INTRODUCTION

Technology is at the very centre of human activities. Historical periods are known by the leading technologies employed in them. Technology largely determines the way societies and individuals live. Our present period is often called post-industrial because production technologies are so advanced and so automated that vast quantities of goods are produced with little employment of labour. The age is also known as the age of information technologies (IT) because these modern technologies are dominant in shaping much of our present economic life.

Technology has made humans the undisputed dominant species on earth. Humans without technology are feeble creatures – with technology they conquer all before them. Yet our seemingly omnipotent technology is the greatest threat to the very existence of life on earth. We are destroying our natural habitat to an unprecedented and highly dangerous extent. With the aid of technology we have created enormous wealth, and yet we try hard to become even wealthier. We regard technology and technological innovation as the means toward the end of economic growth. Technological innovation is regarded as the main source of economic growth, and economic growth has become the very pinnacle of our desire. Economic growth means increased wealth and we tend, falsely, to identify increased wealth with increased happiness. Thus we are torn between praise and damnation of technology and charge our political system with fostering technology and yet curbing its apparent excesses. We are aware that we need to tread a narrow path between support and control, yet find it rather difficult to find the right compromise, to steer the right course between high hope and deep fear.

Despite the central role that technology plays in human affairs, there are very few books that attempt to clarify the way technology develops and the way it contributes to the development of society. These are the themes that have been at the centre of my interests for the past thirty years. The present book represents an attempt to shed light upon relationships between social and technological developments.

The method chosen is the historical approach. I believe that viewing the historical development of technology and of society in parallel is the most profitable way of gaining insights into the mutual relationships and influences.

Perhaps I am taking the historical approach to its extreme in beginning with the earliest dawn of humankind and ending with the present and a little beyond. It seems to me that this approach is likely to yield new insights and it is up to my readers to judge whether this is the case.

The book may be viewed in two alternative ways. It may be seen as a history of technology, albeit sketchy and selective, with remarks upon the social conditions and interactions between technology and society at any given historic period. Alternatively, and preferably, it may be viewed as an attempt to clarify the basic relationships between technology and society, illustrated by historic examples. I accept the dual nature of the book but hope that the attempt to clarify the interactions between technology and society will be seen to have the upper hand. These relationships are certainly uppermost in my mind.

My objective in writing this book is to achieve an overview of the ways in which technology shapes society and, in turn, is shaped by society. I aim to achieve some general understanding of the interaction and interdependence of technology with the society that creates and uses it. I hope that improved understanding of the mechanisms of interaction between society and its technology may lead to more beneficial and less destructive uses of technology.

Technology is at the core of all material and economic human activities and there can be no doubt that such activities dominate much of our thinking, all of our work, and much of our time.

Before turning to the development of technology and society through the ages, we should define our terms. I shall dodge the problem of defining society. Nearly all of us know what society is and very few subscribe to the view expressed by one recent politician, who claimed that there was no such thing as society. I shall leave each reader with his or her own understanding of what constitutes human society. To define this apparently simple concept unequivocally and comprehensively is fraught with too many difficulties to make the attempt worthwhile in the context of this book. In highly simplified and general terms, society is the community of humans living at a given time in a given geographic or organisational entity. Each society is characterised by certain prevailing relationships, legal frameworks, hierarchical and power structures and, of course, by the technologies it uses.

We next need to define technology, and this is a task that I do not feel free to dodge. The Encyclopædia Britannica (2000 edition) defines technology as "*the means or activity by which man seeks to change or manipulate his environment*". The word technology is thus a noun that describes certain classes of artefacts, as well as certain classes of activities. An alternative definition is "the application of scientific knowledge to the practical aims of human life". I regard this definition as unsuitable because it applies only to high technology and not to older, simpler, technologies. There is some justification for such a definition in certain languages, e.g. German, because the word 'Technik' can be used to describe simple technologies and the word 'Technologie' to describe science-based technologies. In my own definition *technology is the production and use of artefacts for human purposes*. Alternatively we can say that *technology is the way and the means of achieving practical human purposes*. The essential feature of technology is the production and use of artefacts. The artefacts involved are tools or machines or chemical entities. The term 'practical' (we might say 'material') distinguishes the purposes achieved by technology from purely spiritual, educational, cultural, or organisational purposes.

Some higher animals use objects found in nature, such as twigs, stones or leaves to achieve practical purposes like fighting, crushing nuts or soaking up inaccessible water. We might term these objects tools, but they are not purpose-made artefacts. They are natural objects, maybe slightly modified, but not planned, designed and produced for a specific task. Hence my emphasis on the use of artefacts: only humans manufacture artefacts for the achievement of their purposes. The distinction between producing and using a chipped stone as a tool, as early humans did, and using chewed leaves to sponge up water, as chimpanzees do, is rather slender, but perhaps the difference between early humans and apes was rather slender.

