Innovation – What It Is and Why It Matters

CHAPTER 1

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LEARNING OBJECTIVES

By the end of this chapter you will develop an understanding of:

- what 'innovation' and 'entrepreneurship' mean and how they are essential for survival and growth
- innovation as a process rather than a single flash of inspiration
- the difficulties in managing what is an uncertain and risky process
- the key themes in thinking about how to manage this process effectively

> *'A slow sort of country' said the Red Queen. 'Now here, you see, it takes all the running you can do to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!'*
>
> *— Lewis Carroll, Alice Through the Looking Glass, 1872. Public domain.*

You don't have to look far before you bump into the innovation imperative. It leaps out at you from a thousand mission statements and strategy documents, each stressing how important innovation is to 'our customers/our shareholders/our business/our future and most often, our survival and growth'. Innovation shouts from advertisements

for products ranging from hairspray to hospital care. It nestles deep in the heart of our history books, pointing out how far and for how long it has shaped our lives. And it is on the lips of every politician, recognizing that our lifestyles are constantly shaped and reshaped by the process of innovation.

Innovation makes a huge difference to organizations of all shapes and sizes. The logic is simple – if we don't change what we offer the world (products and services) and how we create and deliver them, we risk being overtaken by others who do. At the limit, it's about survival, and history is very clear on this point: survival is not compulsory! Those enterprises that survive do so because they are capable of regular and focused change. (It's worth noting that Bill Gates used to say of Microsoft that it was always only two years away from extinction. Or, as Andy Grove, one of the founders of Intel, pointed out in his autobiography, 'only the paranoid survive!') [1].

In this chapter, we'll look at the challenge of innovation in more detail – what it is, why it matters and, most importantly, how we might think about organizing and managing the process.

1.1 THE IMPORTANCE OF INNOVATION

This isn't just hype or advertising babble – you can get a feel for the importance attached to it in **View 1.1**.

Innovation is strongly associated with *growth*. New business is created by new ideas, by the process of creating competitive advantage in what a firm can offer. While competitive advantage can come from size, or possession of assets, and so on, the pattern is increasingly coming to favour those organizations that can mobilize knowledge and technological skills and experience to create novelty in their offerings (product/service) and the ways in which they create and deliver those offerings. Economists have argued for decades over the exact nature of the relationship, but they have generally agreed that innovation accounts for a sizeable proportion of economic growth. In a recent book, William Baumol [2] pointed out that 'virtually all of the economic growth that has occurred since the eighteenth century is ultimately attributable to innovation'.

Research Note 1.1 gives some examples of this economic importance.

VIEW 1.1 INNOVATION – EVERYBODY'S TALKING ABOUT IT

- 'We believe in making a difference. Virgin stands for value for money, quality, innovation, fun and a sense of competitive challenge. We deliver a quality service by empowering our employees and we facilitate and monitor customer feedback to continually improve the customer's experience through innovation' (Richard Branson)
- 'Adi Dassler had a clear, simple, and unwavering passion for sport. Which is why with the benefit of 50 years of relentless innovation created in his spirit, we continue to stay at the forefront of technology', Adidas about its future (www.adidas.com)
- 'Innovation is our lifeblood', Siemens about innovation (www.siemens.com)
- 'Since 1899 HELLA has been continuously making its mark on the market with outstanding ideas. This innovative power is both the origin and the future of the company. Those who want to be global leaders must be – and stay – curious, persistent and flexible. Networking at all levels is the primary reason behind this wealth of ideas. Our employees from around the world contribute new, fresh ideas.' Hella Annual Report (www.hella.com)
- 'Innovation distinguishes between a leader and a follower', Steve Jobs, Apple
- 'John Deere's ability to keep inventing new products that are useful to customers is still the key to the company's growth', Robert Lane, CEO, John Deere

RESEARCH NOTE 1.1 Why Innovation Is Economically Important

OECD countries spend $1700 billion per year on R&D [3].

China has the ambition to spend 2.5% of gross domestic product (GDP) on research by 2020; in 2019 it spent 2.2%, equivalent to $278 billion.

South Korea and Israel are the world's most R&D-intensive countries, spending well over 4% of GDP on research and development. Other high performers in Asia included Japan at 3.35% and Chinese Taiwan at 3.1%.

In 2008, 16.8% of all firms' turnover in Germany was earned with newly introduced products, and in the research-intensive sector, this figure was 38%. During the same year, the German economy was able to save costs of 3.9% per piece by means of process innovations.

The European Union's Community Innovation Survey (CIS) reported in 2015 that 53% of the businesses were innovative, compared to 45% of the businesses in the 2013 survey; 61% of large businesses (those with more than 250 employees) and 53% of small and medium enterprises (those with 10 to 250 employees) were innovative.

In the United Kingdom, 28% of innovators were engaged in exports (compared with 10% of non-innovators); they reported employing more highly qualified staff, particularly staff with science and engineering degrees (12%, compared to only 4% of non-innovators). Twenty-five per cent of all businesses used technological (either product or process) innovation, and 42% of all businesses used nontechnological (organizational or market) innovation, and 27% reported engaging in 'new business practices'.

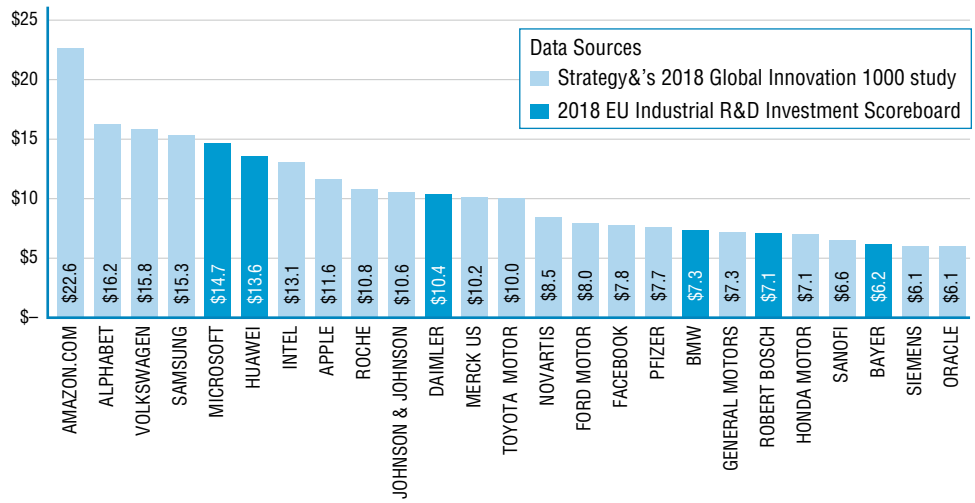

FIGURE 1.1 World's top 25 R&D spend 2018 (US$ billions)

Source: By Nick Skillicorn "Top 1000 companies that spend the most on Research & Development (charts and analysis)", IdeatoValue.com, 2019 https://www.ideatovalue.com/inno/nickskillicorn/2019/08/top-1000-companies-that-spend-the-most-on-research-development-charts-and-analysis/

Figure 1.1 shows the huge amount committed to R&D in some of the world's most successful businesses.

The consulting firm PWC runs a regular survey of senior executives on the theme of innovation; in their 2015 Global Innovation Survey, almost half of the 1757 executives interviewed (43%) felt that innovation is a 'competitive necessity' for their organization. This was not simply an act of faith; PWC data suggests that leading *innovators can expect significant rewards both financially and in terms of competitive positioning. 'Over the last three years, the most innovative companies in our study delivered growth at a rate of 16% above that of the least innovative . . . In five year's time, they forecast that their rate of growth will further increase to almost double the global average, and over three times, higher than the least innovative. For the average company, this equates to $0.5bn more revenue than their less innovative peers*' [4].

Similarly, BCG in their report on the world's top 50 innovative companies draws similar conclusions. The importance issue remains the same – with 79% of respondents in 2015 ranking it as their most important strategic priority, up from around 66% in 2005. And the benefits expected include not only market share but also speed of entry into new and fast-growing fields [5].

Case Study 1.1 gives some more examples of the link between innovation and growth.

CASE STUDY 1.1 Growth Champions and the Returns from Innovation

Tim Jones has been studying successful innovating organizations for some time, looking to try and establish a link between those organizations that invest consistently in innovation and their subsequent performance [3]. His findings show that over a sustained period of time, there is a strongly positive link between the two; innovative organizations are more profitable and more successful.

Tim Jones talked about the Growth Champions project in a 2014 interview: **https://www.youtube.com/watch?v=O91BxG14G1c.**

1.2 INNOVATION IS NOT JUST HIGH TECHNOLOGY

Importantly, innovation and competitive success are not simply about high-technology companies; for example, the German firm Wurth is the largest maker of screws (and other fastenings such as nuts and bolts) in the world with a turnover of €15 billion in 2019. Despite low-cost competition from China, the company has managed to stay ahead through an emphasis on product and process innovation across a supplier network similar to the model used in computers by Dell. In a similar fashion, the UK Dairy Crest business (now part of the Canadian food giant Saputo) has built up a turnover of nearly €1.5 billion (2018) by offering a stream of product innovations including resealable packaging, novel formats and new varieties of cheese and related dairy products, supported by manufacturing and logistics process innovations [8]. The Danish company Christian Hansen has spent the last two hundred years supplying a huge range of live bacterial cultures to the food industry around the world. Their natural food colours are also extensively used and they have a growing presence in the field of healthcare via probiotics. Their dominance of this niche traces its roots to a commitment to innovation, borne out of the earliest days of the company as a university lab-based spin out [4].

Another long-established German firm, Wilo was founded in 1872 and has evolved into one of Europe's most successful manufacturers of pumps for a wide range of domestic and industrial applications. And Hella manufactures the lion's share of headlights (as well as many other automobile electronic parts), having built from a nineteenth century startup to a €7 billion company employing 35,000 people worldwide. Both survived and grew through a consistent commitment to innovation in products, processes and markets [5].

Research Note 1.2 gives some more examples of the link between innovation and economic performance.

RESEARCH NOTE 1.2 Company-level Innovation Performance

At the level of the firm, a number of research studies have regularly highlighted the link between performance and innovation – for example Kumar and Li of the University of Houston found that '. . . innovative capacity is positively related to subsequent cumulative stock returns . . .' [6]. Innovative companies tend to enjoy greater profits, faster profit growth, larger profit margins and other profit metrics as compared to non-innovative firms. Importantly this is not due to investments in R&D alone but rather to the ability to convert knowledge into value. Another study found that firms that have been successful innovators '. . . in the past earn substantially higher future stock market returns than firms that invest identical amounts in R&D but that have poor track (innovation) records . . .' [7]. This finding emerges from many studies – for example the Boston Consulting Group's 2018 survey of the top 1000 innovating firms concluded 'There is no long-term correlation between the amount of money a company spends on its innovation efforts and its overall financial performance. Instead, what matters is how companies use that money and other resources, as well as the quality of their talent, processes, and decision making, to create products and services that connect with their customers' [8].

Case Study 1.2 gives an example of how innovation can strengthen competitive position.

CASE STUDY 1.2 Running Away with the Competition

Shoes have been around for a very long time – archaeologists have found them from 40,000 years ago. And even sports shoes are not that new – the first footwear designed to help improve running performance were developed by Adolf Dassler in 1920 (giving the brand name 'Adidas' from a shortening of his name).

So you could be forgiven for thinking that by now there is little room for innovation in this space. But you'd be wrong – in an industry worth an estimated $13 billion globally the pressure to keep introducing new products and services is intense. It has led to new designs, new fabrics, new approaches to the process of getting shoes to fit exactly (Adidas with its 'mi-adidas' platform now enables a user to have the shoes custom made for them using various 3D imaging and printing technologies. Nike even has a version of its shoes with self-tying shoelaces which can be controlled from a smartphone).

But while the major players in this industry have been running neck and neck for some time, Nike has recently achieved a breakthrough. Its Vaporfly shoes were developed to include a carbon-fibre plate and a wedge of soft, energy-returning foam that help runners move at least 4% more efficiently. Independent research studies have backed up this claim; the shoe offers such a significant improvement to performance that it risked being banned from the 2021 Olympics and even now creates controversy in sporting circles. A report by *Wired* magazine suggests that '*twice as many men and women ran faster than 2:10 and 2:27 for a marathon than before the shoe's debut in 2016. For elite athletes, a Vaporflys could make a reduction of one to two minutes across an entire marathon. It's potentially the difference between coming first and coming fifth*' [9].

It has helped athletes break multiple world records – and also thrown down a big challenge to other manufacturers to catch up; at a recent Japanese marathon, television showed 84% of the athletes wearing the Nike shoe. The impact on Asics, the local competitor brand, was dramatic, the share price falling sharply. By contrast Nike has been streaking ahead; since the shoes were introduced its share price has risen by 90% [10].

The fuss is, of course, not about the running track but about the message sent to the millions of 'ordinary' people who run for pleasure and whose role models are now winning in such style. Despite their high cost – a pair of Vaporfly shoes currently cost $250 – the prospect of a performance boost is irresistible.

Needless to say the big competitors in the field like Asics and Adidas have been running hard to catch up with their own versions of carbon fibre plate shoes. Only now, three years after the Vaporfly trainers first emerged, are running shoe rivals releasing their own versions of footwear with carbon fibre plates installed combined with soft foam cushioning – the new dominant design. But it takes time and money to develop such offerings and competitors like Adidas are currently on the back foot; sales of its 'Boost' shoe have flattened out reflecting its age and lack of excitement compared to Nike's product.

