Different types of innovation

Industrial innovation includes not only major (radical) innovations but also minor (incremental) technological advances. Indeed, the definition offered above suggests that successful commercialisation of the innovation may involve considerably wider organisational changes. For example, the introduction of a radical, technological innovation, such as digital cameras by Kodak and Fuji, invariably results in substantial internal organisational changes. In this case, substantial changes occurred with the manufacturing, marketing and sales functions. Both of these firms decided to concentrate on the rapidly developing digital photography market. Yet both Fuji and Kodak were the market leaders in supplying traditional 35mm film cartridges. Their market share of the actual camera market was less significant. Such strategic decisions forced changes on all areas of the business. For example, in Kodak's case, the manufacturing function underwent substantial changes as it began to substantially cut production of 35mm film cartridges. Opportunities existed for manufacturing in producing digital cameras and their associated equipment. Similarly, the marketing function had to employ extra sales staff to educate and reassure retail outlets that the new technology would not cannibalise their film-processing business. Whilst many people would begin to print photographs from their PCs at home, many others would continue to want their digital camera film processed into physical photographs. For both Fuji and Kodak, the new technology has completely changed the photographic industry. Both firms have seen their revenues fall from film cartridge sales, but Kodak and Fuji are now market leaders in digital cameras, whereas before they were not.

Hence, technological innovation can be accompanied by additional managerial and organisational changes, often referred to as innovations. This presents a far more blurred picture and begins to widen the definition of innovation to include virtually any organisational or managerial change. Table 1.5 shows a typology of innovations.

Innovation was defined earlier in this section as the application of knowledge. It is this notion that lies at the heart of all types of innovation, be they product, process or

Table 1.5 A typology of innovations

Type of innovation	Example
Product innovation	The development of a new or improved product
Process innovation	The development of a new manufacturing process such as Pilkington's float glass process
Organisational innovation	A new venture division; a new internal communication system; introduction of a new accounting procedure
Management innovation	TQM (total quality management) systems; BPR (business process re-engineering); introduction of SAPR3*
Production innovation	Quality circles; just-in-time (JIT) manufacturing system; new production planning software, e.g. MRP II; new inspection system
Commercial/marketing innovation	New financing arrangements; new sales approach, e.g. direct marketing
Service innovation	Internet-based financial services

**Note*: SAP is a German software firm and R3 is an enterprise resource planning (ERP) product.

service. It is also worthy of note that many studies have suggested that product innovations are soon followed by process innovations in what they describe as an industry innovation cycle (see Chapter 6). Furthermore, it is common to associate innovation with physical change, but many changes introduced within organisations involve very little physical change. Rather, it is the activities performed by individuals that change. A good example of this is the adoption of so-called Japanese management techniques by automobile manufacturers in Europe and the United States.

It is necessary to stress at the outset that this book concentrates on the management of product innovation. This does not imply that the list of innovations above are less significant; this focus has been chosen to ensure clarity and to facilitate the study of innovation.

Technology and science

We also need to consider the role played by *science and technology* in innovation. The continual fascination with science and technology at the end of the nineteenth century and subsequent growth in university teaching and research have led to the development of many new strands of science. The proliferation of scientific journals over the past 30 years demonstrates the rapidly evolving nature of science and technology. The scientific literature seems to double in quantity every five years (Rothwell and Zegveld, 1985).

Science can be defined as systematic and formulated knowledge. There are clearly significant differences between science and technology. Technology is often seen as being the application of science and has been defined in many ways (Lefever, 1992).

It is important to remember that technology is not an accident of nature. It is the product of deliberate action by human beings. The following definition is suggested:

Technology is knowledge applied to products or production processes.

No definition is perfect and the above is no exception. It does, however, provide a good starting point from which to view technology with respect to innovation. It is important to note that technology, like education, cannot be purchased off the shelf like a can of tomatoes. It is embedded in knowledge and skills.

In a lecture given to the Royal Society in 1992, the former chairman of Sony, Akio Morita, suggested that, unlike engineers, scientists are held in high esteem. This, he suggested, is because science provides us with information that was previously unknown. Yet, technology comes from employing and *manipulating science* into concepts, processes and devices. These, in turn, can be used to make our life or work more efficient, convenient and powerful. Hence, it is technology, as an *outgrowth of science*, that fuels the industrial engine. And it is *engineers* and not scientists who make technology happen. In Japan, he argued, you will notice that almost every major manufacturer is run by an engineer or technologist. However, in the United Kingdom, some manufacturing companies are led by chief executive officers (CEOs) who do not understand the technology that goes into their own products. Indeed, many UK corporations are headed by chartered accountants. With the greatest respect to accountants, their central concerns are statistics and figures of *past* performance. How can an accountant reach out and grab the future if he or she is always looking at *last* quarter's results (Morita, 1992)?