CHAPTER 1

A World-scale Risk and a World-scale Opportunity

Virtually everything we take for granted in the modern world was someone's project at one point. The smartphone and computer you use, the house you live in, the car you drive, the roads it drives on, and the energy you use were brought into existence by a project. This book was a project. Ideas for a better future will come down to a series of projects, some of which will rate among the most ambitious endeavors humans have made.

Many of the projects that have changed our lives for the better had benefits that justified the time and resources spent. Clear project successes, however, are not the most common outcomes. Cost and schedule overruns with benefits short of what was expected are not the exception but the norm. And some of the biggest failures not only end up wasting the resources committed to that effort but have repercussions beyond the cost of the projects themselves.

The persistence of these issues is not for a lack of efforts to solve them. For several decades now, there have been attempts to improve the situation with better standards, methods, software, and professional certifications. Yet, evidence of real improvements is elusive.

We will argue that a large part of these problems come down to inadequate measurements. The solution is better measurements before, during, and even after the project. These will include measurements that may have been dismissed as impossible to compute but, as the title of this book indicates, we will argue that anything that matters to your project is measurable.

The Size of Projects

Projects can be very large endeavors, but they don't have to be. Indeed, the definitions that many separate sources have proposed for a project don't define a size at all. Consider this definition:

> **Project:** *A temporary endeavor with a beginning and an end and it must be used to create a unique product, service or result.*

This is the definition proposed by the *Project Management Body of Knowledge* (PMBOK),[1] which was developed by the Project Management Institute (PMI), the largest professional organization of project managers in the world. There are at least a dozen similar definitions from other recognized sources like the PRojects IN Controlled Environments 2 (PRINCE2), International Project Management Association (IPMA), Association for Project Management (APM), and NASA.

The general agreement among these sources is that projects are temporary endeavors with a defined start and end time. By all these definitions, a project is considered distinct from continuous processes. However, there is less agreement on whether the output needs to be "unique." Some definitions add that a project is held to defined quality standards (IPMA) or should be based on a business case (PRINCE2). But none require that these endeavors be a given size or complexity to constitute a project. By many of these definitions, making breakfast is a project—especially if it was a *unique* breakfast with stated quality standards. But when people pursue careers as project managers and study for project management certifications, most are thinking of something bigger.

For our purposes, and to specify the type of project that would be of interest to our readers or nearly anyone pursuing a career in project management, we add the conditions that projects are at least a couple of weeks long, involve multiple individuals or parties with separate responsibilities who need to coordinate efforts, and are complex enough to require some sort of deliberate plan. Additionally, at least one person on the project is the project manager. Of course, the projects we will discuss will include not only the smallest of these but also projects that cost billions of US dollars, take many years—perhaps decades—and involve the efforts of hundreds or thousands of workers.

When we add up the projects of all sizes and attempt to estimate their impact on the entire world's economy, that's when we see the true scale of projects. This may sound like a difficult measurement, but it is possible to use existing data to provide some rational bounds on the economic impact. Oxford Global Projects (OGP), a consulting firm cofounded by leading project management researchers, Bent Flyvbjerg and Alexander Budzier (Budzier is a coauthor of this book), can provide insights on questions like this. Since 2010, OGP has gathered data on projects in many sectors, including IT, transportation infrastructure, power generation, architecture, nuclear waste disposal, defense, and more. At the time of this writing, the OGP data had more than 20,000 projects with costs totaling over $6 trillion.

Of course, the OGP database, as large as it is, contains a small fraction of all projects worldwide. To estimate project work on a global scale, Alexander Budzier and another researcher, Harvey Maylor, built on previous surveys of workers that assess how much of their effort went toward project work in various industry sectors.[2,3] These studies surveyed more than 950 separate organizations, and even though they used different methods of assessing economic value, their findings were consistent with one another. The methods used "gross value added" (GVA) as the measure of contribution to the world economy. GVA is an economic metric which adds up the contribution to value at each stage of production. It is useful in this context because it can avoid some of the potential double counting that could come from metrics like gross domestic product (GDP).

