apparent. This habit can sometimes be seen in the "steering committees" of many organizations. These committees may review proposed investments and decide which to accept or reject. The proposed investments could be

related to IT, new product research and development, major real estate development, or advertising campaigns. In some cases I've observed, the committees were categorically rejecting any investment where the benefits were "soft." Important factors with names like "improved word-of-mouth advertising," "reduced strategic risk," or "premium brand positioning" were being ignored in the evaluation process because they were considered immeasurable.

It's not as if the proposed initiative was being rejected simply because the person proposing it hadn't measured the benefit (which would be a valid objection to a proposal); rather, it was believed that the benefit couldn't possibly *be* measured. Consequently, some of the most important strategic proposals were being overlooked in favor of minor cost-saving ideas simply because everyone knew how to measure some things and didn't know how to measure others. In addition, many major investments were approved with no plans for measuring their effectiveness after they were implemented. There would be no way to know whether they ever worked at all.

In an equally irrational way, an immeasurable would be treated as a key strategic principle or "core value" of the organization. In some cases decision makers effectively treat this alleged intangible as a "must have" so that the question of the degree to which the intangible matters is never considered in a rational, quantitative way. If "improving customer relationships" is considered a core value, and one could make the case that a proposed investment supported it, then the investment was justified—no matter the *degree* to which customer relationships improved at a given cost.

In some cases, a decision maker might concede that something could be measured in principle, but for various reasons is not feasible. This also renders the thing, for all practical purposes, as another "intangible" in their eyes. For example, perhaps there is a belief that "management productivity" is measurable but that sufficient data is lacking or that getting the data is not economically feasible. This belief—not usually based on any specific calculation—is as big an obstacle to measurement as any other.

The fact of the matter is that all of the previously listed intangibles are not only measurable but have already been measured by someone (sometimes my own team of analysts), using methods that are probably less complicated and more economically feasible than you might think.

YES, I MEAN *ANYTHING*

The reader should try this exercise: Before going on to the next chapter, write down those things you believe are immeasurable or, at least, you are not sure how to measure. After reading this book, my goal is that you

will be able to identify methods for measuring each and every one of them. Don't hold back. We will be talking about measuring such seemingly immeasurable things as the number of fish in the ocean, the value of a happy marriage, and even the value of a human life. Whether you want to measure phenomena related to business, government, education, art, or anything else, the methods herein apply.

With a title like *How to Measure Anything*, anything less than an enormous multivolume text would be sure to leave out something. My objective does not explicitly include every area of physical science or economics, especially where measurements are already well developed. Those disciplines have measurement methods for a variety of interesting problems, and the professionals in those disciplines are already much less inclined to apply the label "intangible" to something they are curious about. The focus here is on measurements that are relevant—even critical—to major organizational decisions, and yet don't seem to lend themselves to an obvious and practical measurement solution.

So, regardless of your area of interest, if I do not mention your specific measurement problem by name, don't conclude that methods relevant to that issue aren't being covered. The approach I will talk about applies to *any* uncertainty that has some relevance to your firm, your community, or even your personal life. This extrapolation is not difficult. For example, when you studied arithmetic in elementary school, you may not have covered the solution to 347 times 79 in particular, but you knew that the same procedures applied to any combination of numbers and operations.

I mention this because I periodically receive emails from someone looking for a specific measurement problem mentioned by name in earlier editions of this book. They may write, "Aha, you didn't mention X, and X is uniquely immeasurable." The actual examples I've been given by earlier readers included the quality of education and the competency of medical staff. Yet, just as the same procedure in arithmetic applies to multiplying any two numbers, the methods we will discuss are fundamental to any measurement problem regardless of whether it is mentioned by name.

So, if your problem happens to be something that isn't specifically analyzed in this book—such as measuring the value of better product labeling laws, the quality of a movie script, or the effectiveness of motivational seminars—don't be dismayed. Just read the entire book and apply the steps described. Your immeasurable will turn out to be entirely measurable.

No matter what field you specialize in and no matter what the measurement problem may be, we start with the idea that if you care about

this alleged intangible at all, it must be because it has observable consequences, and usually you care about it because you think knowing more about it would inform some decision. Everything else is a matter of clearly defining what you observe, why you care about it, and some (often surprisingly trivial) math.