Of course, not all games are about win/lose outcomes. Public services such as health care, education and social security may not generate profits, but they do affect the quality of life for millions of people. Bright ideas when implemented well can lead to valued new services and the efficient delivery of existing ones at a time when pressure on national purse strings is becoming ever tighter. For example, the Karolinska Hospital in Stockholm managed to make radical improvements in the speed, quality and effectiveness of its care services – such as cutting the waiting lists by 75% and cancellations by 80% – through innovation [11]. Similar dramatic gains have been made in a variety of Indian health-care operations, and suggest important new directions for global health-care management to help deal with the crisis of rising demands but limited resources [12]. Public sector innovations have included the postage stamp, the National Health Service in the United Kingdom and much of the early development work behind technologies such as fibre optics, radar and the Internet.

And new ideas – whether wind-up radios in Tanzania or microcredit financing schemes in Bangladesh – have the potential to change the quality of life and the availability of opportunity for people in some of the poorest regions of the world. There's plenty of scope for innovation and entrepreneurship, and sometimes, this really is about life and death – for example, in the context of humanitarian aid for disasters.

Table 1.1 gives some examples drawn from across the spectrum showing how innovation makes a difference to organizations of all shapes and sizes.

Table 1.1 Where Innovation Makes a Difference

Innovation Is About . . .	Examples
Identifying or creating opportunities	Innovation is driven by the ability to see connections, to spot opportunities, and to take advantage of them. Sometimes, this is about completely new possibilities – for example, by exploiting radical breakthroughs in technology. New drugs based on genetic manipulation have opened a major new front in the war against disease. Mobile phones, tablets, and other devices have revolutionized where and when we communicate. Even the humble window pane is the result of radical technological innovation – these days, almost all the window glass in the world is made by the Pilkington float glass process, which moved the industry away from the time-consuming process of grinding and polishing to get a flat surface. James Dyson built a global business by applying new technologies to domestic appliances such as vacuum cleaners and hand driers.
New ways of serving existing markets	Innovation isn't just about opening up new markets – it can also offer new ways of serving established and mature ones. Low-cost airlines are still about transportation – but the innovations that firms such as Southwest Airlines, EasyJet and Ryanair introduced have revolutionized air travel and grown the market in the process. Despite a global shift in textile and clothing manufacture towards developing countries, the Spanish company Inditex (through its retail outlets under various names including Zara) has pioneered a highly flexible, fast-turnaround clothing operation with over 2000 outlets in 52 countries. It was founded by Amancio Ortega Gaona, who set up a small operation in the west of Spain in La Coruna – a region not previously noted for textile production – and the first store opened there in 1975. They now have over 5000 stores worldwide and are now the world's biggest clothing retailer; significantly, they are also the only manufacturer to offer specific collections for Northern and Southern Hemisphere markets. Central to the Inditex philosophy is the close linkage between design, manufacture and retailing, and their network of stores constantly feeds back information about trends that are used to generate new designs. They also experiment with new ideas directly on the public, trying samples of cloth or design and quickly getting back indications of what is going to catch on. Despite their global orientation, most manufacturing is still done in Spain, and they have managed to reduce the turnaround time between a trigger signal for an innovation and responding to it to around 15 days.
Growing new markets	Equally important is the ability to spot where and how new markets can be created and grown. Alexander Bell's invention of the telephone didn't lead to an overnight revolution in communications – that depended on developing the market for person-to-person communications. Henry Ford may not have invented the motor car, but in making the Model T – 'a car for everyman' at a price most people could afford – he grew the mass market for personal transportation. And eBay justifies its multibillion-dollar price tag not because of the technology behind its online auction idea but because it created and grew the market.
Rethinking services	In most economies, the service sector accounts for the vast majority of activity, so there is likely to be plenty of scope. And the lower capital costs often mean that the opportunities for new entrants and radical change are greatest in the service sector. Online banking and insurance have become commonplace, but they have radically transformed the efficiencies with which those sectors work and the range of services they can provide. New entrants riding the digital wave have rewritten the rule book for a wide range of industrial games – for example, Amazon in retailing, eBay in market trading and auctions, Google in advertising, Skype in telephony, Uber in transportation and Airbnb in accommodation.
Meeting social needs	Innovation offers huge challenges – and opportunities – for the public sector. Pressure to deliver more and better services without increasing the tax burden is a puzzle likely to keep many civil servants awake at night. But it's not an impossible dream – right across the spectrum, there are examples of innovation changing the way the sector works. For example, in health care, there have been major improvements in efficiencies around key targets such as waiting times. Hospitals such as the Leicester Royal Infirmary in the United Kingdom or the Karolinska Hospital in Stockholm, Sweden, have managed to make radical improvements in the speed, quality and effectiveness of their care services – such as cutting the waiting lists for elective surgery by 75% and cancellations by 80% – through innovation.
Improving operations – doing what we do but better	At the other end of the scale, Kumba Resources is a large South African mining company that makes another dramatic claim – 'We move mountains'. In their case, the mountains contain iron ore, and their huge operations require large-scale excavation – and restitution of the landscape afterward. Much of their business involves complex large-scale machinery – and their ability to keep it running and productive depends on a workforce able to contribute their innovative ideas on a continuing basis.

Survival and growth pose a problem for established players but a huge opportunity for newcomers to rewrite the rules of the game. One person's problem is another's opportunity, and the nature of innovation is that it is fundamentally about *entrepreneurship*. The skill to spot opportunities and create new ways to exploit them is at the heart of the innovation process. Entrepreneurs are risk-takers – but they calculate the costs of taking a bright idea forward against the potential gains if they succeed in doing something different – especially if that involves upstaging the players already in the game. **Case Study 1.3** gives some examples of such entrepreneurship in action.

CASE STUDY 1.3 Finding Opportunities

Back in 1877 Sally Windmuller set up a small business near his home town of Lippstadt in Germany making and selling accessories and equipment for farm transportation – lamps, harnesses, horns and so on to go on their buggies, wagons and bicycles. By 1895 it was a thriving business with a factory employing 120 people; four years later in 1899 he set up the company Hella making headlamps and horns for the emerging world of 'horseless carriages' along with other entrepreneurs in the nascent automobile industry. Over the next hundred years this grew to become a global company turning over €7 billion and employing 35,000 people, dominating the headlamp market and also playing an increasingly important role in automotive electronics.

When the Tasman Bridge collapsed in Hobart, Tasmania, in 1975, Robert Clifford was running a small ferry company and saw an opportunity to capitalize on the increased demand for ferries – and to differentiate his by selling drinks to thirsty cross-city commuters. The same entrepreneurial flair later helped him build a company – Incat – that pioneered the wave-piercing design, which helped them capture over half the world market for fast catamaran ferries. Continuing investment in innovation has helped this company from a relatively isolated island build a key niche in highly competitive international military and civilian markets.

People have always needed artificial limbs, and the demand has, sadly, significantly increased as a result of high-technology weaponry such as mines. The problem is compounded by the fact that many of those requiring new limbs are also in the poorest regions of the world and unable to afford expensive prosthetics. The chance meeting of a young surgeon, Dr Pramod Karan Sethi, and a sculptor, Ram Chandra, in the hospital in Jaipur, India, has led to the development of a solution to this problem – the Jaipur foot. This artificial limb was developed using Chandra's skill as a sculptor and Sethi's expertise and is so effective that those who wear it can run, climb trees, and pedal bicycles. It was designed to make use of low-tech materials and be simple to assemble – for example, in Afghanistan, craftsmen hammer the foot together out of spent artillery shells, while in Cambodia, part of the foot's rubber components are scavenged from truck tires. Perhaps the greatest achievement has been to do all of this at a low cost – the Jaipur foot costs only $28 in India. Since 1975, nearly 1 million people worldwide have been fitted with the Jaipur limb, and the design is being developed and refined – for example, using advanced new materials.

Not all innovation is necessarily good for everyone. One of the most vibrant entrepreneurial communities is in the criminal world where there is a constant search for new ways of committing crime without being caught. The race between the forces of crime and law and order is a powerful innovation arena – as works by Howard Rush and colleagues have shown in their studies of 'cybercrime' [13].

1.3 IT'S NOT JUST PRODUCTS . . .

Innovation is, of course, not confined to manufactured products; plenty of examples of growth through innovation can be found in services [14–16]. (In fact, the world's first business computer was used to support bakery planning and logistics for the UK catering services company J. Lyons and Co.) In banking, the UK First Direct organization became the most competitive bank, attracting around 10,000 new customers each month by offering a telephone banking service backed up by sophisticated information technology (IT) – a model that eventually became

the industry standard. A similar approach to the insurance business – Direct Line – radically changed the basis of that market and led to widespread imitation by all the major players in the sector [17,18]. Internet-based retailers such as Amazon changed the ways in which products as diverse as books, music and travel were sold, while firms such as eBay brought the auction house into many living rooms.

Research Note 1.3 discusses some examples of innovation in fields that may sometimes be 'hidden' from view.

RESEARCH NOTE 1.3 Hidden Innovation

In 2006, the UK organization NESTA published a report on 'The Innovation Gap' in the United Kingdom and laid particular emphasis on 'hidden Innovation' – innovation activities that are not reflected in traditional indicators such as investments in formal R&D or patents awarded. In a research focusing on six widely different sectors that were not perceived to be innovative, they argued that innovation of this kind is increasingly important, especially in services, and in a subsequent study looked in detail at six 'hidden innovation' sectors – oil production, retail banking, construction, legal aid services, education, and the rehabilitation of offenders. The study identified four types of hidden innovation:

- **Type I:** Innovation that is identical or similar to activities that are measured by traditional indicators, but which is excluded from measurement. For example, the development of new technologies in oil exploration;
- **Type II:** Innovation without a major scientific and technological basis, such as innovation in organizational forms or business models. For example, the development of new contractual relationships between suppliers and clients on major construction projects;
- **Type III:** Innovation created from the novel combination of existing technologies and processes. For example, the way in which banks have integrated their various back-office IT systems to deliver innovative customer services such as Internet banking;
- **Type IV:** Locally developed, small-scale innovations that take place 'under the radar', not only of traditional indicators but often also of many of the organizations and individuals working in a sector, for example, the everyday innovation that occurs in classrooms and multidisciplinary construction teams.

Source: National Endowment for Science, Technology and the Arts (NESTA), 2006, 'The innovation gap', and 2007, 'Hidden innovation', **https://www.nesta.org.uk/.**

Innovation is a central plank in national economic policy – for example, a UK government report called it 'the motor of the modern economy, turning ideas and knowledge into products and services' [17]. An Australian government website puts the case equally strongly – *Companies that do not invest in innovation put their future at risk. Their business is unlikely to prosper, and they are unlikely to be able to compete if they do not seek innovative solutions to emerging problems.* According to Statistics Canada (2006), the following factors characterize successful small- and medium-sized enterprises:

- Innovation is consistently found to be the most important characteristic associated with success.
- Innovative enterprises typically achieve stronger growth or are more successful than those that do not innovate.
- Enterprises that gain market share and increasing profitability are those that are innovative.

Not surprisingly, this rationale underpins a growing set of policy measures designed to encourage and nurture innovation at regional and national levels.

1.4 INNOVATION AND ENTREPRENEURSHIP

One person's problem is another's opportunity, and the nature of innovation is that it is fundamentally about *entrepreneurship* – a potent mixture of vision, passion, energy, enthusiasm, insight, judgement and plain hard work, which enables good ideas to become a reality. As the famous management writer Peter Drucker put it:

> *'Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or service. It is capable of being presented as a discipline, capable of being learned, capable of being practised' [19].*

Entrepreneurship is a human characteristic that mixes structure with passion, planning with vision, tools with the wisdom to use them, strategy with the energy to execute it and judgement with the propensity to take risks. It's possible to create structures within organizations – departments, teams, specialist groups and so on – with the resources and responsibility for taking innovation forward, but effective change won't happen without the 'animal spirits' of the entrepreneur.

Research Note 1.4 discusses the ideas of Joseph Schumpeter, the 'godfather' of innovation studies.

RESEARCH NOTE 1.4 Joseph Schumpeter – The 'Godfather' of Innovation Studies

One of the most significant figures in this area of economic theory was Joseph Schumpeter, who wrote extensively on the subject. He had a distinguished career as an economist and served as Minister for Finance in the Austrian government. His argument was simple: entrepreneurs will seek to use technological innovation – a new product/service or a new process for making it – to get strategic advantage. For a while, this may be the only example of the innovation, so the entrepreneur can expect to make a lot of money – what Schumpeter calls 'monopoly profits'. But, of course, other entrepreneurs will see what he has done and try to imitate it – with the result that other innovations emerge, and the resulting 'swarm' of new ideas chips away at the monopoly profits until an equilibrium is reached. At this point, the cycle repeats itself – our original entrepreneur or someone else looks for the next innovation, which will rewrite the rules of the game, and off we go again. Schumpeter talks of a process of 'creative destruction' where there is a constant search to create something new that simultaneously destroys the old rules and establishes new ones – all driven by the search for new sources of profits [20].

In his view , '[What counts is] competition from the new commodity, the new technology, the new source of supply, the new type of organization. . . competition which. . . strikes not at the margins of the profits and the outputs of the existing firms but at their foundations and their very lives'.

Of course, entrepreneurship plays out on different stages in practice. One obvious example is the new start-up venture in which the lone entrepreneur takes a calculated risk to bring something new into the world. But entrepreneurship matters just as much to the established organization, which needs to renew itself in what it offers and how it creates and delivers that offering. Internal entrepreneurs – often labelled as 'intrapreneurs' or working in 'corporate entrepreneurship' or 'corporate venture' departments – provide the drive, energy and vision to take risky new ideas forward inside that context. And of course, the passion to change things may not be around creating commercial value but rather in improving conditions or enabling change in the wider social sphere or in the direction of environmental sustainability – a field that has become known as 'social entrepreneurship'.

This idea of entrepreneurship driving innovation to create value – social and commercial – across the life cycle of organizations is central to this book. **Table 1.2** gives some examples of entrepreneurship and innovation.

