Introduction 1

1.1 Why This Book?

Not long ago, many serious people would dismiss studies of the long-term future. This is not altogether surprising, given that many popular books and films that claim to tell us about what will happen are indeed easy to dismiss. Those that are not simply establishing an environment for adventure stories, almost always represent partial and one-sided views. They are aimed mainly at arguing for a particular goal—or arguing for the credibility of one futures guru or another. More serious pieces of work are often thrown out with the bathwater, dismissed as not really worth much attention for one or more reason.

Sometimes the argument has been that efforts to inform current activities by insights based upon such studies smacked of old-fashioned long-range planning. Such planning has surely now rendered obsolete by the triumph of free markets and neoconservative politics. *The future can take care of itself*.

Another argument made the case against basing decisions on ultimately untestable judgements about people's actions, or about scientific discoveries, that lie over the immediate horizon. *The future is inherently unknowable*.

A different line of argument warned against the risk of imposing rigid thinking, or unexamined assumptions reflecting dominant ideologies, closing off many potentially valuable lines of development when seeking to shape affairs with the long-term in mind. *The future is not ours to colonise*.

Views such as these were very influential during an upsurge of futures studies in the 1960s and 1970s, perhaps best-known through The Limits to Growth (1972)—which succeeded in putting environmental concerns firmly onto the agenda.[1] Though many activists were mobilised around concerns about the long-term

[1]Futures studies have a long lineage, of course, and the tools and techniques now employed in ForSTI often date back many years, with much intensive development in the 1950s and '60s. See Miles (2008).

I. Miles et al., *Foresight for Science, Technology and Innovation*, Science, Technology and Innovation Studies, DOI 10.1007/978-3-319-32574-3_1

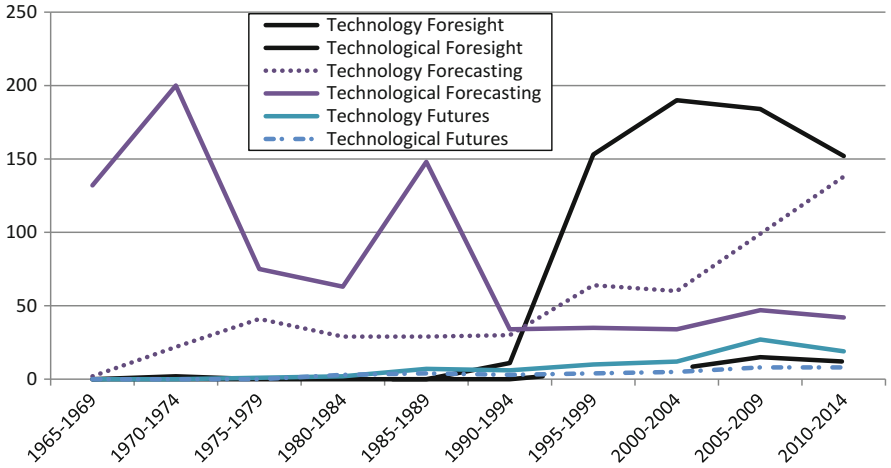

Fig. 1.1 Publications featuring key words in their titles, 1965–2014. *Note*: The data points capture the number of times both words appear in the title of a publication, regardless of order or proximity. *Source*: data produced using Harzing's "*Publish or Perish*" (accessed on: 04/02/2016)

implications of, for example, climate change, most decision-makers were concerned with much shorter-term issues. Those who had to make decisions affecting the long term (such as investments in power plants and infrastructure) usually took these decisions from a "business as usual" perspective. Their attention tended to be narrowly focused on the immediate concerns of their industry or government department. Limits had been very controversial, but as scientific consensus around dangers of climate change became established in later decades, increasing pressure was exerted on business and political leadership to take the threats into account.

The last decades of the twentieth century saw a remarkable revival of futures activities (Fig. 1.1). There were many manifestations of this, for example "Twenty First Century Studies" and a body of work concerned with the UN's Millennium Goals. The approaches that have most informed the discussions of this book were the large-scale Technology Foresight Programmes being launched in a great many countries (henceforth, TF = Technology Foresight and TFP = Technology Foresight Programme). (For a detailed account, see Georghiou et al. 2008). Some of these TFPs proved very influential, for example playing major roles in the restructuring of national and regional STI (Science, Technology and Innovation) activities; others were less so. The wave of (mainly government-funded) TF activities has continued to expand. Some countries have been through several rounds of TF, while others are taking the activity up for the first time. Meanwhile, the general principles of Foresight exercises have been widely disseminated, beyond narrow understandings of STI. Countries, regions, firms and voluntary organisations have launched activities with diverse foci. Technology remains a major preoccupation, but we also see activities with more of a focus on, for

example, health and demographic issues, ecological and climate change issues, social and political development, and so on.