Definitions serve the purpose of describing certain objects or activities to the exclusion of all others. Too broad a definition serves no useful purpose. I disagree with S. Macdonald[1] when he says "…it is quite possible to view change in administrative or managerial practices as technological change …." Of course it is possible, but it is not helpful. We do not wish to define technology so broadly as to make any bishop into a technology manager, although his activities are in part managerial and do serve some human purpose. On the other hand, there can be no doubt that a bishop, just as any other member of modern human society, uses technology in many of his daily tasks. So ubiquitous has technology become that we use it all the time in almost all that we do. The simplest definition of technology as "*the way humans achieve their material purposes*" is not far off the mark.

Cooperation between individuals and groups has been a vital feature of human societies since the dawn of humankind. Even very early hunters, to give an example, cooperated in hunting animals and used various weapons, such as wooden spears, in a concerted effort to trace, chase, and kill. The use of the spear is technology, whereas the organisation of the hunt, and the various ruses used, we shall term *social organisation*, rather than technology. The activity of hunting, as so many social activities, requires technology as well as social organisation. Indeed the use of technology is generally associated with, or even dependent upon, social organisation.

The word technology has a somewhat high-powered ring to it. We often use the word *technique* instead, particularly to describe details of technical procedures. For the Stone Age, it is best to limit the use of the

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[1]   S. Macdonald, p. 27, in S. Macdonald et al., 1983

word technology to the general methods of manufacture of tools and other artefacts, while using the word technique to describe the detailed ways of using tools. We may speak of the techniques of butchering carcasses, or of providing shelter, producing clothing, and so forth. We also use the word technique to describe details of any particular method of, for example, knapping. The basic technology is using a hammer to shape a stone tool out of a natural blank, perhaps a large pebble of flint. The detailed way of splitting the stone, and of chipping flakes off it to obtain the desired tool may be termed technique. Other derived terms are the adjectives technical or technological and the nouns technician or technologist and several more.

Both words, technology and technique, are nouns. To describe actions associated with technology, as for all actions, we need verbs. Some verbs describing technical actions are directly associated with the word describing the tool used. Thus hammer, and saw are nouns and verbs; the verbs scrape and bore are associated with the nouns scraper and borer. But we sew when using needle and thread, we thrust or throw when using a spear and we build or construct a shelter when using a variety of tools and techniques.

Much linguistic development is associated with the development of technology. A very large number of our words are used to describe artefacts and technology, and the number of words increases with technological progress. Computer and information technology have contributed a large number of English words that have come into use throughout the world. Examples are computer and computing, CD (compact disc), DVD (digital video disc), Internet, e-mail, LAN (local area network), modem, and many more. Some older words have acquired additional meanings: surfing, virus, café, or web.

Tools are means to an end. Some tools are used to make other tools, and thus satisfy our needs less directly. Even in earliest times humans used stones as hammers or anvils to make stone tools that were used to produce food or achieve some other desirable objectives. We may regard weapons as a special form of tool used either for hunting – and thus the production of food – or to kill enemies in the pursuit of some economic or social objective. In all cases tools are used to enhance, amplify or supplement our innate abilities. A hammer adds hardness to our hands and helps to focus muscle-power; an aeroplane enables us to fly; a computer amplifies our memory and adds speed to our mathematical powers.

The prime purpose of all living creatures is survival, and humans are no exception in this respect. Thus the needs that arise directly out of the primary purpose of survival are primary needs and were the first to be served by the earliest technology. Gradually technology became able to serve further needs and its focus shifted from aiding sheer survival to becoming an essential economic force. In modern societies technologies mainly serve to make money, to help the economy to grow. The focus of technology has shifted from satisfying primary needs to the satisfaction of human greed. This is true for producers of technology who are after profits and consumers of technology to expect technology to satisfy ever more sophisticated and far-ranging demands. How this happened is the story of this book.

Over the years, I have derived much benefit and pleasure from numerous discussions with students and colleagues on the subject matter of this book. All of them, too numerous to name, I thank wholeheartedly. My thanks are also owing to my wife for putting up with my frequent physical and mental absences and my obsessive preoccupation with the task of writing this book. Special thanks to Geoffrey Boyfield and Helge Torgersen for reading an earlier version of the whole manuscript and offering much helpful comment.

Hadleigh, March 2009   Ernest Braun