Table 1.2 Entrepreneurship and Innovation

Stage in Life Cycle of an Organization	Start-up	Growth	Sustain/Scale	Renew
Creating commercial value	Individual entrepreneur exploiting new technology or market opportunity	Growing the business through adding new products/services or moving into new markets	Building a portfolio of incremental and radical innovation to sustain the business and/or spread its influence into new markets	Returning to the radical frame-breaking kind of innovation, which began the business and enables it to move forward as something very different
Creating social value	Social entrepreneur, passionately concerned with improving or changing something in their immediate environment	Developing the ideas and engaging others in a network for change – perhaps in a region or around a key issue	Spreading the idea widely, diffusing it to other communities of social entrepreneurs, engaging links with mainstream players such as public sector agencies	Changing the system – and then acting as an agent for the next wave of change

1.5 STRATEGIC ADVANTAGE THROUGH INNOVATION

Innovation contributes in several ways. For example, research evidence suggests a strong correlation between market performance and new products. New products help capture and retain market shares and increase profitability in those markets. In the case of more mature and established products, competitive sales growth comes not simply from being able to offer low prices but also from a variety of nonprice factors – design, customization and quality. And in a world of shortening product life cycles – where, for example, the life of a particular model of television set or computer is measured in months, and even complex products such as motor cars now take only a couple of years to develop – being able to replace products frequently with better versions is increasingly important. 'Competing in time' reflects a growing pressure on firms not just to introduce new products but to do so faster than the competitors [21]; in their 2019 survey, BCG found that increasing the speed of innovation was a key driver [8].

At the same time, new product development is an important capability because the environment is constantly changing. Shifts in the socioeconomic field (in what people believe, expect, want and earn) create opportunities and constraints. Legislation may open up new pathways, or close down others – for example, increasing the requirements for environmentally friendly products. Competitors may introduce new products that represent a major threat to existing market positions. In all these ways, firms need the capability to respond through product innovation.

While new products are often seen as the cutting edge of innovation in the marketplace, *process* innovation plays just as important a strategic role. Being able to make something no one else can, or to do so in ways that are better than anyone else is a powerful source of advantage. For example, the Japanese dominance in the late twentieth century across several sectors – cars, motorcycles, shipbuilding, consumer electronics – owed a great deal to superior abilities in manufacturing – something that resulted from a consistent pattern of process innovation. The Toyota production system and its equivalent in Honda and Nissan led to performance advantages of around two to one over average car makers across a range of quality and productivity indicators [22]. One of the main reasons for the ability of relatively small firms such as Oxford Instruments or Incat to survive in highly competitive global markets is the sheer complexity of

what they make and the huge difficulties a new entrant would encounter in trying to learn and master their technologies.

Similarly, being able to offer better service – faster, cheaper, higher quality – has long been seen as a source of competitive edge. Citibank was the first bank to offer automated teller machinery (ATM) service and developed a strong market position as a technology leader on the back of this process innovation. Benetton is one of the world's most successful retailers, largely due to its sophisticated IT-led production network, which it innovated over a 10-year period, and the same model has been used to great effect by the Spanish firm Zara. Southwest Airlines achieved an enviable position as the most effective airline in the United States despite being much smaller than its rivals; its success was due to process innovation in areas such as reducing airport turnaround times. This model has subsequently become the template for a whole new generation of low-cost airlines whose efforts have revolutionized the once-cosy world of air travel.

Importantly, we need to remember that the advantages that flow from these innovative steps gradually fall to the competition as others imitate. Unless an organization is able to move into further innovation, it risks being left behind as others take the lead in changing their offerings, their operational processes or the underlying models, which drive their business. For example, leadership in banking has been passed to those who were able to capitalize early on the boom in information and communications technologies; in particular, many of the lucrative financial services such as securities and share dealing have become dominated by players with radical new models such as Charles Schwab. In turn, there are now major challenges from the world of peer-to-peer lending and other Web-based financial services.

Research Note 1.5 discusses the innovation imperative facing organizations.

Case Study 1.4 looks in detail at one example – the music industry.

RESEARCH NOTE 1.5 The Innovation Imperative

In the mid-1980s, a study by Shell suggested that the average corporate survival rate for large companies was only about half as long as that of a human being. Since then, the pressures on firms have increased enormously from all directions – with the inevitable result that life expectancy is reduced still further. Many studies look at the changing composition of key indices and draw attention to the demise of what were often major firms and, in their time, key innovators. For example, Foster and Kaplan point out that, of the 500 companies originally making up the Standard and Poor 500 list in 1857, only 74 remained on the list through to 1997 [23]. Of the top 12 companies that made up the Dow Jones index in 1900 only one – General Electric – survives today. Even apparently robust giants such as IBM, GM or Kodak can suddenly display worrying signs of mortality, while for small firms, the picture is often considerably worse since they lack the protection of a large resource base.

Some firms have had to change dramatically to stay in business. For example, a company founded in the early nineteenth century, which had Wellington boots and toilet paper among its product range, became one of the largest and most successful in the world in the telecommunications business. Nokia began life as a lumber company, making the equipment and supplies needed to cut down forests in Finland. It moved through into paper and from there into the 'paperless office' world of IT – and from there into mobile telephones. It has now moved beyond handsets and into the core architecture of networks and systems infrastructure.

Another mobile phone player – Vodafone Airtouch – grew to its huge size by merging with a firm called Mannesman, which, since its birth in the 1870s, had been more commonly associated with the invention and production of steel tubes! TUI is the largest European travel and tourism services company. Its origins, however, lie in the mines of old Prussia, where it was established as a public sector state lead mining and smelting company! [24].

CASE STUDY 1.4 The Changing Nature of the Music Industry

1 April 2006. Apart from being a traditional day for playing practical jokes, this was the day on which another landmark in the rapidly changing world of music was reached. 'Crazy' – a track by Gnarls Barkley – made pop history as the United Kingdom's first song to top the charts based on download sales alone. Commenting on the fact that the song had been downloaded more than 31,000 times but was only released for sale in the shops on 3 April, Gennaro Castaldo, spokesman for retailer HMV, said 'This not only represents a watershed in how the charts are compiled, but shows that legal downloads have come of age . . . if physical copies fly off the shelves at the same rate it could vie for a place as the year's biggest seller'.

One of the less visible but highly challenging aspects of the Internet is the impact it has had – and is having – on the entertainment business. This is particularly the case with music. At one level, its impacts could be assumed to be confined to providing new 'e-tailing' channels, such as Amazon or hundreds of other websites. These innovations increased the choice and tailoring of the music purchasing service and demonstrated some of the 'richness/reach' economic shifts of the new Internet game.

But beneath this updating of essentially the same transaction lay a more fundamental shift – in the ways in which music is created and distributed and in the business model on which the whole music industry is currently predicated. In essence, the old model involved a complex network in which songwriters and artists depended on A&R (artists and repertoire) to select a few acts, production staff who would record in complex and expensive studios, other production staff who would oversee the manufacture of physical discs, tapes and CDs, and marketing and distribution staff who would ensure that the product was publicized and disseminated to an increasingly global market.

Several key changes undermined this structure and brought with it significant disruption to the industry. Old competencies were no longer relevant, while acquiring new ones became a matter of urgency. Even well-established names such as Sony found it difficult to stay ahead, while new entrants were able to exploit the economics of the Internet. At the heart of the change was the potential for creating, storing and distributing music in digital format – a problem that many researchers had worked on for some time. One solution, developed by one of the Fraunhofer Institutes in Germany, was a standard based on the Motion Picture Experts Group (MPEG) level 3 protocol (MP3). MP3 offers a powerful algorithm for managing one of the big problems in transmitting music files – that of compression. Normal audio files cover a wide range of frequencies and are thus very large and not suitable for fast transfer across the Internet – especially with a population who may only be using relatively slow modems. With MP3, effective compression is achieved by cutting out those frequencies that the human ear cannot detect – with the result that the files to be transferred are much smaller.

As a result, MP3 files could be moved across the Internet quickly and shared widely. What did this mean for the music business? In the first instance, aspiring musicians no longer needed to depend on being picked up by A&R staff from major companies who could bear the costs of recording and production of a physical CD. Instead, they could use home recording software and either produce a CD themselves or else go straight to MP3 – and then distribute the product globally via newsgroups, chatrooms and so on. In the process, they effectively created a parallel and much more direct music industry, which left existing players and artists on the sidelines.

Such changes were not necessarily threatening. For many people, the lowering of entry barriers opened up the possibility of participating in the music business – for example, by making and sharing music without the complexities and costs of a formal recording contract and the resources of a major record company. There was also scope for innovation around the periphery – for example, in the music publishing sector where sheet music and lyrics are also susceptible to lowering of barriers through the application of digital technology. Journalism and related activities became increasingly open – music reviews and other forms of commentary become possible via specialist user groups and channels on the Web, whereas before, they were the province of a few magazine titles. Compiling popularity charts – and the related advertising – was also opened up as the medium switched from physical CDs and tapes distributed and sold via established channels to new media such as MP3 distributed via the Internet.

As if this were not enough, the industry was also challenged from another source – the sharing of music between different people connected via the Internet. Although technically illegal, this practice of sharing between people's record collections had always taken place – but not on the scale that the Internet threatened to facilitate. Much of the established music industry was concerned with legal issues – how to protect copyright and how to ensure that royalties were paid in the right proportions to those who participated in production and distribution. But when people could share music in MP3 format and distribute it globally, the potential for policing the system and collecting royalties became extremely difficult to sustain.

It was made much more so by another technological development – that of person-to-person networking. Shawn Parker and Sean Fanning, teenage students (Fanning had the nickname 'The Napster'), were intrigued by the challenge of being able to enable their friends to 'see' and share between their

own personal record collections. They argued that if they held these in MP3 format, then it should be possible to set up some kind of central exchange program that facilitated their sharing.

The result – the Napster.com site – offered sophisticated software that enabled peer-to-peer (P2P) transactions. The Napster server did not actually hold any music on its files – but every day, millions of swaps were made by people around the world exchanging their music collections. Needless to say, this posed a huge threat to the established music business since it involved no payment of royalties. A number of high-profile lawsuits followed, but while Napster's activities were curbed, the problem did not go away. Many other sites began emulating and extending what Napster started – sites such as Gnutella, Kazaa and Limewire took the P2P idea further and enabled exchange of many different file formats – text, video and so on. In Napster's own case, the phenomenally successful site concluded a deal with the entertainment giant Bertelsmann, which paved the way for subscription-based services that provide some revenue stream to deal with the royalty issue.

Expectations that legal protection would limit the impact of this revolution were dampened by a US Court of Appeal ruling, which rejected claims that P2P violated copyright law. Their judgement said, 'History has shown that time and market forces often provide equilibrium in balancing interests, whether the new technology be a player piano, a copier, a tape recorder, a video recorder, a PC, a karaoke machine or an MP3 player' (Personal Computer World, November 2004, p. 32).

Significantly, the new opportunities opened up by this were seized not by music industry firms but by computer companies, especially Apple. In parallel with the launch of their successful iPod personal MP3 player, they opened a site called iTunes, which offered users a choice of thousands of tracks for download at 99c each. In its first weeks of operation, it recorded 1 million hits; in February 2006, the billionth song, 'Speed of Sound', was purchased as part of Coldplay's 'X&Y' album by Alex Ostrovsky from West Bloomfield, Michigan. 'I hope that every customer, artist, and music company executive takes a moment today to reflect on what we've achieved together during the past three years', said Steve Jobs, Apple's CEO, 'Over one billion songs have now been legally purchased and downloaded around the globe, representing a major force against music piracy and the future of music distribution as we move from CDs to the Internet'.

This technological change to digital music was a dramatic shift, reaching the point where more singles were bought as downloads in 2005 than as CDs and where new players began to dominate the game. And the changes didn't stop there. In February 2006, the Arctic Monkeys topped the UK album charts and walked off with a fistful of awards from the music business – yet their rise to prominence had been entirely via 'viral marketing' across the Internet rather than by conventional advertising and promotion. Playing gigs around the northern English town of Sheffield, the band simply gave away CDs of their early songs to their fans, who then obligingly spread them around on the Internet. 'They came to the attention of the public via the Internet, and you had chat rooms, everyone talking about them', says a slightly worried Gennaro Castaldo of HMV Records. David Sinclair, a rock journalist, suggests that 'It's a big wakeup call to all the record companies, the establishment, if you like . . . This lot caught them all napping . . . We are living in a completely different era, which the Arctic Monkeys have done an awful lot to bring about'.

Subsequent developments have shown an acceleration in the pace of change and an explosion in the variety of new business models better adapted to create and capture value from the industry. For example, the US music download business became dominated by Apple and Amazon (with 70% and 10%, respectively, of the market) – two companies with roots in very different worlds. While the volume of downloads increased significantly, competition emerged from other new business models, notably those built around streaming services. In 2008 the Swedish company Spotify AB launched the Spotify service with a different assumption – that people did not necessarily wish to own the music they wanted but would be prepared to rent access to it on a subscription basis. Its catalogue now runs to over 30 million items and the company currently has 271 million users spread across 79 countries; of these 124 million pay a subscription for the premium service while the rest access the service for free with the costs being picked up in advertising streamed alongside the music.

With the rise of the Internet, the scope for service innovation has grown enormously, so much so that it is sometimes called 'a solution looking for problems'. As Evans and Wurster point out, the traditional picture of services being offered either as a standard to a large market (high 'reach' in their terms) or else highly specialized and customized to a particular individual able to pay a high price (high 'richness') is 'blown to bits' by the opportunities of Web-based technology. Now it becomes possible to offer both richness and reach at the same time – and thus to create totally new markets and disrupt radically those that exist in any information-related businesses [25].