THE PROPOSAL: IT'S ABOUT DECISIONS

Why do we care about measurements at all? There are just three reasons. The first reason—and the focus of this book—is that we should care about a measurement because it informs key decisions. Second, a measurement might also be taken because it has its own market value (e.g., results of a consumer survey) and could be sold to other parties for a profit. Third, perhaps a measurement is simply meant to entertain or satisfy a curiosity (e.g., academic research about the evolution of clay pottery). But the methods we discuss in this decision-focused approach to measurement should be useful on those occasions, too. If a measurement is not informing your decisions, it could still be informing the decisions of others who are willing to pay for the information. If you are an academic curious about what really happened to the woolly mammoth, then, again, I believe this book will have some bearing on how you define the problem and the methods you might use.

Upon reading the first edition of this book, a business school professor remarked that he thought I had written a book about the somewhat esoteric field called "decision analysis" and disguised it under a title about measurement so that people from business and government would read it. I think he hit the nail on the head. Measurement is about supporting decisions, and there are even "micro-decisions" to be made within measurements themselves. Consider the following points.

1. Decision makers usually have imperfect information (i.e., uncertainty) about the best choice for a decision.
2. These decisions should be modeled quantitatively because (as we will see) quantitative models have a favorable track record compared to unaided expert judgment.
3. Measurements inform uncertain decisions.
4. For any decision or set of decisions, there is a large combination of things to measure and ways to measure them—but perfect certainty is rarely a realistic option.

In other words, management needs a method to analyze options for reducing uncertainty about decisions. Now, it should be obvious that important decisions are usually made under some level of uncertainty. Still, all management consultants, performance metrics experts, or even statisticians approach measurements with the explicit purpose of supporting defined decisions.

Even when a measurement is framed in terms of some decision, that decision might not be modeled in a way that makes good use of measurements. Although subjective judgment informed by real data may be better than intuition alone, choices made entirely intuitively dilute the value of measurement. Instead, measurements can be fed directly into quantitative models so that optimal strategies are computed rather than guessed. Just think of a cost-benefit analysis in a spreadsheet. A manager may calculate benefits based on some estimates and check to see if they exceed the cost. If some input to one of the benefit calculations is measured, there is a place for that information to go and the net value of a choice can be immediately updated. You don't try to run a spreadsheet in your head.

The benefits of modeling decisions quantitatively may not be obvious and may even be controversial to some. I have known managers who simply presume the superiority of their intuition over any quantitative model (this claim, of course, is never itself based on systematically measured outcomes of their decisions). Some have even blamed the 2008 global financial crisis, not on inadequate regulation or shortcomings of specific mathematical models, but on the use of mathematical models *in general* in business decisions. The overconfidence some bankers, hedge fund managers, and consumers had in their unaided intuition was likely a significant factor as well.

The fact is that the superiority of even simple quantitative models for decision making has been established for many areas normally thought to be the preserve of expert intuition, a point this book will spend some time supporting with citations of several published studies. I'm not promoting the disposal of expert intuition for such purposes—on the contrary, it is a key element of some of the methods described in this book. In some ways expert intuition is irreplaceable but it has its limits and decision makers at all levels must know when they are better off just "doing the math."

When quantitatively modeled decisions are the focus of measurement, then we can address the last item in the list. We have many options for reducing uncertainty and some are economically preferable. It is unusual for most analysis in business or government to handle the economic questions of measurement explicitly, even when the decision is big and risky, and even in cultures that are proponents of quantitative

analysis otherwise. Computing and using the economic value of measurements to guide the measurement process is, at a minimum, where a lot of business measurement methods fall short.

However, thinking about measurement as another type of choice among multiple strategies for reducing uncertainty is very powerful. If the decision to be analyzed is whether to invest in some new product development, then many intermediate micro-decisions about what to measure (e.g., emergence of competition, market size, project risks, etc.) can make a significant difference in the decision about whether to commit to the new product. Fortunately, in principle, the basis for assessing the value of information for decisions is simple. If the outcome of a decision in question is highly uncertain and has significant consequences, then measurements that reduce uncertainty about it have a high value.