Foresight approaches, then, have become more "respectable". Foresight has moved from being a fringe activity, dismissed as wild futurology, to becoming a body of widely adopted practices, used in significant ways by a wide range of decision-makers. Substantial amounts of experience and documentation have accumulated, and the community of practitioners has expanded; there is much more explication of the tools, techniques and practices involved than was previously the case. (Indeed, another common, and not altogether unjust, criticism of the futures field was that it was too reliant on the wisdom of talented individuals and consequently too dependent on fashions, celebrity, and opaque methods. *The future was the preserve of gurus*.) Not everything in the garden is rosy. As the term "Foresight" became recognised as conferring a certain legitimacy upon futures work, so many less systematic and lower quality activities were marketed as Foresight.

This book sets out to draw out the key lessons from the experience of the last few decades. It will focus particularly on Foresight dealing with Science, Technology and Innovation (ForSTI—Foresight for STI). The meaning of these terms will need to be spelled out in more detail, but at this point we shall note that the STI field is one where longer-term analyses are of considerable importance for stakeholders of all kinds. The aim of this book is to help provide guidance to practitioners, would-be practitioners, and users of ForSTI, as to how activities may be planned, implemented, interpreted, and applied.

1.2 foresight, Foresight—and Foresight for STI

We use the term "Foresight" in a particular way in this book, which is why we capitalise the "F". It is this sense of Foresight that we embed in the term ForSTI. We will explain just why we are introducing this new acronym in a few paragraphs. First we further clarify the meaning of Foresight.

Dictionary definitions of *foresight* usually refer to one or both of two complementary capabilities. The first capability is *insight* into possible future affairs, being adept at drawing conclusions about possible implications of current trends and contingencies. The second capability is *prudence*, being prepared for the substantial responses that challenging implications may require. The combination of these capabilities lends "foresight" positive connotations lacking from terms such as, say, prediction, prophecy, and planning. However, the capabilities are typically seen as the preserve of gifted individuals possessed of intuition or other mysterious talents—rather than as involving skills that can be (more or less easily) cultivated and practices that can be (more or less effectively) enacted.

Of course, ForSTI activities may well be most successful if they can enlist really capable and charismatic practitioners. This is true for all but the most routine human enterprises. People vary in how capable they are as analysts and communicators, narrators and visionaries. They also differ in their expertise

(or lack of it) in one or other specialism, and a few are "T-shaped" professionals who can span multiple disciplines. Some skills can be learned, but recruitment of talented people is important.

Moving away from individual gifts, when we talk about Foresight—with a capital "F"—we are referring mainly to what Loveridge (2009) has described as institutional Foresight.[2] This involves some serious, structured effort to develop, gather and organise evidence-based insights concerning future challenges and opportunities, and to apply these as strategic intelligence for decision-making. This is much more than an exercise in prediction, one that seeks to establish what *will* happen. Likewise, it is more than an effort of planning, aimed at saying what should happen in order to solve specific problems or implement specific solutions.

As we shall spell out in more detail in the next chapter, ForSTI (and Foresight more generally) involves a participative process in which evidence is assessed, possibilities articulated, and actions proposed. It is liable to be related to decision-making. Equally, it is liable to engage a range of stakeholders that is sufficient for two purposes. First, since relevant knowledge is unevenly distributed across many people and institutions, reflecting the wide spectrum of experience that can be brought to bear on most STI activities. Thus, the range of stakeholders should be sufficient to access critical varieties of knowledge. Second, if action is to be effective, insight into the rationale for, and potential outcomes of, particular courses of action may need to be widely shared among those responsible for and affected by the actions. This is a matter both of democracy and legitimacy, and of more instrumental purposes—i.e. understanding of the rationale for action may be essential if action is to be implemented as intended. Again, achieving this requires engaging a sufficient range of stakeholders.

This notion of Foresight has much in common with the work of the "prospectives" school in France. Much of the pioneering work in this tradition, from de Jouvenel, Godet and others, has tended to focus on strategic issues confronting firms and regions, rather than the sorts of ForSTI that has formed the core of many national governmental (and intergovernmental) TFPs, and the typical methods used in its toolkit include some rarely used in TFPs. But much of the core philosophy is shared between the approaches.

"Foresight" has been a remarkably successful piece of terminology. It was rarely used before the 1990s, less frequently than formulations such as futures studies, futurology, and forecasting (the list could go on: prospectives, prognostics, futuribles, futuristics…). Figure 1.1 depicts the remarkable rise of this term. Foresight has effectively displaced many of these terms, being used on an increasing scale since the 1990s (as documented by Miles, 2010). This is no doubt because of the success and successful diffusion of TFPs around the world from the early 1990s on. Sometimes this use is misleading, with quite narrow desk-based activities being labelled Foresight. So not everything that is now labelled Foresight is really

[2]The term 'institutional' here refers to "an aggregate of individual perceptions negotiated into some agreed form that becomes a property of the institution" (Loveridge 2009).

any advance on traditional forecasting and futures analysis. Likewise, not all Foresight is labelled as such. Recent years have also seen the new terminology, such as FLA (Forward Looking Activities), and FTA (Future-oriented Technology Analysis), and recently "Horizon Scanning" seems to have been used rather frequently to refer to a spectrum of activities extending well beyond the more technical meaning of the term. Variations in terminology seem in part to reflect particular individuals and organisations seeking to differentiate themselves (sometimes misleadingly), in part to stress specific activities such as Technology Assessment or computer simulation.