The challenge that the Internet poses is not only one for the major banks and retail companies, although those are the stories that hit the headlines. It is also an issue – and quite possibly a survival one – for thousands of small businesses. Think about the local travel agent and

the cosy way in which it used to operate. Racks full of glossy brochures through which people could browse, desks at which helpful sales assistants sort out the details of selecting and booking a holiday, procuring the tickets, arranging insurance and so on. And then think about how all of this can be accomplished at the click of a mouse from the comfort of home – and that it can potentially be done with more choice and at lower cost. Not surprisingly, one of the biggest growth areas in dot.com start-ups was the travel sector, and while many disappeared when the bubble burst, others such as lastminute.com and Expedia have established themselves as mainstream players.

The point is that whatever the dominant technological, social or market conditions, the key to creating – and sustaining – competitive advantage is likely to lie with those organizations that continually innovate.

Table 1.3 indicates some of the ways in which enterprises can obtain strategic advantage through innovation.

Table 1.3 Strategic Advantages Through Innovation

Mechanism	Strategic Advantage	Examples
Novelty in product or service offering	Offering something no one else can	Introducing the first . . . Walkman, mobile phone, fountain pen, camera, dishwasher, telephone bank, online retailer and so on . . . to the world
Novelty in process	Offering it in ways others cannot match – faster, lower cost, more customized and so on	Pilkington's float glass process, Bessemer's steel process, Internet banking, online bookselling and so on
Complexity	Offering something that others find difficult to master	Rolls-Royce and aircraft engines – only a handful of competitors can master the complex machining and metallurgy involved
Legal protection of intellectual property	Offering something that others cannot do unless they pay a license or other fee	Blockbuster drugs such as Zantac, Prozac, Viagra and so on
Add/extend range of competitive factors	Move basis of competition – for example, from price of product to price and quality, or price, quality, choice and so on	Japanese car manufacturing, which systematically moved the competitive agenda from price to quality, to flexibility and choice, to shorter times between launch of new models and so on – each time not trading these off against each other but offering them all
Timing	First-mover advantage – being first can be worth significant market share in new product fields. Fast follower advantage – sometimes being first means you encounter many unexpected teething problems, and it makes better sense to watch someone else make the early mistakes and move fast into a follow-up product	Amazon, Google – others can follow, but the advantage 'sticks' to the early movers. For example, personal digital assistants (PDAs), which captured a huge and growing share of the market and then found their functionality absorbed into mobile phones and tablet devices. In fact, the concept and design was articulated in Apple's ill-fated Newton product some five years earlier – but problems with software and especially handwriting recognition meant it flopped. Equally, their iPod was not the first MP3 player, but the lessons they learned from earlier product failures from other companies helped them focus on making the design a success and built the platform for the iPhone
Robust/platform design	Offering something that provides the platform on which other variations and generations can be built	Walkman architecture – through minidisk, CD, DVD, MP3 . . . Boeing 737 – over 50 years old, the design is still being adapted and configured to suit different users – one of the most successful aircraft in the world in terms of sales Intel and AMD with different variants of their microprocessor families
Rewriting the rules	Offering something that represents a completely new product or process concept – a different way of doing things – and makes the old ones redundant	Typewriters versus computer word processing, ice versus refrigerators, electric versus gas or oil lamps

Table 1.3 Strategic Advantages Through Innovation (*continued*)

Mechanism	Strategic Advantage	Examples
Reconfiguring the parts of the process	Rethinking the way in which bits of the system work together – for example, building more effective networks, outsourcing, coordination of a virtual company and so on	Zara, Benetton in clothing, Dell in computers, Toyota in its supply chain management, Cisco in providing the digital infrastructure underpinning the Web
Transferring across different application contexts	Recombining established elements for different markets	Polycarbonate wheels transferred from application market such as rolling luggage into children's toys – lightweight micro-scooters
Others	Innovation is all about finding new ways to do things and to obtain strategic advantage – so there will be room for new ways of gaining and retaining advantage	Napster. This firm began by writing software that would enable music fans to swap their favourite pieces via peer-to-peer (P2P) networking across the Internet. Although Napster suffered from legal issues, followers developed a huge industry based on downloading and file sharing. The experiences of one of these firms – Kazaa – provided the platform for successful high-volume Internet telephony, and the company established with this knowledge – Skype – was sold to eBay for $2.6 billion and eventually to Microsoft for $8.5 billion

1.6 OLD QUESTION, NEW CONTEXT

'Constant revolutionizing of production, uninterrupted disturbance of all social conditions, everlasting uncertainty . . . all old-established national industries have been destroyed or are daily being destroyed. They are dislodged by new industries . . . whose products are consumed not only at home but in every quarter of the globe. In place of old wants satisfied by the production of the country, we find new wants . . . the intellectual creativity of individual nations become common property'

This quote does not come from a contemporary journalist or politician but from the Communist Manifesto, published by Karl Marx and Friedrich Engels in 1848! But it serves to remind us that the innovation challenge isn't new – organizations have always had to think about changing what they offer the world and the ways they create and deliver that offering if they are to survive and grow. The trouble is that innovation involves a moving target – not only is there competition among players in the game, but the overall context in which the game is played out keeps shifting. And while many organizations have some tried-and-tested recipes for playing the game, there is always the risk that the rules will change and leave them vulnerable. Changes along several core environmental dimensions mean that the incidence of discontinuities is likely to rise – for example, in response to a massive increase in the rate of knowledge production and the consequent increase in the potential for technology-linked instabilities. But there is also a higher level of interactivity among these environmental elements – complexity – which leads to unpredictable emergence.

The current uncertainty in the automobile industry is a good example. During most of the twentieth century the technological and market trajectories were clear, and innovation took place in a pattern reflecting the maturity of the sector. But now it has reverted to a fluid state in which social forces (such as changing attitudes to ownership and concern for the health of the planet), regulatory pressures (on emissions and on energy conservation), the entry of new players (many coming from outside the traditional auto sector) and technological shifts (especially towards driverless car technology) are all creating a complex co-evolving system.

Case Study 1.5 explores the ways in which Kodak is reinventing itself through redeploying some of its knowledge base.

CASE STUDY 1.5 Reinventing Kodak

The difficulties of a firm such as Kodak illustrate the problem. Founded around 100 years ago, the basis of the business was the production and processing of film and the sales and service associated with mass-market photography. While the latter set of competencies are still highly relevant (even though camera technology has shifted), the move away from wet physical chemistry conducted in the dark (coating emulsions onto films and paper) to digital imaging represented a profound change for the firm. It needed – across a global operation and a workforce of thousands – to let go of old competencies, which are unlikely to be needed in the future, while at the same time to rapidly acquire and absorb cutting edge new technologies in electronics and communication. Although they made strenuous efforts to shift from being a manufacturer of film to becoming a key player in the digital imaging industry and beyond, they found the transition very difficult, and in 2012, they filed for Chapter 11 bankruptcy protection.

Significantly, this is not the end of the company; instead, it has regrouped around other core technologies and developed new directions for innovation-led growth in fields such as high-speed, high-volume printing.

1.7 THE GLOBALIZATION OF INNOVATION

Innovation has always been a globally distributed activity but until the latter part of the twentieth century it was strongly linked to the major industrial nations. The rise of the industrial research laboratory and the growing investment in universities and other parts of the science and technology ecosystem took place particularly in regions like the USA, Japan and Europe. That pattern has changed dramatically; now even small country players like Taiwan, Singapore or Denmark are important parts of the international innovation system.

As **Figure 1.2** shows one indicator of this is the shift from the USA as a dominating R&D spending in the 1960s to the current picture which has seen that share more than halved.

Figure 1.3 shows that the biggest shift by far has been in the entry of China on to the world innovation stage.

And as **Figure 1.4** shows the rise in recent years of China as a significant spender has been dramatic.

Nor are the sums of money invested trivial, as Table 1.4 shows.

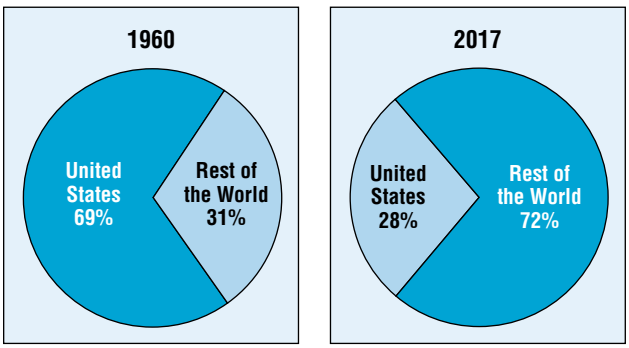

FIGURE 1.2 U.S. share of global R&D

Sources: Based on 1960 : CRS analysis of U.S Department of commerce, office of technology policy. The Global context of U.S Technology policy 1997. 2017: CRS analysis of organisation for economic cooperation and Development (OECD) data, Main science and Technology Indicators, OECD.Stat.

Notes: Rest of the World includes the members of the OECD (less the United States), Argentina, China, Romania, Russia, Singapore, South Africa, and Taiwan. R&D expenditures by others countries are not included but are likely to be small in relative terms. In estimating total global R&D, CRS used the most recent year's reported R&D expenditures for two countries (Singapore and South Africa) that had not reported data for 2017.

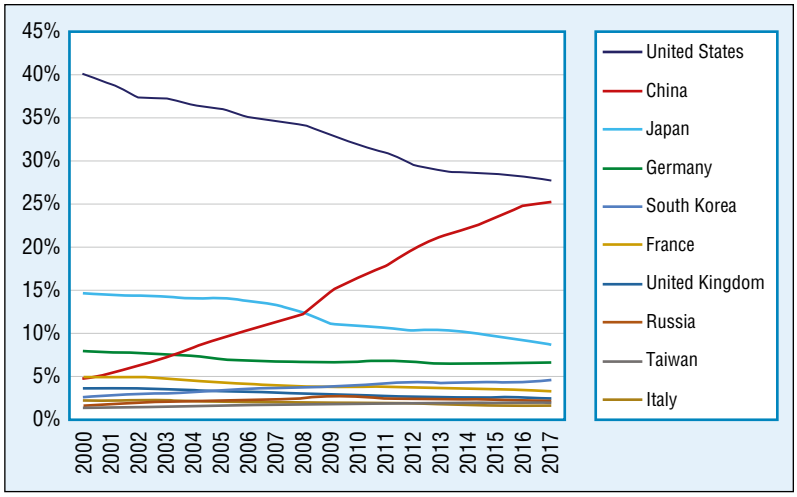

FIGURE 1.3 Share of global R&D of selected countries, 2000–2017

Source: Data from CRS analysis of Economic Development and cooperation. OECD.Stat database, https://stats.oecd.org/index.aspx?DataSetCode=MSTI_Pub

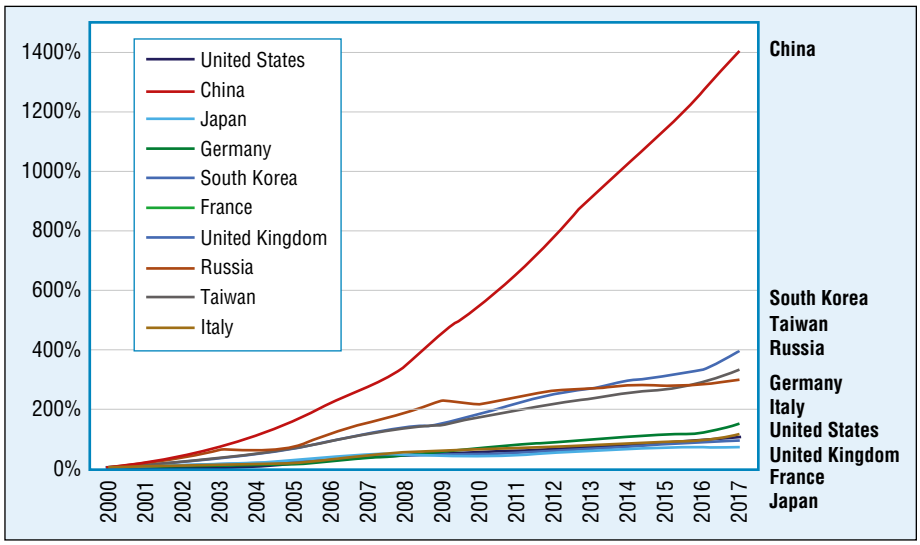

FIGURE 1.4 Growth in R&D expenditures since 2000 for selected countries, 2000–2017

Source: Data from CRS analysis of Economic Development and cooperation. OECD.Stat database, https://stats.oecd.org/index.aspx?DataSetCode=MSTI_Pub

Table 1.4 Countries with the Highest Expenditure on R&D, 2017 (in billions of current PPP dollars)

Rank	Country	Amount	Rank	Country	Amount
1	United States	$543.2	6	France	$64.7
2	China	496.0	7	United Kingdom	49.3
3	Japan	170.9	8	Russia	41.9
4	Germany	132.0	9	Taiwain	39.3
5	South Korea	91.0	10	Italy	33.5

Source: Data from CRS analysis of Economic Development and cooperation. OECD.Stat database, https://stats.oecd.org/index.aspx?DataSetCode=MSTI_Pub.

While these figures reflect spending on science and technology R&D we also need to take into account the significant growth of other countries in terms of their innovation potential. Countries like Brazil (with growing presence in aerospace and shipbuilding) and India (with a particularly strong IT sector and major industrial groups like Tata active in key sectors like automobiles) are playing an increasingly significant role, while small countries like Israel have become renowned for their high levels of entrepreneurial activity, generating the seeds from which major international businesses have grown [26]. And although Russia features primarily as an energy and resource exporting economy the legacy of its massive investment during the Cold War continues to fuel a variety of innovative businesses, particularly based on software.

The significance of this for innovation management is twofold. On the one hand the potential for strategic collaboration and sourcing of ideas is massively amplified in a world spending so much on creating new knowledge. Open innovation in this landscape has much to offer. But at the same time the ability to realize this potential requires a much more global outlook in terms of search activity – a theme which we will return to in Chapter 7. There are also significant implications for innovation strategy – a theme we explore in Chapter 4.

Table 1.5 summarizes some of the key changes in the context within which the current innovation game is being played out.

