Preface

The motto of the Chicago World Fair in 1933: 'Science finds, industry applies, man conforms', sounds like something from another age. The linear science–technology–use schema no longer works today. Engineers are questioning user-centred design as the benefits of technological progress no longer appear obvious to all and the harmful consequences of technology, or at least the risks it entails, are a prominent topic on the public agenda. Technology assessment procedures urge us to reflect on technological choices. But experts and politicians do not necessarily have the answers that enable us to make wise choices. Other actors, especially ordinary individuals, need to be involved; hence, the recent development of public participation and citizen panels.[1]

Three-quarters of a century after the Chicago World Fair, technology is still one of the kingpins of our societies, but the number of actors who wish to be involved in technological choices is now far greater. In this new context, the social science output on the subject has increased substantially. Social scientists are regularly invited to work with technology assessment offices as well as with industrial research laboratories.

As the social science production in this sphere has grown, it has simultaneously undergone profound change. In standard theories, technology was a black box that the social sciences rarely opened. They studied general frameworks (research and development expenditures), the diffusion of innovations and their effects on daily life or business environments, but showed very little interest in the shaping of technology or even in the details of its uses. When studying technology, social scientists set off from their home ground. They consequently projected their own perspectives onto it: economists of growth examined the role of technology in their model; sociologists of communication saw the diffusion of innovations as an interesting case for analysing the influence of the media; historians created a subdiscipline, the technical history of technology which explored the evolution of technologies over time, without regard for other factors of social life.

From the 1980s, a number of social scientists decided to pay far more attention to technology, to study its different dimensions and to do so in places in which they had rarely undertaken research: the research laboratory,

but also the home or the office, where technologies were used on a daily basis. They started to study not only successful objects but also abortive attempts and failures, both objects that were used and those that spent their life in a cupboard. Like physicists who, in exploring matter, try to find increasingly small elementary particles, social scientists started to examine the technical object from the inside, in more and more detail. Behind their approach lay the questions: which choice was made when the technical object was designed, and what do users do with it? The idea was not to draw up the technological genealogy of the one best solution, or to examine how engineers responded to the needs of humans or markets, but rather to examine the processes of trial and error, and the different alternative routes. Finally, some contemporary studies consider that the technical object is not only a functional entity; it also conveys meaning. The object is not only material; it is also symbolic.

All these approaches have marked a profound departure from standard theories. However, most of them still separate the design and production of technologies from their use. To be sure, contemporary research on design does include users; not only is it user-centred, but it also considers that certain users, the lead users, play a crucial part in design (von Hippel, 2002). Many social scientists would therefore agree with a former director of the Xerox research lab that 'design and use mutually shape one another in iterative, social processes' (Brown and Duguid, 1994: 29). As for sociologists who observe uses, whereas they no longer pay attention to the technology, some do observe the relationship with the object in detail: representation, manipulation, choice of functionalities and so on. The question is not whether people use a machine but what they actually do with it. Turkle (1982), for example, asked this question in respect of computers, while Jouët (1994) analysed how the everyday life communication process became increasingly technical. Yet, despite the unquestionable advances of all these research studies, they are still situated either in the sphere of design or in that of use. The aim of this book is to go one step further and to combine the two perspectives within the same analysis.

To present this new approach, it is necessary to discuss the different social science theories on technology. I shall therefore present them in some detail. Of course an entire overview of the social science literature on the subject is not possible within the scope of this book. My intention is critically to examine a range of works with a view to formulating a new approach to the analysis of technological innovation. The choice of authors with whom I establish a dialogue is partly subjective; the order in which I present their work is that which seemed most appropriate for the construction of my approach.

I wish also to point out that the authors in question belong to various disciplines: sociology, history, economics and anthropology. This choice naturally reflects a wish to be situated within the field of social science as a whole. The drawback of such an approach is that it involves the real risk of concepts being borrowed carelessly and taken out of the theoretical framework in which they are meaningful. I nevertheless felt that this risk could be taken because many of the works on which I drew already had a pluri-disciplinary dimension associating historians, economists, sociologists and anthropologists. Moreover, my main aim was actually less to situate myself in the all-embracing sphere of social science, than to base the construction of my thesis on boundary concepts that lie at the interface between several disciplines, the fertility of which is a direct result of their heterogeneity.

This reflection on innovation is therefore of a general nature, but the cases used to illustrate my arguments are drawn primarily from the field of information and communication technology (ICT). I have studied old technologies of the nineteenth and early twentieth centuries (Flichy, 1995) as well as new ones, especially videotext (Jouët et al., 1991) and the Internet (Flichy, 2007). I shall use these examples to illustrate my theoretical reflection on innovation, which matured during my studies of these subjects and was fed, to a large extent, by that research.

The first version of this book was published in French. This English version has been amended substantially to give more consideration to the English-language literature on the subject and to take into account research on technological innovation or ICTs published recently[2]. While this volume therefore has a strong international dimension, it nevertheless remains rooted in a French research tradition. This is more specifically the case when I diverge from my own scientific background (the sociology of technology and of ICTs). Hence, the passage that examines how the sociology of work has addressed the subject of technology draws essentially on the French tradition, which is particularly rich in this respect, while the US and British traditions are simply mentioned in passing. Likewise, the rich tradition of feminist, green and development studies has not been included.

The translation from French to English sometimes involves problems of terminology. In French, we clearly distinguish technique from technology. As Leroi-Gourhan (1964) put it, a technique is a combination of gesture and tool. It always associates the object or machine with the human being who builds and uses it. Technology, by contrast, is the study and knowledge of techniques. In English the word 'technology' tends to embrace both meanings.

The route followed in this book consists of three steps. In Part I, I present standard theories on technology, organized around a clear division between technology and society. While some studies focus on laboratories

and inventors, others concentrate on the diffusion of a technology and its uses, without the two ever meeting. More significantly, while some scholars examine the conditions of innovation and others its diffusion, the technology itself remains excluded; it is a black box into which nobody dares to look. When, in other theories, a link is established between technology and society, this relationship is always seen from a deterministic viewpoint. The main question is then to know which of the two determines the other or, at least, influences it.

Alongside these largely dominant theories in economics, sociology and history, new approaches have been proposed by anthropology and the new sociology of science and technology (Social Construction of Technology: SCOT; and Actor Network Theory: ANT). They try to open the black box and to consider both technological and social questions. This is the theme of Part II. After presenting this research tradition, with studies of use of ICTs in everyday life and in the workplace, and drawing upon the contribution of interactionist sociology, I present my own approach to innovation. I study how the socio-technical action of the different actors in innovation, particularly designers and users, is organized within the same frames of reference. The most original aspect of this position is that it presents an approach which focuses as much on the design of technologies as on their use.

Part III introduces a new element into the model: time. What part does it play and how is it involved in technological choices? This analysis concerns not only the series of technological events studied in an evolutionary approach or in a switch of paradigm, and the irreversibility of choices made, but also the evolution of representations and of technological and social utopias. Social imagination or *imaginaire* plays an important role in the shaping of innovation. With these basic elements we are able to study the different phases through which both the functioning and the uses of an innovation are developed.

NOTES

1. See the special issue of *Science and Public Policy*, 1999, **26** (5).
2. For bibliographic references and citations, the English-language versions of English-language publications are always used. In the case of French publications, we have translated the citations ourselves. If an English version of the publication exists, it is noted in the bibliography.