Combining all the studies, Budzier extrapolated the sector data across 54 other countries for which data are available and weighted the findings based on national GVA. He found that projects accounted for about $20.9 trillion, which is roughly the size of the whole 2019 US economy. Note that this estimate of GVA excludes huge economies like China[4] and South Korea. But, if the proportions of projects in these large economies are similar to others, and the weighted average proportion of 40% were simply applied to the entire global GVA of about $110 trillion in 2024, then the weighted average contribution to GVA is more than $44 trillion.[5,6]

If we need more evidence for how much of the world economic output is in the form of projects, other back-of-the-envelope calculations put us in the same ballpark. For example, PMI estimates that there are about 65.9 million project managers worldwide who earn an average of $105,000 annually, accounting for $6.9 trillion annually.[7] Of course, the total salaries in projects would be a multiple of this given that each project manager manages, on average, a team of five or six other people with annual salaries of about $90,000. Even if those project managers don't spend all their time on projects, an estimate of $20 trillion is in the ballpark. Finally, other studies look at total spending in some areas like R&D, infrastructure, and IT, and how much of each of those is new projects versus maintenance or overhead.[8,9,10] Again, those add up to something more than $10 trillion in the most conservative sums.

Every way we check this puts projects in the same general range of 10% to 40% of the world economy. Clearly, project work comprises an enormous share of the global economy. But again, the products and services we now take for granted are mostly examples of relatively successful projects—successful, at least, in the sense that they finished and produced something we use.

The Size of Project Problems

The projects that comprise so much of the global economy must come with an expectation that the benefits will justify the costs. Yet, various surveys raise serious doubts as to whether these resources are well spent. The surveys varied on how they defined "failure" versus "success", and they covered different types of projects, but none of the research casts a positive light on outcomes. One source reported that 18% of IT projects were canceled after considerable time and money had been spent with nothing to show for it in the end.[11] Another source reported that 70% of projects experienced what it defined as "significant" cost and schedule overruns.[12]

And yet, those are somewhat lenient measures of failure. In the OGP database, if we counted success only for those where budget, schedule, and expected benefits were all met, then we would find that just 0.4% are successes by all three criteria. Note that all of these were projects that were at least, eventually, completed. This does not include projects that were canceled after spending time and money on the project (see Figure 1.1). We've summarized the findings from the OGP data in further detail in Appendix 2.

As bad as a 0.4% complete success rate appears to be, there are worse outcomes than merely falling short of expectations and those even worse still than just being canceled partway through the effort. Failed projects can have

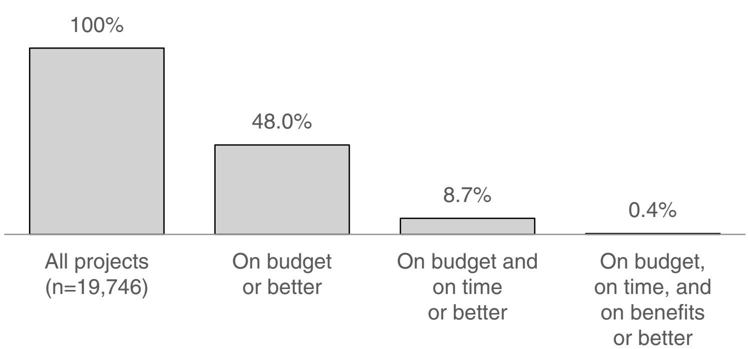

FIGURE 1.1 Share of projects meeting requirements of budget, schedule, and benefits or better.

costs beyond the resources spent directly on the project, even beyond the overruns. There are cases where a project generated costly disruptions in the very areas they were meant to help. Businesses have lost market share, or even gone bankrupt, because of a project that went terribly wrong.

For example, the Hershey Chocolate's SAP Enterprise Resource Planning (ERP) implementation in 1999 was so problematic that instead of getting the expected benefits, the project resulted in so many lost sales from the inability to process orders that it reduced market share and stock price of the firm. In some other firms, new software development projects meant to improve a process made the process worse than before and the firm was forced to abandon the new software and switch back to the previous system. Projects involving two airports, the Denver Airport luggage handling system in the 1990s and the Berlin Brandenburg airport construction in the 2010s, were both vastly overbudget and behind schedule. But the biggest loss in both of those was the impact on the broader economy, including loss of revenue for airlines, loss of tourism, local disruptions during construction, and so on. These are among the most prominent examples, but, even in smaller projects, unintended losses can be greater than what is spent on the project itself.

Given the size of projects and the size of their problems, making even small improvements would justify significant efforts. Budzier's estimates of the global costs of projects and their problems lead him to refer to this as a "world-scale risk" and contend that efforts to fix this can present a "world-scale opportunity."