Unless someone is planning on selling the information or using it for their own entertainment, they shouldn't care about measuring something if it doesn't inform a significant bet of some kind. So don't confuse the proposition that *anything can be measured* with *everything should be measured.* This book supports the first proposition while the second proposition directly contradicts the economics of measurements made to support decisions. Likewise, if measurements were free, obvious, and instantaneous, we would have no dilemma about what, how, or even whether to measure. As simple as this seems, the specific calculations tend to be surprising to those who have tended to rely on intuition for deciding whether and what to measure.

So what does a decision-oriented, information-value-driven measurement process look like? This framework happens to be the basis of the method I call Applied Information Economics (AIE). I summarize this approach in the following steps.

Applied Information Economics: A Universal Approach to Measurement

1. Define the decision.
2. Determine what you know now.
3. Compute the value of additional information. (If none, go to step 5.)
4. Measure where information value is high. (Return to steps 2 and 3 until further measurement is not needed.)
5. Make a decision and act on it. (Return to step 1 and repeat as each action creates new decisions.)

Each of these steps will be explained in more detail in chapters to come. But, in short: *measure what matters, make better decisions.* My hope is that as we raise the curtain on each of these steps in the upcoming chapters, the reader may have a series of small revelations about measurement.

A "POWER TOOLS" APPROACH TO MEASUREMENT

I think it is fair to say that most people have the impression that statistics or scientific methods are not accessible tools for practical use in real decisions. Managers may have been exposed to basic concepts behind scientific measurement in, say, a chemistry lab in high school, but that may have just left the impression that measurements are fairly exact and apply only to obvious and directly observable quantities like temperature and mass. They've probably had some exposure to statistics in college, but that experience seems to confuse as many people as it helps. After that, perhaps they've dealt with measurement within the exact world of accounting or other areas where there are huge databases of exact numbers to query. What they seem to take away from these experiences is that to use the methods from statistics one needs a lot of data, that the precise equations don't deal with messy real-world decisions where we don't have all of the data, or that one needs a PhD in statistics to use any statistics at all.

We need to change these misconceptions. Regardless of your background in statistics or scientific measurement methods, the goal of this book is to help you conduct measurements *just like a bona fide real-world scientist usually would*. Some might be surprised to learn that most scientists—after college—are not actually required to commit to memory hundreds of complex theorems and master deep, abstract mathematical concepts in order to perform their research. Many of my clients over the years have been PhD scientists in many fields and none of them have relied on their memory to apply the equations they regularly use—honest. Instead, they simply learn to identify the right methods to use and then they usually depend on software tools to convert the data they enter into the results they need.

Yes, real-world scientists effectively "copy/paste" the results of their statistical analyses of data even when producing research to be published in the most elite journals in the life and physical sciences. So, just like a scientist, we will use a "power tools" approach to measurements. Like many of the power tools you use already (I'm including your car and computer along with your power drill) these will make you more productive and allow you to do what would otherwise be difficult or impossible.

Power tools like ready-made spreadsheets, tables, charts, and procedures will allow you to use useful statistical methods without knowing how to derive them all from fundamental axioms of probability theory or even without memorizing equations. To be clear, I'm not saying you can just start entering data without knowing what is going on. It is critical that you understand some basic principles about how these methods

work so that you don't misuse them. However, memorizing the equations of statistics (much less deriving their mathematical proofs) will not be required any more than you are required to build your own computer or car to use them.

So, without compromising substance, we will attempt to make some of the more seemingly esoteric statistics around measurement as simple as they can be. Whenever possible, math will be relegated to Excel spreadsheets or even simpler charts, tables, and procedures. Some simple equations will be shown but, even then, I will usually show them in the form of Excel functions that you can type directly into a spreadsheet. My hope is that some of the methods are so much simpler than what is taught in the typical introductory statistics courses that we might be able to overcome many phobias about the use of quantitative measurement methods. Readers do not need any advanced training in any mathematical methods at all. They just need some aptitude for clearly defining problems.

Some of the power tools referred to in this book are in the form of spreadsheets available for download on this book's website at www.howtomeasureanything.com. This free online library includes many of the more detailed calculations shown in this book. There are also examples, learning aids, and a discussion board for questions about the book or measurement challenges in general. And, since technologies and measurement topics evolve faster than publishing cycles of books, the site provides a way for me to discuss new issues as they arise.