Table 1.5 Changing Context for Innovation

Context Change	Indicative Examples
Acceleration of knowledge production	OECD estimates that around $1700 billion is spent each year (public and private sector) in creating new knowledge – and hence, extending the frontier along which 'breakthrough' technological developments may happen.
Global distribution of knowledge production	Knowledge production is increasingly involving new players especially in emerging markets – so the need to search for innovation opportunities across a much wider space. One consequence of this is that 'knowledge workers' are now much more widely distributed and concentrated in new locations – for example, Microsoft's third largest R&D centre employing thousands of scientists and engineers is now in Shanghai.
Market expansion	Traditionally, much of the world of business has focused on the needs of around 1 billion people since they represent wealthy enough consumers. But the world's population has just passed the 7 billion mark and population – and, by extension, market – growth is increasingly concentrated in nontraditional areas such as rural Asia, Latin America and Africa. Understanding the needs and constraints of this 'new' population represents a significant challenge in terms of market knowledge.
Market fragmentation	Globalization has massively increased the range of markets and segments so that these are now widely dispersed and locally varied – putting pressure on innovation search activity to cover much more territory, often far from 'traditional' experiences – such as the 'bottom of the pyramid' conditions in many emerging markets [28] or along the so-called long tail – the large number of individuals or small target markets with highly differentiated needs and expectations.
Market virtualization	The emergence of large-scale social networks in cyberspace pose challenges in market research approaches – for example, Facebook with over 1 billion members is technically the third largest country in the world by population. Further challenges arise in the emergence of parallel world communities – for example, by some accounts, World of Warcraft has over 10 million players.
Rise of active users	Although users have long been recognized as a source of innovation, there has been an acceleration in the ways in which this is now taking place – for example, the growth of Linux has been a user-led open community development [29]. In sectors such as media, the line between consumers and creators is increasingly blurred – for example, YouTube has around 5 billion videos viewed each day but over 300 hours of new video material is uploaded every minute from its user base.
Growing concern with sustainability issues	Major shifts in resource and energy availability prompting search for new alternatives and reduced consumption; increasing awareness of impact of pollution and other negative consequences of high and unsustainable growth; concern over climate change; major population growth and worries over ability to sustain living standards and manage expectations; increasing regulation on areas such as emissions and carbon footprint.
Development of technological and social infrastructure	Increasing linkages enabled by information and communications technologies around the Internet and broadband have enabled and reinforced alternative social networking possibilities. At the same time, the increasing availability of simulation and prototyping tools have reduced the separation between users and producers.

Source: J. Bessant and T. Venables, Creating wealth from knowledge: Meeting the innovation challenge. Cheltenham: Edward Elgar, 2008.

1.8 SO, WHAT IS INNOVATION?

One of America's most successful innovators was Thomas Alva Edison, who during his life registered over 1000 patents. Products for which his organization was responsible include the light bulb, 35 mm cinema film and even the electric chair. Edison appreciated better than most that the real challenge in innovation was not invention – coming up with good ideas – but in making them work technically and commercially. His skill in doing this created a business empire worth, in 1920, around $21.6 billion. He put to good use an understanding of the interactive nature of innovation, realizing that both technology push (which he systematized in one of the world's first organized R&D laboratories) and demand pull need to be mobilized.

His work on electricity provides a good example of this; Edison recognized that although the electric light bulb was a good idea, it had little practical relevance in a world where there was no power point to plug it into. Consequently, his team set about building up an entire electricity generation and distribution infrastructure, including designing lamp stands, switches and wiring. In 1882, he switched on the power from the first electric power generation plant in Manhattan and was able to light up 800 bulbs in the area. In the years that followed, he built over 300 plants all over the world [30].

As Edison realized, innovation is more than simply coming up with good ideas; it is the *process* of growing them into practical use. Definitions of innovation may vary in their wording, but they all stress the need to complete the development and exploitation aspects of new knowledge, not just its invention. Some examples are given in Research Note 1.6.

The dictionary defines innovation as 'change'; it comes from Latin *innovare*, meaning 'to make something new'. That's a bit vague if we're trying to manage it; perhaps, a more useful definition might be 'the successful exploitation of new ideas'. It's also important to recognize that we are not just concerned with creating commercial value although that business driver is powerful. Innovation is also about creating social value – for example, in education, health care, poverty alleviation and humanitarian aid. So perhaps, we can extend our definition to *read* 'creating value from ideas . . .'

Those ideas don't necessarily have to be completely new to the world, or particularly radical; as one definition has it, '. . . innovation does not necessarily imply the commercialization of only a major advance in the technological state of the art (a radical innovation) but it includes also the utilization of even small-scale changes in technological know-how (an improvement or incremental innovation). . .' [31]. Whatever the nature of the change, the key issue is how to bring it about. In other words, how to *manage* innovation?

One answer to this question comes from the experiences of organizations that have survived for an extended period. While most organizations have comparatively modest life spans, there are some that have survived at least one and sometimes multiple centuries. Looking at the experience of these '100 club' members – firms such as 3M, Corning, Procter & Gamble, Reuters, Siemens, Philips and Rolls-Royce – we can see that much of their longevity is down to having developed a capacity to innovate on a continuing basis [4]. They have learned – often the hard way – how to manage the process and, importantly, how to repeat the trick. Any organization gets lucky once but sustaining it for a century or more suggests that there's a bit more to it than just luck.

Research Note 1.6 looks at some definitions of innovation.

If we only understand part of the innovation process, then the behaviours we use in managing it are also likely to be only partially helpful – even if well intentioned and executed. For example, innovation is often confused with invention – but the latter is only the first step in a long process of bringing a good idea to widespread and effective use. Being a good inventor is – to contradict Emerson – no guarantee of commercial success and no matter how good the better mousetrap idea, the world will only beat a path to the door if attention is also paid to project management, market development, financial management, organizational behaviour and so on. **Case Study 1.6** gives some examples that highlight the difference between invention and innovation.

RESEARCH NOTE 1.6 What Is Innovation?

One of the problems in managing innovation is variation in what people understand by the term, often confusing it with invention. In its broadest sense, the term comes from the Latin – innovare – meaning 'to make something new'. Our view, shared by the following writers, assumes that innovation is a process of turning opportunity into new ideas and of putting these into widely used practice.

'Innovation is the successful exploitation of new ideas.'

– Innovation Unit,
UK Department of Trade
and Industry (2004)

'Industrial innovation includes the technical, design, manufacturing, management and commercial activities involved in the marketing of a new (or improved) product or the first commercial use of a new (or improved) process or equipment.'

– Chris Freeman (1982),
The Economics of Industrial Innovation,
2nd ed. Frances Pinter, London

'. . .Innovation does not necessarily imply the commercialization of only a major advance in the technological state of the art (a radical innovation) but it includes also the utilization of even small-scale changes in technological know-how (an improvement or incremental innovation).'

– Roy Rothwell and Paul Gardiner (1985),
'Invention, innovation, re-innovation and the
*role of the user,' Technovation, **3**, 168*

'Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or service. It is capable of being presented as a discipline, capable of being learned, capable of being practised.'

– Peter Drucker (1985),
Innovation and Entrepreneurship.
Harper & Row, New York

'Companies achieve competitive advantage through acts of innovation. They approach innovation in its broadest sense, including both new technologies and new ways of doing things.'

– Michael Porter (1990),
The Competitive Advantage of Nations.
Macmillan, London

'An innovative business is one which lives and breathes 'outside the box'. It is not just good ideas, it is a combination of good ideas, motivated staff and an instinctive understanding of what your customer wants.'

– Richard Branson (1998),
DTI Innovation Lecture

CASE STUDY 1.6 Invention and Innovation

In fact, some of the most famous inventions of the nineteenth century came from men whose names are forgotten; the names that we associate with them are of the entrepreneurs who brought them into commercial use. For example, the vacuum cleaner was invented by one J. Murray Spangler and originally called an 'electric suction sweeper'. He approached a leather goods maker in the town who knew nothing about vacuum cleaners but had a good idea of how to market and sell them – a certain W. H. Hoover. Similarly, a Boston man called Elias Howe produced the world's first sewing machine in 1846. Unable to sell his ideas despite traveling to England and trying there, he returned to the United States to find that one Isaac Singer had stolen the patent and built a successful business from it. Although Singer was eventually forced to pay Howe a royalty on all machines made, the name that most people now associate with sewing machines is Singer not Howe. And Samuel Morse, widely credited as the father of modern telegraphy, actually invented only the code that bears his name; all the other inventions came from others. What Morse brought was enormous energy and a vision of what could be accomplished; to realize this, he combined marketing and political skills to secure state funding for development work and to spread the concept of something that for the first time would link up people separated by vast distances on the continent of America. Within five years of demonstrating the principle, there were over 5000 miles of telegraph wire in the United States. And Morse was regarded as 'the greatest man of his generation' [32].

Case Study 1.7 reminds us that managing invention into successful innovation is not always easy to do.

CASE STUDY 1.7 Innovation Isn't Easy . . .

Although innovation is increasingly seen as a powerful way of securing competitive advantage and a more secure approach to defending strategic positions, success is by no means guaranteed. The history of product and process innovations is littered with examples of apparently good ideas that failed – in some cases with spectacular consequences. For example:

- In 1952, Ford engineers began working on a new car to counter the mid-sized models offered by GM and Chrysler – the 'E' car. After an exhaustive search for a name involving some 20,000 suggestions, the car was finally named after Edsel Ford, Henry Ford's only son. It was not a success; when the first Edsels came off the production line, Ford had to spend an average of $10,000 per car (twice the vehicle's cost) to get them roadworthy. A publicity plan was to have 75 Edsels drive out on the same day to local dealers; in the event, the firm only managed to get 68 to go, while in another live TV slot, the car failed to start. Nor were these teething troubles; by 1958, consumer indifference to the design and concern about its reputation led the company to abandon the car – at a cost of $450 million and 110,847 Edsels.
- During the latter part of World War II, it became increasingly clear that there would be a big market for long-distance airliners, especially on the trans-Atlantic route. One UK contender was the Bristol Brabazon, based on a design for a giant long-range bomber, which was approved by the Ministry of Aviation for development in 1943. Consultation with BOAC, the major customer for the new airliner, was 'to associate itself closely with the layout of the aircraft and its equipment' but not to comment on issues such as size, range, and payload! The budget rapidly escalated, with the construction of new facilities to accommodate such a large plane and, at one stage, the demolition of an entire village in order to extend the runway at Filton, near Bristol. Project control was weak, and many unnecessary features were included – for example, the mock-up contained 'a most magnificent ladies' powder room with wooden aluminium-painted mirrors and even receptacles for the various lotions and powders used by the modern young lady'. The prototype took six-and-a half years to build and involved major technical crises with wings and engine design; although it flew well in the tests, the character of the postwar aircraft market was very different from that envisaged by the technologists. Consequently in 1952, after flying less than 1000 miles, the project was abandoned at considerable cost to the taxpayer. The parallels with the Concorde project, developed by the same company on the same site a decade later, are hard to escape.
- During the late 1990s, revolutionary changes were going on in mobile communications involving many successful innovations – but even experienced players can get their fingers burned. Motorola launched an ambitious venture that aimed to offer mobile communications from literally anywhere on the planet – including the middle of the Sahara Desert or the top of Mount Everest! Achieving this involved a $7 billion project to put 88 satellites into orbit, but despite the costs, Iridium – as the venture was known – received investment funds from major backers, and the network was established. The trouble was that, once the novelty had worn off, most people realized that they did not need to make many calls from remote islands or at the North Pole and that their needs were generally well met with less exotic mobile networks based around large cities and populated regions. Worse, the handsets for Iridium were large and clumsy because of the complex electronics and wireless equipment they had to contain – and the cost of these high-tech bricks was a staggering $3000! Call charges were similarly highly priced. Despite the incredible technological achievement that this represented, the take-up of the system never happened, and in 1999, the company filed for Chapter 11 bankruptcy. Its problems were not over – the cost of maintaining the satellites safely in orbit was around $2 million per month. Motorola who had to assume the responsibility had hoped that other telecoms firms might take advantage of these satellites, but after no interest was shown, they had to look at a further price tag of $50 million to bring them out of orbit and destroy them safely! Even then, the plans to allow them to drift out of orbit and burn up in the atmosphere were criticized by NASA for the risk they might pose in starting a nuclear war, since any pieces that fell on the Earth would be large enough to trigger the Russian antimissile defences since they might appear not as satellite chunks but as Moscow-bound missiles!
- In the accelerating race to dominate the smartphone industry, Apple and Samsung became locked in a spiral of shorter product life cycles and increasing features, trying to balance the risks of launching unproven technology by the need to get to the market first. With the launch of the Galaxy Note 7 in August 2016, Samsung appeared to have found a winning formula, offering increased functionality to users, and preorders exceeded expectations. But weeks after the launch, reports

began to emerge about the devices catching fire; this surge accelerated and led to many airlines refusing to carry passengers with such phones. Despite a major product recall (of around 2 million devices) and attempts to fix the problem, the crisis continued with over $2 billion wiped off the company's share value and concerns about damage to the wider brand. Eventually, on October 11, the company announced that production would cease; *TIME* magazine wrote that this might prove to be one of the costliest product failures in history.

- A museum opened in Sweden in 2017 carefully preserving and showcasing examples of notable product failures, some of them coming from the very best known and otherwise successful organizations like Apple, Coca-Cola and Ford: https://failuremuseum.com/.

1.9 A PROCESS VIEW OF INNOVATION

In this book, we will make use of a simple model of innovation as the *process* of turning ideas into reality and capturing value from them. We will explain the model in more detail in Chapter 3, but it's worth introducing it here (see **Figure 1.5**).

There are four key phases, each of which requires dealing with particular challenges – and only if we can manage the whole process is innovation likely to be successful.