Efforts to Fix Projects: The Emergence of Project Management

There were project managers at least as early as the construction of the pyramids or even of Stonehenge, and they may have had some title similar to project manager in the languages of the time. But in modern English, the term "project management" begins to appear in some literature in the nineteenth century and becomes more common in the 1960s. In 1969, the term finally became a recognized profession with the formation of the Project Management Institute (PMI), mentioned earlier.

Among its goals, PMI sought to "foster recognition of the need for professionalism in project management" and to "provide a forum for the free exchange of project management challenges, solutions and applications." In 1996, PMI published the first edition of a complete project management guide titled the *Project Management Body of Knowledge* (PMBOK). This document defined project management as "the application of knowledge, skills, tools and techniques to project activities to meet the project requirements."

Over the following decades, more guides and standards were developed. The International Organization for Standardization (ISO), the National Institute of Standards and Technology (NIST), and more started to develop detailed project management standards. At the same time, new approaches to project management, such as "Agile", were developed, particularly within the context of software development.[13]

Project management was further developed as a profession when, in 1984, PMI developed the "Project Management Professional" (PMP) certification. By the start of the twenty-first century, other certifications from both professional nonprofits and for-profit organizations began to appear, including the aforementioned APM and IPMA. In 2019, the total number of PMI certifications alone exceeded 1 million people worldwide, and by 2021, millions more certifications of many types were granted.

In that same time span, various software solutions that supported project management were created. The number of users of this software continues to grow, far exceeding the number of professional certifications. Project management software like Microsoft Project, Asana, Jira, and Trello each have millions of users.

Each new standard, method, framework, certification, and software solution was meant to be at least a partial solution to persistent problems in project management. But is there evidence that project management has improved as a result of these solutions? The short answer is no - and certainly not nearly as much as many of the solutions have claimed. When we look at the thousands of projects collected by OGP, we see no significant change from decade to decade in cost and schedule overruns. There is some variation partly due to changes in the number and types of projects represented in the data. But, even as the use of solutions to problems grew dramatically, we do not see a consistent downward trend in cost and schedule overruns. Some solutions were claiming dramatic improvements, and some of those were widely adopted enough that if the claims were true, we should be able to detect these improvements in the data. Yet, we see nothing that indicates anything like what is claimed. At the time of this writing, the data for the 2020s is not complete but, so far, this decade is not heading in the right direction. (See Figure 1.2.)

The adoption of these solutions has also not had a detectable effect on the delivery of benefits. Projects that even track benefits after completion are sparse, but the OGP database does have this data on some projects. OGP can limit benefit measures to objectively observable outcomes like traffic congestion reduction in transportation projects, units produced in manufacturing, and so on. OGP has details on the original estimated and actual measured benefits for 2861 projects of the following types: Aerospace, Airport, Bridge,

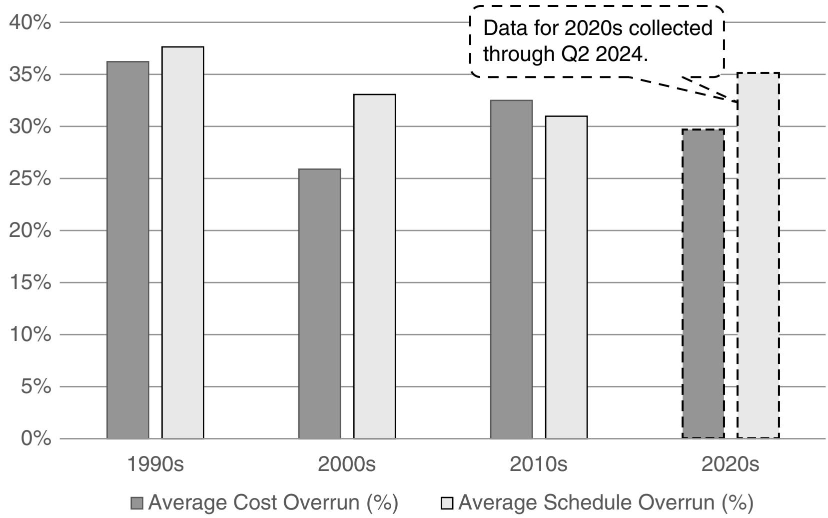

FIGURE 1.2 Total cost and schedule overruns by decade.