A GUIDE TO THE REST OF THE BOOK

As mentioned, the chapters are not organized by type of measurement whereby, for example, you could see the entire process for measuring improved efficiency or quality in one chapter. To measure any single thing, you need to understand the sequence of steps in a process which is described sequentially in various chapters. For this reason, I do not recommend skipping around from chapter to chapter. But I think a quick review of the entire book will help the reader see when they should expect certain topics to be covered. I've grouped the 14 chapters of this book into four major parts as follows.

Synopsis of the Four Parts of This Book

Part I: The Measurement Solution Exists. The three chapters of the first section (including this chapter) address broadly the claims of immeasurability. In the next chapter we explore some interesting examples of measurements by focusing on three

interesting individuals and the approaches they took to solve interesting problems (Chapter 2). These examples come from both ancient and recent history and were chosen primarily for what they teach us about measurement in general. Building on this, we then directly address common objections to measurement (Chapter 3). This is an attempt to preempt many of the objections managers or analysts have when considering measurement methods. I never see this treatment in standard college textbooks but it is important to directly confront the misconceptions that keep powerful methods from being attempted in the first place.

Part II: Before You Measure. Chapters 4 through 7 discuss important "set up" questions that are prerequisites to good measurement and that coincide with steps 1 through 3 in the previously described "universal" approach to measurement. These steps include defining the decision problem well (Chapter 4). Then we estimate the current level of uncertainty about a problem. This is where we learn how to provide "calibrated probability assessments" to represent our uncertainties quantitatively (Chapter 5). Next, we put those initial estimates of uncertainty together in a model of decision risk (Chapter 6) and compute the value of additional information (Chapter 7). Before we discuss how to measure something, these sequential steps are critical to help us determine what to measure and how much of an effort a measurement is worth.

Part III: Measurement Methods. Once we have determined what to measure, we explain some basic methods about how to conduct the required measurements in Chapters 8 through 10. This coincides with part of what is needed for step 4 in the universal approach. We talk about the general issue of how to decompose a measurement further, consider prior research done by others, and select and outline measurement instruments (Chapter 8). Then we discuss some basic traditional statistical sampling methods and how to *think* about sampling in a way that reduces misconceptions about it (Chapter 9). The last chapter of the section describes another powerful approach to sampling based on what are called "Bayesian methods," contrasts it with other methods, and applies it to some interesting and common measurement problems (Chapter 10).

Part IV: Beyond the Basics. The final section adds some additional tools and brings it all together with case examples. First, we build on the sampling methods by describing measurement instruments when the object of measurement is human attitudes and preferences (Chapter 11). Then we discuss methods in

which refining human judgment can itself be a powerful type of a measurement instrument (Chapter 12). Next, we will explore some recent and developing trends in technology that will provide management with entirely new sources of data, such as using social media and advances in personal health and activity monitoring as measurement devices (Chapter 13). These three chapters also round out the remainder of step 4 and the issues of step 5 in the universal approach. Finally, we explain some case examples from beginning to end of the entire process and help the reader get started on some other common measurement problems (Chapter 14).

Again, each chapter builds on earlier chapters, especially once we get to Part 2 of the book. The reader might decide to skim later chapters, say, after Chapter 9, or to read them in different orders, but skipping earlier chapters would cause some problems. This applies even to the next two chapters (2 and 3) because, even though they may wax somewhat more philosophical, they are important foundations for the rest of the material.

The details might sometimes get complicated, but it is much less complicated than many other initiatives organizations routinely commit to. I know because I've helped many organizations apply these methods to the *really* complicated problems; allocating venture capital, reducing poverty and hunger, prioritizing technology projects, measuring training effectiveness, improving homeland security, and more. In fact, humans possess a basic instinct to measure, yet this instinct is suppressed in an environment that emphasizes committees and consensus over making basic observations. It simply won't *occur* to many managers that an "intangible" can be measured with simple, cleverly designed observations.

Again, measurements that are useful are often much simpler than people first suspect. I make this point in the next chapter by showing how three clever individuals measured things that were previously thought to be difficult or impossible to measure. Viewing the world as these individuals do—through "calibrated" eyes that see things in a quantitative light—has been a historical force propelling both science and economic productivity. If you are prepared to rethink some assumptions and can put in the effort to work through this material, you will see through calibrated eyes as well.