Phase 1 involves the question of *search*. To take a biological metaphor, we need to generate variety in our gene pool – and we do this by bringing new ideas to the system. These can come from R&D, 'Eureka' moments, copying, market signals, regulations, competitor behaviour – the list is huge, but the underlying challenge is the same – how do we organize an effective search process to ensure a steady flow of 'genetic variety' that gives us a better chance of surviving and thriving?

But simply generating variety isn't enough – we need to *select* from that set of options the variants most likely to help us grow and develop. Unlike natural selection where the process is random, we are concerned here with some form of *strategic* choice – out of all the things we could do, what are we going to do – and why? This process needs to take into account competitive differentiation – which choices give us the best chance of standing out from the crowd? – and previous capabilities – can we build on what we already have or is this a step into the unknown . . .?

Generating and selecting still leaves us with the huge problem of actually making it happen – committing our scarce resources and energies to doing something different. This is the challenge of *implementation* – converting ideas into reality. The task is essentially one of managing a growing commitment of resources – time, energy, money and above all mobilizing knowledge of different kinds – against a background of uncertainty. Unlike conventional project management, the innovation challenge is about developing something that may never have been done before – and the only way we know whether or not we will succeed is by trying it out.

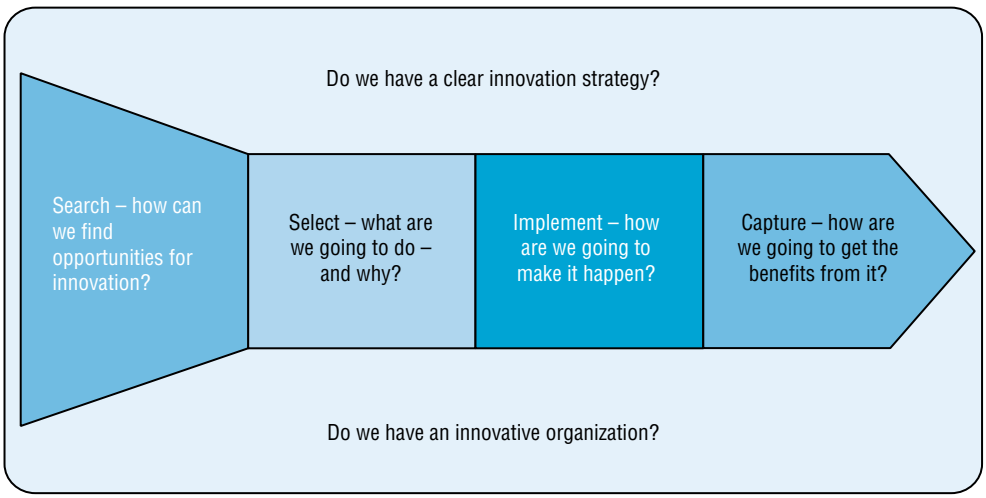

FIGURE 1.5 Simplified model of the innovation process

Here the biological metaphor comes back into play – it is a risky business. We are betting – taking calculated risks rather than random throws of the dice but nonetheless gambling – that we can make this new thing happen (manage the complex project through to successful completion) *and* that it will deliver us the calculated value that exceeds or at least equals what we put into it. If it is a new product or service – the market will rush to our stall to buy what we are offering, or if it is a new process, our internal market will buy into the new way of doing things, and we will become more effective as a result. If it is a social innovation, can we manage to make the world a better place in ways that justify the investment we put in?

Finally, we need to consider the challenge of *capturing value* from our innovative efforts. How will we ensure that the efforts have been justified – in commercial terms or in terms of creating social value? How will we protect the gains from appropriation by others? And how might we learn from the experience and capture useful learning about how to improve the innovation process in the future?

None of this takes place in a vacuum; the innovation process is influenced by a number of factors. Of particular relevance is the presence of an innovation strategy, a clear roadmap laying out how and why innovation will take the organization forward. And innovation is at heart a process involving people – their creativity, ideas and knowledge. So the presence of an enabling innovative organization is another key influence.

Viewed in this way, the innovation task looks deceptively simple. The big question is, of course, how to make it happen? This has been the subject of intensive study for a long period of time – plenty of practitioners have not only left us their innovations but also some of their accumulated wisdom, lessons about managing the process that they have learned the hard way. And a growing academic community has been working on trying to understand, in systematic fashion, questions about not only the core process but also the conditions under which it is likely to succeed or fail. This includes knowledge about the kinds of things that influence and help/hinder the process – essentially boiling down to having a clear and focused direction (the underpinning 'why' of the selection stage) and creating the organizational conditions to allow focused creativity.

The end effect is that we have a rich – and convergent – set of recipes that go a long way towards helping answer the practising manager's question when confronted with the problem of organizing and managing innovation – 'what do I do on Monday morning?' Exploring this in greater detail provides the basis for the rest of the book.

View 1.2 gives some examples of these managerial concerns.

VIEW 1.2

'There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things.'

– Niccolo Machiavelli, The Prince, 1532

'Anything that won't sell, I don't want to invent. Its sale is proof of utility, and utility is success.'

'Everything comes to him who hustles while he waits.'

'Genius is one percent inspiration and ninety-nine percent perspiration.'

'I never did anything by accident, nor did any of my inventions come by accident; they came by work.'

'Make it a practice to keep on the lookout for novel and interesting ideas that others have used successfully. Your idea has to be original only in its adaptation to the problem you are working on.'

– Thomas A. Edison

'Managing and innovation did not always fit comfortably together. That's not surprising. Managers are people who like order. They like forecasts to come out as planned. In fact, managers are often judged on how much order they produce. Innovation, on the other hand, is often a disorderly process. Many times, perhaps most times, innovation does not turn out as planned. As a result, there is tension between managers and innovation.'

– Lewis Lehro, about the first years at 3M

'To turn really interesting ideas and fledgling technologies into a company that can continue to innovate for years, it requires a lot of disciplines.'

– Steve Jobs

1.10 THE SCOPE FOR INNOVATION

If innovation is a process, we need to consider the output of that process. In what ways can we innovate – what kinds of opportunities exist for us to create something different and capture value from bringing those ideas into the world?

Sometimes, it is about completely new possibilities – for example, by exploiting radical breakthroughs in technology. For example, new drugs based on genetic manipulation have opened a major new front in the war against disease. Mobile phones, watches and other smart wearable devices have revolutionized where and when we communicate. Even the humble window pane is the result of radical technological innovation – almost all the window glass in the world is made these days by the Pilkington float glass process, which moved the industry away from the time-consuming process of grinding and polishing to get a flat surface.

Many innovations fail to develop significant markets because of their very newness. First-movers often face the challenge of growing the market while imitators may be able to learn from their experience and adapt to help shape and expand the market. For example, Facebook came later than MySpace but was able to build the market, while AirBnB's key contribution was in developing a market originally identified by another start-up, VRBO. Henry Ford's main claim to innovation fame was not inventing the automobile but growing the mass market for it, as George Eastman did for photography.

Innovation isn't just about opening up new markets – it can also offer new ways of serving established and mature ones. Low-cost airlines are still about transportation – but the innovations that firms such as Southwest Airlines, EasyJet and Ryanair have introduced have revolutionized air travel and grown the market in the process. One challenging new area for innovation lies in the previously underserved markets of the developing world – the 4 billion people who earn less than $2 per day. The potential for developing radically different innovative products and services aimed at meeting the needs of this vast population at what C.K. Prahalad calls 'the bottom of the pyramid' is huge – and the lessons learned may impact on established markets in the developed world as well [33].

And it isn't just about manufactured products; in most economies, the service sector accounts for the vast majority of activity, so there is likely to be plenty of scope. Lower capital costs often mean that the opportunities for new entrants and radical change are the greatest in the service sector. Online banking and insurance have become commonplace, but they have radically transformed the efficiencies with which those sectors work and the range of services they can provide. New entrants riding the Internet wave have rewritten the rule book for a wide range of industrial games – for example, Amazon in retailing, eBay in market trading and auctions, Google in advertising and Skype in telephony. Others have used the Web to help them transform business models around things such as low-cost airlines, online shopping and the music business [34]. (We'll look in detail at digital innovation and the radical changes it enables in the next chapter.)

FOUR DIMENSIONS OF INNOVATION SPACE

Given this wide area of possibility it would be helpful to have some form of framework to help us navigate – a compass to steer our innovation search by. For the purposes of this book, we will focus on four broad directions in which change – innovation – might take place:

- Product innovation – changes in the things (products/services) that an organization offers;
- Process innovation – changes in the ways in which they are created and delivered;
- Position innovation – changes in the context in which the products/services are introduced;
- Paradigm innovation – changes in the underlying mental models that frame what the organization does.

Figure 1.6 shows how these '4Ps' provide the framework for a map of the innovation space available to any organization [34]. And this link – **https://vimeo.com/160130228** – leads to a case study of the 4P framework applied to a small fish-and-chip shop business.

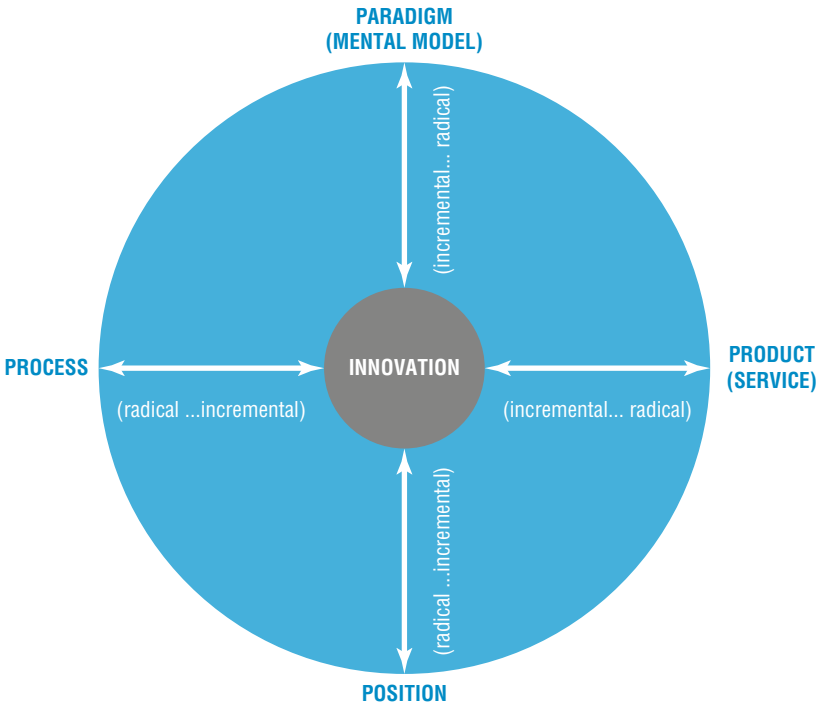

FIGURE 1.6 The 4Ps of innovation space

For example, a new design of car, a new insurance package for accident-prone babies and a new home entertainment system would all be examples of product innovation. And change in the manufacturing methods and equipment used to produce the car or the home entertainment system, or in the office procedures and sequencing in the insurance case, would be examples of process innovation.

Sometimes, the dividing line is somewhat blurred – for example, a new jet-powered sea ferry is both a product and a process innovation. Services represent a particular case of this where the product and process aspects often merge – for example, is a new holiday package a product or process change?

Innovation can also take place by repositioning the perception of an established product or process in a particular user context. For example, an old-established product in the United Kingdom is Lucozade – originally developed in 1927 as a glucose-based drink to help children and invalids in convalescence. These associations with sickness were abandoned by the brand owners, GSK, when they relaunched the product as a health drink aimed at the growing fitness market where it is now presented as a performance-enhancing aid to healthy exercise. This shift is a good example of 'position' innovation. In a similar fashion, Häagen-Dazs were able to give a new and profitable lease of life to an old-established product (ice cream) made with well-known processes. Their strategy was to target a different market segment and to reposition their product as a sensual pleasure to be enjoyed by adults – essentially telling an 'ice cream for grown ups' story. And we have seen how Starbucks, Innocent and many other players have repositioned drinks such as coffee and fruit juice as premium 'designer' products.

Sometimes, opportunities for innovation emerge when we reframe the way we look at something. Henry Ford fundamentally changed the face of transportation not because he invented the motor car (he was a comparative latecomer to the new industry) nor because he developed the manufacturing process to put one together (as a craft-based specialist industry, car making had been established for around 20 years). His contribution was to change the underlying model from one that offered a handmade specialist product to a few wealthy customers to one that offered a car for everyman at a price they could afford. The ensuing shift from craft to mass production was nothing short of a revolution in the way cars (and later countless other

products and services) were created and delivered. Of course, making the new approach work in practice also required extensive product and process innovation – for example, in component design, in machinery building, in factory layout, and particularly in the social system around which work was organized. Significantly, Ford's current presentation of itself is no longer as a car manufacturer but as a global *mobility* company, reflecting the significant technological and social trends around the industry and the need to rethink its business model accordingly.

Recent examples of 'paradigm' innovation – changes in mental models – include the shift to low-cost airlines, the provision of online insurance and other financial services, and the shifts in the transportation and accommodation sectors triggered by players like Uber and Airbnb. Although in its later days Enron became infamous for financial malpractice, it originally came to prominence as a small gas pipeline contractor that realized the potential in paradigm innovation in the utilities business. In a climate of deregulation and with global interconnection through grid distribution systems, energy and other utilities such as telecommunications bandwidth increasingly became commodities that could be traded much as sugar or cocoa futures.

Increasingly, organizations are talking about 'business model innovation' – essentially the same idea of changing the underlying mental models about how the organization creates value [35]. **Table 1.6** gives some examples of such changes.

Paradigm innovation can be triggered by many different things – for example, new technologies, the emergence of new markets with different value expectations, new legal rules of the game, new environmental conditions (climate change, energy crises) and so on. For example, the emergence of Internet technologies made possible a complete reframing of how we carry out many businesses. In the past, similar revolutions in thinking were triggered by technologies such as steam power, electricity, mass transportation (via railways and, with motor cars, roads) and microelectronics. And it seems very likely that similar reframing will happen as we get to grips with new technologies such as nanotechnology or genetic engineering.