Bus Rapid Transit, Building, Carbon Capture, Dams, Data Centers, Defense, EV OEM, IT, Nuclear Storage, Railway, Roadway, and Tunnel. Here is a summary of those findings:

- Before 2000, there was an average benefits shortfall of 8%. After 2000, the shortfall rose to 13%.
- 11% of projects did not realize even half of the expected benefits.
- Only a third realized the expected benefits or greater.
- Among just IT projects, 7% had a benefit shortfall of more than 100%. In other words, the project negatively affected the outcomes it meant to improve, like the previously mentioned SAP ERP implementation at Hershey.

Note that the OGP data listed here refers to projects that were at least *completed*. Including the cancellation rates we discussed would make these benefit outcomes worse.

Perhaps the problem is that projects have gotten more complex too fast for solutions to catch up. Or maybe the shortcomings of a favored method are simply examples of some not using the method correctly. Perhaps the overruns in newer projects are compared unfairly because they make even more ambitious plans while not making underestimations worse. That is like being judged for falling short of an ambitious goal even though the end result was better than those who were judged by easier standards.

These explanations for the lack of improvement are often asserted by proponents of some methods, standards, or tools, but not usually with anything more than anecdotal evidence. We can investigate these claims more thoroughly. Are larger more complex projects more common even as solutions to improve projects are implemented? If incorrect applications of these methods are behind the lack of observed performance, should project managers with certifications in these methods fare better? For this book, we have collected data to answer some of these claims. The data collected so far do not support these claims. The most likely explanation is that the methods and tools developed so far, like the projects they were meant to improve, just don't work as expected.

Given what effort has gone into improving projects already, much of it with little apparent effect, why do we, the authors, think improvements can still be made? We believe that we can contribute to the solution because most of the solutions developed so far have quite a lot in common: they lack scientific evidence of actually working. Even individuals who served on the committee developing one of the major standards had similar criticisms. They called it "normalization without evidence" and claimed that the solutions "have little evidence in them and little evidence for them".

A Path Forward: The Meta-Project

For organizations struggling to better manage projects, their highest priority project should be improving project management. The consulting practice of one of the authors, Doug Hubbard, has had multiple opportunities to develop project portfolio evaluation and prioritization methods. On occasion, he would include the costs of the analysis itself in the project portfolio along with the measured benefits of better portfolio decisions. When the analysis of a project portfolio is considered as one of the projects in the portfolio, it was almost always the smallest project by far compared to other projects in portfolios he analyzed in aerospace, IT, pharmaceuticals, movies, oil & gas, infrastructure, and more. And because the analysis effort improved the return and risks on a much larger portfolio, the analysis project itself would nearly always be the single best investment in the portfolio.

This makes sense. Spending a tiny fraction of a portfolio on improving the entire portfolio is the best investment in a portfolio. When Alex Budzier teaches and engages with project managers, he also finds that the resulting ideas for improving projects easily pay for themselves. To conduct an impact assessment of the course, he conducted a survey among more than 300 of the project leaders who attended his course at Oxford University to determine the impact of the course on actual projects. Of those who provided impacts, 10% provided specific measurements. In just a short time after the course, the average benefit reported was already 20 times the cost of the course.

We can call the project to improve projects the "Meta Project." Regardless of how projects have changed, one essential aspect of management hasn't changed. Management is about decisions under uncertainty. Managers make forecasts, at least implicitly, in every decision they make, and they have to do this with less than perfect information. This includes the initial approval of the project and all the decisions a manager makes along the way during the project. In each case, the manager is imagining, or perhaps deliberately calculating, the likelihood of outcomes for every action or lack of action. Uncertainty is what makes these forecasts difficult. Measurement is about reducing uncertainties.

We will make the case that insufficient measurement of projects and the methods projects use is a major contributor to their problems. Sometimes critical measurements are not made because there is a belief that they are immeasurable. We will explain why this is never the case. In other cases, much time and effort is spent on measurement, but that effort may be focusing on the wrong measurements while ignoring simpler measurements that are more likely to improve decisions. In other words, we will not only make the case that everything that matters is measurable, but we will also show what measurements matter.

This book is divided into three sections. The first three chapters will make the case for measurements and certain quantitative methods that use those measurements. The next chapter after this will make the case that anything is measurable. And we do mean anything. We will explain that any perceived implausibility of this claim is based on some pervasive misconceptions about measurement, the so-called "intangibles" we intend to measure, and how statistical inference works. The remainder of this section will describe the "meta-measurements"—that is, what we know about existing measurement methods, why they fail, and, in fact, why sometimes they don't even constitute a real measurement. The problematic methods will include some very popular items that many project managers reading this book will be familiar with. We will even include some basic psychology that explains why experienced project managers may feel a method works even when it doesn't. To replace these flawed methods, we will propose methods that have been shown to work better based on empirical research, not just in project management, but in estimation and decision-making in general.