Why introduce yet another acronym—ForSTI—into this already-crowded field? First, in order to indicate that Foresight practices including participatory and policy activities, as well as prospective analyses, are involved. The activities are not simply forecasting, though examination of trends and possible futures are integral to ForSTI. Prospective analyses and associated efforts to elicit wide participation and influence policy agendas have been particularly honed in the context of STI activity and decisions. But often this is labelled as Technology Foresight (TF). ForSTI indicates that we are looking beyond TF as narrowly understood in terms of the features and capabilities of emerging technologies. ForSTI encompasses a wider range of activities—including "upstream" developments in science and research, and "downstream" developments in terms of innovations and innovation processes and their outcomes, and more contextual phenomena such as the evolving structure of innovation systems. Many TF exercises (especially more recent ones) have been ForSTI in this sense. It is not uncommon for TF exercises to drop the "Technology" prefix and simply been labelled as Foresight. We have not followed in this usage, because we are focussing in this book on Foresight applied to the STI field, and the specificities that this involves.

Using This Book

We frame ForSTI as a process involving a number of activities. These activities, while overlapping and subject to several iterations, can be viewed in terms of a succession of stages. This book, after introducing the subject and its background in more depth (Chap. 2), will be organised in terms of this somewhat idealised succession of stages.

We shall examine the issues confronted at the outset, in terms of determining just what sort of activity is being undertaken, what objectives are pursued, what methods are used, what participants enlisted, and what management frameworks are adopted and decisions made (Chap. 3). We shall consider how the work is to be structured, and how key participants are identified and encouraged to be engaged in the process (Chap. 4). We outline some of the main methods applied to scan horizons and gather intelligence for ForSTI (Chap. 5). We then examine ways of eliciting and analysing expert opinions, which remain important sources of evidence about possible futures (Chap. 6). Methods for exploring alternative futures, explicating the range of contingencies that may be confronted, are the next topic (Chap. 7). We consider how we can elaborate our understanding of how things are related to each other as systems, through modelling approaches of various kinds

(Chap. 8). Following the appraisals of future prospects, we turn our attention to how strategies to create desirable futures may be developed and assessed (Chap. 9). Finally, the book explores ways in which ForSTI can be used to help establish priorities and provide more recommendations for action, how it can be followed up by efforts to disseminate and apply these results, and how we can assess and evaluate the ForSTI process itself (Chap. 10)—and hopefully embed it further into decision-making (Chap. 11). In all of these cases, we combine discussions of the key ideas and principles involved, with case studies drawn from various exercises and countries, and dealing with a range of STI issues.

The case studies are sometimes part of a continuous text, but we will present some more extended cases in the form of Boxes that can be read separately, if desired. Each chapter is structured in such a way that the reader can quickly see which sections deal with general orientation, with specific concepts and principles, with explication of tools and methods, and with case studies.

These structural features are intended to make this book useful for a range of readers interested in ForSTI ideas and approaches. It is especially aimed at those interested in how these ideas and approaches can be applied in practice. The book can be read as a single narrative, but particular topics can be easily located via the table of contents (and the index) and thus rapidly accessed when required.

An Overview of the Structure of This Book

More specifically, the following chapter will continue to elaborate the case, sketched in above, for considering Foresight and in particular ForSTI to be increasingly important activities, ones that need to be addressed in serious and systematic ways. Following this, Chap. 3 will discuss the initiation of such activities—how we need to scope and manage them. Since, as we shall argue, interaction with stakeholders and sources of knowledge is a key element of ForSTI processes, Chap. 4 discusses the issues that arise in this respect.

The next set of chapters deal with the main methods typically applied in ForSTI activities. Though we present them in an order that reflects a common and systematic way of going about the process (as outlined in Chap. 2, in fact), they do not need to be read in this order. Furthermore, many of the methods may be applied at multiple stages of the ForSTI process, and various different ways of designing and implementing the tools involved can be brought to bear.

Chapter 5 examines Horizon Scanning and the gathering of intelligence for a ForSTI exercise: this is normally a very early step in the process, but it is also something that needs to be attended to more continually. Chapter 6 goes on to consider ways in which this intelligence may be further gathered, and inputs synthesised so as to appraise possible futures, by methods such as Delphi. Delphi tools are in reality rather flexible, and some designs allow for their application to other tasks such as priority setting. Chapter 7 introduces scenario analysis, which involves imagination and integrates various partial appraisals of possible developments into more coherent accounts of prospects and choices. Chapter 8 concerns the informal and more quantitative models that underpin our analyses and appraisals.

Chapter 9 discusses methods for integrating and interpreting these appraisals, so as to help guide action through strategies. The chapter outlines Critical Technology Analysis and other approaches to priority setting as well as techniques that form roadmapping. Next, Chap. 10 first considers a variety of outputs and outcomes generated through ForSTI, and their reporting and dissemination. The chapter involves a discussion of the impact of ForSTI, and how to go about evaluating ForSTI exercises.

A round-up of conclusions that emerge from the overviews of numerous aspects of ForSTI in the course of this book will be presented in Chap. 11.