In their book 'Wikinomics', Tapscott and Williams highlight the wave of innovation that follows the paradigm change to 'mass collaboration' via the Internet, which builds on social networks and communities [34]. Companies such as Lego and Adidas are reinventing themselves by engaging their users as designers and builders rather than as passive consumers, while others are

Table 1.6 Examples of Paradigm Innovation

Business Model Innovation	How It Changes the Rules of the Game
'Servitization'	Traditionally manufacturing was about producing and then selling a product. But increasingly, manufacturers are bundling various support services around their products, particularly for major capital goods. Rolls-Royce, the aircraft engine maker still produces high-quality engines, but it has an increasingly large business around services to ensure that those engines keep delivering power over the 30-plus-year life of many aircraft. Caterpillar, the specialist machinery company, now earns as much from service contracts that help keep its machines running productively as it does from the original sale.
Ownership to rental	Spotify is one of the most successful music streaming companies with around 8 million subscribers. They shifted the model from people's desire to own the music they listened to towards one in which they rent access to a huge library of music. In a similar fashion, Zipcar and other car rental businesses have transformed the need for car ownership in many large cities.
Offline to online	Many businesses have grown up around the Internet and enabled substitution of physical encounters – for example, in retailing – with virtual ones.
Mass customization and cocreation	New technologies and a growing desire for customization have enabled the emergence of not only personalized products but also platforms on which users can engage and cocreate everything from toys (e.g., Lego), clothing (e.g., Adidas) to complex equipment such as cars (Local Motors).
Experience innovation	Moving from commodity through offering a service towards creating an experience around a core product – for example, coffee, bookselling and so on.

exploring the potential of using the crowd to help make innovation selection decisions using 'idea markets'. Concerns about global warming and sustainability of key resources such as energy and materials are, arguably, setting the stage for some significant paradigm innovation across many sectors as firms struggle to redefine themselves and their offerings to match these major social issues.

Table 1.7 gives some examples of innovations mapped on to the 4Ps model.

Table 1.7 Some Examples of Innovations Mapped on to the 4Ps Model

Innovation Type	Incremental – Do What We Do but Better	Radical – Do Something Different
'Product' – what we offer the world	Microsoft Windows and Apple OS versions, essentially improving on existing software idea	New to the world software – for example, the first speech recognition program
	New versions of established car models, essentially improving on established car design	Toyota Prius – bringing a new concept – hybrid engines. Tesla – high-performance electric car
	Improved performance incandescent light bulbs	LED-based lighting, using completely different and more energy-efficient principles
	MP3s replacing CDs replacing vinyl records – essentially improving on the storage technology	Spotify and other music streaming services – changing the pattern from owning your own collection to renting a vast library of music
Process – how we create and deliver that offering	Improved fixed line telephone services	Skype and other VOIP systems
	Extended range of stock broking services	Online share trading
	Improved auction house operations	eBay
	Improved factory operations efficiency through upgraded equipment	Toyota Production System and other 'lean' approaches
	Improved range of banking services delivered at branch banks	Online banking and now mobile banking in Kenya, the Philippines – using phones as an alternative to banking systems
	Improved retailing logistics	Online shopping
Position – where we target that offering and the story we tell about it	Häagen-Dazs changing the target market for ice cream from children to consenting adults	Addressing underserved markets – for example, the Tata Nano aimed at an emerging but relatively poor Indian market with car priced around $2000
	Starbucks, Innocent and others repositioning drinks like coffee and fruit juice as premium designer products	Low-cost airlines opening up air travel to those previously unable to afford it – create new market and also disrupt existing one. Variations on the 'One laptop per child' project – for example, Indian government offering $20 computer for schools
	Airlines segmenting service offering for different passenger groups – Virgin Upper Class, BA Premium Economy and so on	University of Phoenix and others building large education businesses via online approaches to reach different markets
	Dell and others segmenting and customizing computer configuration for individual users. Online support for traditional higher education courses	'Bottom of the pyramid' approaches using a similar principle but tapping into huge and very different high-volume/ low-margin markets – Aravind eye care, Cemex construction products
	Banking services targeted at key segments – students, retired people and so on	
Paradigm – how we frame what we do	Bausch and Lomb – moved from 'eye wear' to 'eye care' as their business model, effectively letting go of the old business of spectacles, sunglasses (Ray-Ban) and contact lenses, all of which were becoming commodity businesses. Instead, they moved into newer high-tech fields such as laser surgery equipment, specialist optical devices and research in artificial eyesight	Grameen Bank and other microfinance models – rethinking the assumptions about credit and the poor
		iTunes platform – a complete system of personalized entertainment
		Cirque de Soleil – redefining the circus experience
	Dyson redefining the home appliance market in terms of high-performance engineered products	Amazon, Google and Skype – redefining industries such as retailing, advertising and telecoms through online models
	Rolls-Royce – from producing high-quality aero engines to becoming a service company offering 'power by the hour'	Linux, Mozilla and Apache – moving from passive users to active communities of users cocreating new products and services
	IBM from being a machine maker to a service and solution company – selling off its computer making and building up its consultancy and service side.	

MAPPING INNOVATION SPACE

The area indicated by the circle in Figure 1.6 is the potential innovation space within which an organization can operate. (Whether it actually explores and exploits all the space is a question for innovation *strategy*, and we will return to this theme later in Chapter 4.)

We can use the model to look at where the organization currently has innovation projects – and where it might move in the future. For example, if the emphasis has been on product and process innovation, there may be scope for exploring more around position innovation – which new or underserved markets might we play in? – or around defining a new paradigm, a new business model with which to approach the marketplace.

We can also compare maps for different organizations competing in the same market – and use the tool as a way of identifying where there might be relatively unexplored space, which might offer significant innovation opportunities. By looking at where other organizations are clustering their efforts, we can pick up valuable clues about how to find relatively uncontested space and focus our efforts on these – as the low-cost airlines did with targeting new and underserved markets for travel [36].

Research Note 1.7 looks in more detail at mapping innovation space.

RESEARCH NOTE 1.7 Mapping Innovation Space

Figure 1.7 shows how the 4Ps approach was applied in a company (R&P Ltd) making garden machinery. The diamond diagram provides an indication of where and how they could construct a broad-ranging 'innovation agenda'. Nine innovation activities were listed on the diamond chart, including the following:

- Building totally customized products for customer's individual orders (paradigm)
- Using sensors in the next generation of lawn mowers to avoid roots and stones (product)

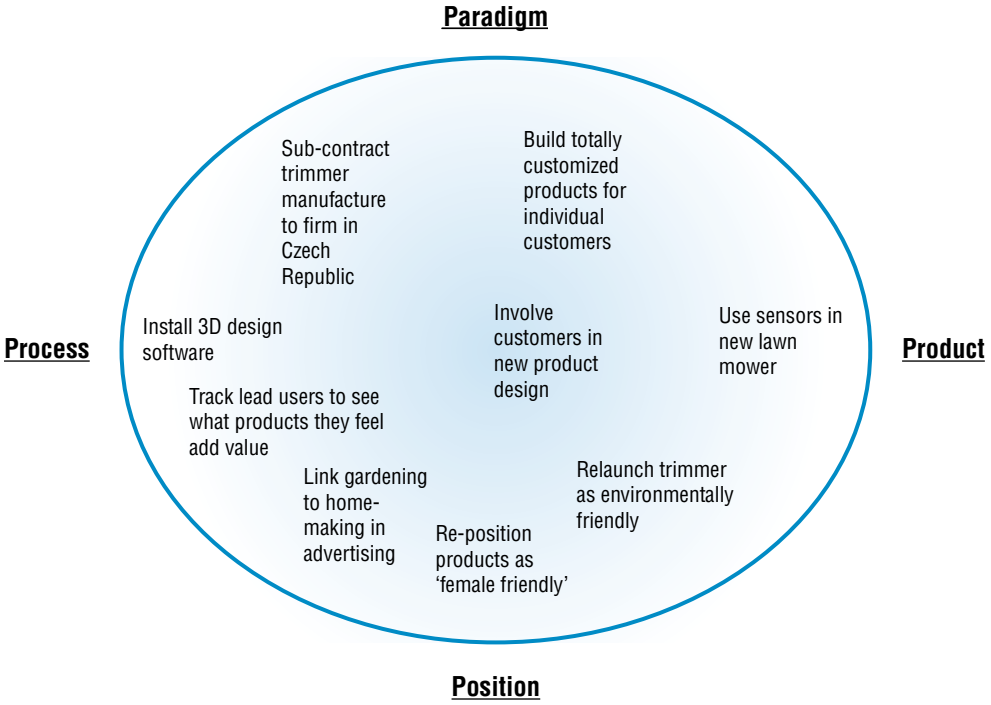

FIGURE 1.7 Suggested innovations mapped on to the 4Ps framework

Source: Based on Francis, D. and J. Bessant, Targeting innovation and implications for capability development. *Technovation*, 2005. **25**(3), 171–83.

- Repositioning the company's products as female-friendly as more women are keen gardeners (position)
- Installing 3D design software in the R&D department (process)

The selection of just nine major innovation initiatives gave focus to R&P's innovation management: the firm considered that 'it is important not to try to do too much at once'.

Some initiatives, such as relaunching their trimmer as environmentally friendly, require both product and positional innovation. Such interdependencies are clarified by discussion on the placing of an initiative on the diagram. Also, the fact that the senior management group had the 4Ps on one sheet of paper had the effect of enlarging choice – they saw completing the diagram as a tool for helping them think in a systematic way about using the innovation capability of the firm.

Of course this 4Ps innovation compass is only one of many frameworks we might use – for example, Research Note 1.8 discusses a model based on 12 types of innovation whilst an influential consulting report and book focuses on ten types [37]. The management question is less about how many different types than the need to recognize the many different ways in which innovation can take place and ensure the innovation space is explored as thoroughly as possible.

Research Note 1.8 gives some examples of different ways to innovate.

RESEARCH NOTE 1.8 Twelve Ways to Innovate

Mohanbir Sawhney, Robert Wolcott and Inigo Arroniz from the Center for Research in Technology and Innovation at the Kellogg School of Management at Northwestern University, USA, interviewed innovation managers at a number of large firms, including Boeing, DuPont, Microsoft, eBay, Motorola and Sony and from these developed a survey questionnaire, which was sent to a further 19 firms, such as General Electric, Merck and Siemens. Analysing these data, they derived an 'innovation radar' to represent 12 dimensions of business innovation they identified. Their definition of 'business innovation' does not focus on new things, but rather anything that creates new value for customers. Therefore, creating new things is neither necessary nor sufficient for such value creation. Instead, they propose a systematic approach to business innovation, which may take place in 12 different dimensions:

- Offerings – new products or services
- Platform – derivative offerings based on reconfiguration of components
- Solutions – integrated offerings that customers value
- Customers – unmet needs or new market segments
- Customer experience – redesign of customer contact and interactions
- Value capture – redefine the business model and how income is generated
- Processes – to improve efficiency or effectiveness
- Organization – change scope or structures
- Supply chain – changes in sourcing and order fulfilment
- Presence – new distribution or sales channels
- Brand – leverage or reposition
- Networking – create integrated offerings using networks

Source: Based on Sawhney, M., R.C. Wolcott, and I. Arroniz (2006). 'The 12 different ways for companies to innovate', *MIT Sloan Management Review,* Spring, 75–81.

1.11 KEY ASPECTS OF INNOVATION

The overall innovation space provides a simple map of the table on which we might place our innovation bets. But before making those bets, we should consider some of the other characteristics of innovation that might shape our strategic decisions about where and when to play. These key aspects include the following:

- Degree of novelty – incremental or radical innovation?
- Level of innovation – component or architecture?

- Platforms and families of innovations
- Timing – the innovation life cycle
- Discontinuous innovation – what happens when the rules of the game change?

We will explore these – and the challenges they pose for managing innovation – a little more in the following section.

INCREMENTAL INNOVATION – DOING WHAT WE DO BUT BETTER

A key issue in managing innovation relates to the degree of novelty involved in different places across the innovation space. Clearly, updating the styling on our car is not the same as coming up with a completely new concept car that has an electric engine and is made of new composite materials as opposed to steel and glass. Similarly, increasing the speed and accuracy of a lathe is not the same thing as replacing it with a computer-controlled laser forming process. There are degrees of novelty in these, running from minor, incremental improvements right through to radical changes, which transform the way we think about and use them. Sometimes, these changes are common to a particular sector or activity, but sometimes, they are so radical and far-reaching that they change the basis of society – for example, the role played by steam power in the Industrial Revolution or the ubiquitous changes resulting from today's communications and computing technologies.

As far as managing the innovation process is concerned, these differences are important. The ways in which we approach incremental, day-to-day change will differ from those used occasionally to handle a radical step change in product or process. But we should also remember that it is the *perceived* degree of novelty that matters; novelty is very much in the eye of the beholder. For example, in a giant, technologically advanced organization such as Shell or IBM, advanced networked information systems are commonplace, but for a small car dealership or food processor, even the use of a simple personal computer (PC) to connect to the Internet may still represent a major challenge.

The reality is that although innovation sometimes involves a discontinuous shift, most of the time it takes place in an incremental fashion. Essentially, this is product/process improvement along the lines of 'doing what we do, but better' – and there is plenty to commend this approach. For example, the Bic ballpoint pen was originally developed in 1957 but remains a strong product with daily sales of 14 million units worldwide. Although superficially the same shape, closer inspection reveals a host of incremental changes that have taken place in materials, inks, ball technology, safety features and so on.