Chapters 4 to 9 of the book will dive more into the "how-to" of the some specific methods we identified in the previous chapters as those that provide measurable improvements. This will include a more quantitatively sound measure of risk, estimating cost and schedule, measuring quality and project benefits. We will explain how subjective judgment can be improved, and how inferences can be made from messy or incomplete data. We will discuss ways to frame some of the most intractable measurements that are sometimes used in business cases for projects like, for example, improved safety, social benefits, environmental impact, project complexity, reputation, and more. These methods are not necessarily specific to project management, but we will explore them in the context of project management applications.

Chapters 10 to 12 are meant to be more strategic and aspirational. Chapter 10 will review some more advanced quantitative methods. Chapters 11 and 12 will address the question, "Where do we go from here?" including the organizational implications of better measurements and other steps needed to turn these recommendations into reality. We will also propose a kind of call-to-arms for organizations behind standards, certifications, and software solutions. We need to steer all of those parties toward methods that show a measurable improvement in estimates and decisions and warn them away from debunked methods that have shown no benefit other than perhaps an unjustified increase in confidence. We discuss the future of project management and related measurements, including consideration of AI, the changing nature of work, robotics, resource limitations, and new resource availability.

In the next chapter, we will address the most important claim we are making: Anything that matters to you at all, regardless of how "immeasurable" it may seem, is actually measurable.

The most ambitious and impactful projects will also tend to be some of the riskiest and perhaps have some of the most difficult measurements. If we want to give those efforts the best chance of succeeding, we can start with informing decisions with better measurements.

Be less fearful of failure than of standing still.

—Marie Curie

Notes

1. Project Management Institute. *A Guide to the Project Management Body of Knowledge*, 7th ed. (Newtown Square, PA: Project Management Institute, 2021).
2. Andreas Wald, Tanja Spanuth, Christoph Schneider, Felix Futterer, Benedikt Schnellbächer, and Yves Schoper. *Makroökonomische Vermessung der Projekttätigkeit in Deutschland* (Nürnberg: GPM Deutsche Gesellschaft für Projektmanagement e. V., 2015).

3. Yvonne-Gabriele Schoper, Andreas Wald, Helgi Thor Ingason, and Thórður Víkingur Fridgeirsson. "Projectification in Western Economies: A Comparative Study of Germany, Norway, and Iceland." *International Journal of Project Management* 36, no. 1 (2018): 71–82.
4. ChinaPower, "Making Sense of China's Government Budget," *ChinaPower Project*, March 15, 2023, https://chinapower.csis.org/making-sense-of-chinas-government-budget/.
5. International Monetary Fund data up to 2024, www.imf.org/external/datamapper/NGDPD@WEO/OEMDC/ADVEC/WEOWORLD.
6. Statista, "Infrastructure Projects Value Global 2022 by Country," https://www.statista.com/statistics/1308732/value-of-infrastructure-construction-projects-worldwide-by-selected-countries/.
7. Project Management Institute, *Pulse of the Profession 2023: Powering the Project Economy* (Newtown Square, PA: Project Management Institute, 2023).
8. Congressional Research Service, *Global Research and Development Expenditures: Fact Sheet* (Congressional Research Service, 2022), https://sgp.fas.org/crs/misc/R44283.pdf.
9. PwC, *Capital Project and Infrastructure Spending Outlook to 2025*. accessed November 15, 2024, https://www.pwc.com/my/en/assets/publications/cpi-spending-outlook-to-2025.pdf.
10. IDC, *Worldwide IT and Business Services Forecast Shows Market Growth Fueled by Investments in Digital Business and IT Modernization*. accessed November 15, 2024, https://www.idc.com/getdoc.jsp?containerId=prUS52305724.
11. Emily Bonnie, "Complete Collection of Project Management Statistics 2015." *Wrike.com*. 2015. https://www.wrike.com/blog/complete-collection-project-management-statistics-2015/.
12. Capers Jones, "Software Project Management Practices: Failure Versus Success." *Project Management*, 2004, https://www.academia.edu/82747453/Software_project_management_practices_Failure_versus_success.
13. The Agile manifesto was published in 2001, but previous ideas of user-centric design and rapid prototyping predate date back to at least the 1970s and Brook's book, *The Mythical Man-Month*.