Another example of a small change that has had a big impact is the three-point seat belt, originating in Volvo in 1959. Nils Bohlin came up with the simple idea of wrapping a belt of fabric around the seats and anchoring it to the car's chassis. Volvo opened up the patent to all manufacturers, and the resulting innovation has saved hundreds of thousands of lives.

In a similar fashion, process innovation is mainly about optimization and getting the bugs out of the system. (Ettlie suggests that disruptive or new-to-the-world innovations are only 6% to 10% of all projects labelled innovation [38].) Studies of incremental process development (such as Hollander's famous study of DuPont rayon plants) suggest that the cumulative gains in efficiency are often much greater over time than those that come from occasional radical changes [39]. Other examples include Tremblay's studies of paper mills, Enos's on petroleum refining and Figueredo's of steel plants [40–42].

Continuous improvement of this kind received considerable attention as part of the 'total quality management' movement in the late twentieth century, reflecting the significant gains that Japanese manufacturers were able to make in improving quality and productivity through sustained incremental change. But these ideas are not new – similar principles underpin the famous 'learning curve' effect, where productivity improves with increases in the scale of

production; the reason for this lies in the learning and continuous incremental problem-solving innovation that accompanies the introduction of a new product or process [43]. More recent experience of deploying 'lean' thinking in manufacturing and services and increasingly between as well as within enterprises underlines further the huge scope for such continuous innovation [44].

COMPONENT/ARCHITECTURE INNOVATION AND THE IMPORTANCE OF KNOWLEDGE

Another important lens through which to view innovation opportunities is as components within larger systems. Rather similar to Russian dolls, we can think of innovations that change things at the level of components or those that involve change in a whole system. For example, we can put a faster transistor on a microchip on a circuit board for the graphics display in a computer. Or, we can change the way several boards are put together into the computer to give it particular capabilities – a games box, an e-book, a media PC. Or, we can link the computers into a network to drive a small business or office. Or, we can link the networks to others into the Internet. There's scope for innovation at each level – but changes in the higher-level systems often have implications for lower down. For example, if cars – as a complex assembly – were suddenly designed to be made out of plastic instead of metal, it would still leave scope for car assemblers – but would pose some sleepless nights for producers of metal components!

Innovation is about knowledge – creating new possibilities through combining different knowledge sets. These can be in the form of knowledge about what is technically possible or what particular configuration of this would meet an articulated or latent need. Such knowledge may already exist in our experience, based on something we have seen or done before. Or, it could result from a process of search – research into technologies, markets, competitor actions and so on. And it could be in explicit form, codified in such a way that others can access it, discuss it, transfer it and so on – or it can be in tacit form, known about but not actually put into words or formulae.

The process of weaving these different knowledge sets together into a successful innovation is one that takes place under highly uncertain conditions. We don't know about what the final innovation configuration will look like (and we don't know how we will get there). Managing innovation is about turning these uncertainties into knowledge – but we can do so only by committing resources to reduce the uncertainty – effectively a balancing act.

A key contribution to our understanding here comes from the work by Henderson and Clark, who looked closely at the kinds of knowledge involved in different kinds of innovation [45]. They argue that innovation rarely involves dealing with a single technology or market but rather a bundle of knowledge, which is brought together into a configuration. Successful innovation management requires that we can get hold of and use knowledge about *components* but also about how those can be put together – what they termed the *architecture* of an innovation.

We can see this more clearly with an example. Change at the component level in building a flying machine might involve switching to newer metallurgy or composite materials for the wing construction or the use of fly-by-wire controls instead of control lines or hydraulics. But the underlying knowledge about how to link aerofoil shapes, control systems, propulsion systems and so on at the *system* level is unchanged – and being successful at both requires different and higher-order set of competencies.

One of the difficulties with this is that innovation knowledge flows – and the structures that evolve to support them – tend to reflect the nature of the innovation. So if it is at the component level, then the relevant people with skills and knowledge around these components will talk to each other – and when change takes place, they can integrate new knowledge. But when change takes place at the higher system level – 'architectural innovation' in Henderson and Clark's terms – then the existing channels and flows may not be appropriate or sufficient to support the innovation, and the firm needs to develop new ones. This is another reason why existing

incumbents often fare badly when a major system-level change takes place – because they have the twin difficulties of learning and configuring a new knowledge system and 'unlearning' an old and established one.

Figure 1.8 illustrates the range of choices, highlighting the point that such change can happen at the component or subsystem level or across the whole system . . .

A variation on this theme comes in the field of 'technology fusion', where different technological streams converge, such that products that used to have a discrete identity begin to merge into new architectures. An example here is the home automation industry, where the fusion of technologies such as computing, telecommunications, industrial control and elementary robotics is enabling a new generation of housing systems with integrated entertainment, environmental control (heating, air conditioning, lighting, etc.) and communication possibilities.

Similarly, in services, a new addition to the range of financial services may represent a component product innovation, but its impacts are likely to be less far-reaching (and the attendant risks of its introduction lower) than a complete shift in the nature of the service package – for example, the shift to direct-line systems instead of offering financial services through intermediaries.

Many businesses are now built on business models that stress integrated solutions – systems of many components that together deliver value to end users. These are often complex, multiorganization networks – examples might include rail networks, mobile phone systems, major construction projects or design and development of new aircraft such as the Boeing Dreamliner or the Airbus A-321. Managing innovation on this scale requires development of skills in what Mike Hobday and colleagues call 'the business of systems integration' [46].

Figure 1.9 highlights the issues in managing innovation.

In Zone 1, the rules of the game are clear – this is about steady-state improvement to products or processes and uses knowledge accumulated around core components.

In Zone 2, there is significant change in one element, but the overall architecture remains the same. Here there is a need to learn new knowledge but within an established and clear framework of sources and users – for example, moving to electronic ignition or direct injection in a car engine, the use of new materials in airframe components, the use of IT systems instead of paper processing in key financial or insurance transactions, and so on. None of these involve major shifts or dislocations.

In Zone 3, we have discontinuous innovation where neither the end state nor the ways in which it can be achieved are known about – essentially, the whole set of rules of the game changes, and there is scope for new entrants.

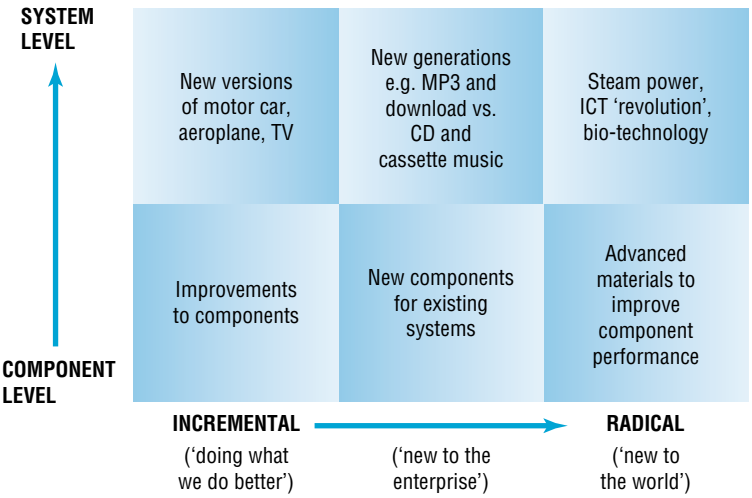

FIGURE 1.8 Dimensions of innovation

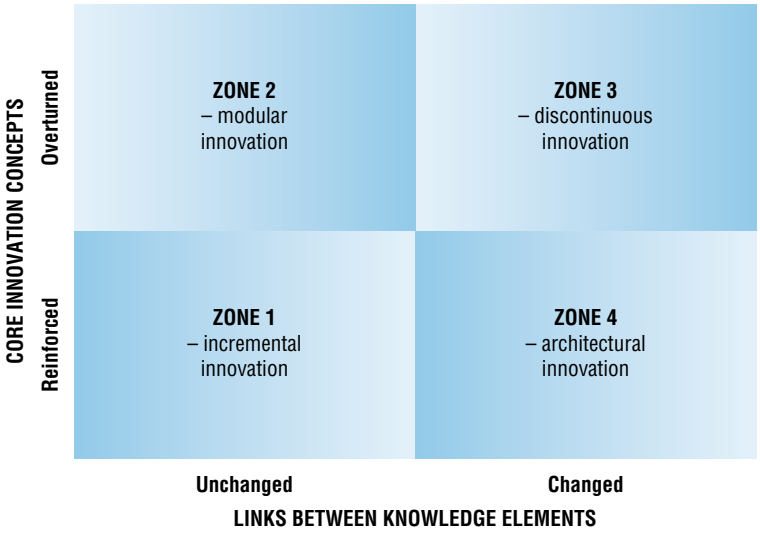

FIGURE 1.9 Component and architectural innovation

Source: Based on Abernathy, W. and J. Utterback, Patterns of industrial innovation. *Technology Review*, 1978. **80**, 40–47.

In Zone 4, we have the condition where new combinations – architectures – emerge, possibly around the needs of different groups of users (as in the disruptive innovation case). Here the challenge is in reconfiguring the knowledge sources and configurations. We may use existing knowledge and recombine it in different ways, or we may use a combination of new and old. Examples might be low-cost airlines, direct line insurance and others.

PLATFORM INNOVATION

One way in which the continuous incremental innovation approach can be harnessed to good effect is through the concept of 'platforms'. This is a way of creating stretch and space around an innovation and depends on being able to establish a strong basic platform or family, which can be extended. Boeing's 737 airliner, for example, was a major breakthrough innovation back in 1967 when it first flew – and it cost a great deal to develop. However, the robustness and flexibility in the design means that many variants and improvements have been made over the years, and the plane is still being manufactured today, nearly 60 years later! (Although the attempts to develop a more fuel-efficient version, the 737 Max floundered because of pressures inside the company to launch too soon and without adequate safety checks or pilot training.) Rothwell and Gardiner call this kind of platform a 'robust design', and examples can be seen in many areas [47].

Aircraft engine makers such as Rolls-Royce and General Electric work with families of core designs, which they stretch and adapt to suit different needs, while semiconductor manufacturers such as Intel and AMD spread the huge cost of developing new generations of chip across many product variants [48]. Car makers produce models that, although apparently different in style, make use of common components and floor pans or chassis. IBM's breakthrough in the PC industry was built on a platform architecture that was then opened up to many players to create hardware and software applications – a forerunner of today's mobile phone apps model. And in consumer products, the 'Walkman' originally developed by Sony as a portable radio and cassette system defined a platform concept (personal entertainment systems) that continued to underpin a wide range of offerings from all major manufacturers deploying technologies such as minidisk, CD, DVD, MP3 players and now smartphones. Lego's highly successful toy business has literally been built with the core brick set representing its platform for innovation over 70 years.

In processes, much has been made of the ability to enhance and improve performance over many years from the original design concepts – in fields such as steel making and chemicals, for example. Service innovation offers other examples where a basic concept can be adapted

and tailored for a wide range of similar applications without undergoing the high initial design costs – as is the case with different mortgage or insurance products. Sometimes, platforms can be extended across different sectors – for example, the original ideas behind 'lean' thinking originated in firms such as Toyota in the field of car manufacturing – but have subsequently been applied across many other manufacturing sectors and into both public and private service applications including hospitals, supermarkets and banks [49].

Platforms and families are powerful ways for companies to recoup their high initial investments in R&D by deploying the technology across a number of market fields. For example, Procter & Gamble invested heavily in their cyclodextrin development for original application in detergents but then were able to use this technology or variants on it in a family of products including odour control ('Febreze'), soaps and fine fragrances ('Olay'), off-flavour food control, disinfectants, bleaches and fabric softening ('Tide', 'Bounce', etc.). They were also able to license out the technology for use in noncompeting areas such as industrial-scale carpet care and in the pharmaceutical industry.

If we take the idea of 'position' innovation mentioned earlier, then the role of brands can be seen as establishing a strong platform association, which can be extended beyond an initial product or service. For example, Richard Branson's Virgin brand has successfully provided a platform for entry into a variety of new fields including trains, financial services, telecommunications and food, while Stelios Haji-Ioannou has done something similar with his 'Easy' brand, moving into cinemas, car rental, cruises and hotels from the original base in low-cost flying.

In their work on what they call 'management innovation', Julian Birkinshaw and colleagues highlight a number of core organizational innovations (such as 'total quality management') that have diffused widely across sectors [50]. These are essentially paradigm innovations, which represent concepts that can be shaped and stretched to fit a variety of different contexts – for example, Henry Ford's original ideas on mass production became applied and adapted to a host of other industries. McDonald's owed much of their inspiration to him in designing their fast-food business, and in turn, they were a powerful influence on the development of the Aravind Eye Clinics in India, which bring low-cost eye surgery to the masses [51]. (We will return to this important question of platforms in the next chapter.)

THE INNOVATION LIFE CYCLE – DIFFERENT EMPHASIS OVER TIME

We also need to recognize that innovation opportunities change over time. In new industries – such as today's biotech, Internet-software or nanomaterials – there is huge scope for experimentation around new product and service concepts. But more mature industries tend to focus more around process innovation or position innovation, looking for ways of delivering products and services more cheaply or flexibly or for new market segments into which to sell them. In their pioneering work on this theme, Abernathy and Utterback developed a model describing the pattern in terms of three distinct phases (as we can see in **Figure 1.10**) [52].

Initially, under the discontinuous conditions, which arise when completely new technology and/or markets emerge, there is what they term a 'fluid phase' during which there is high uncertainty along two dimensions:

- The target – what will the new configuration be and who will want it?
- The technical – how will we harness new technological knowledge to create and deliver this?

No one knows what the 'right' configuration of technological means and market needs will be, and so there is extensive experimentation (accompanied by many failures) and fast learning by a range of players including many new entrepreneurial businesses.

Gradually, these experiments begin to converge around what they call a 'dominant design' – something that begins to set up the rules of the game. This represents a convergence around the most popular (importantly, not necessarily, the most technologically sophisticated

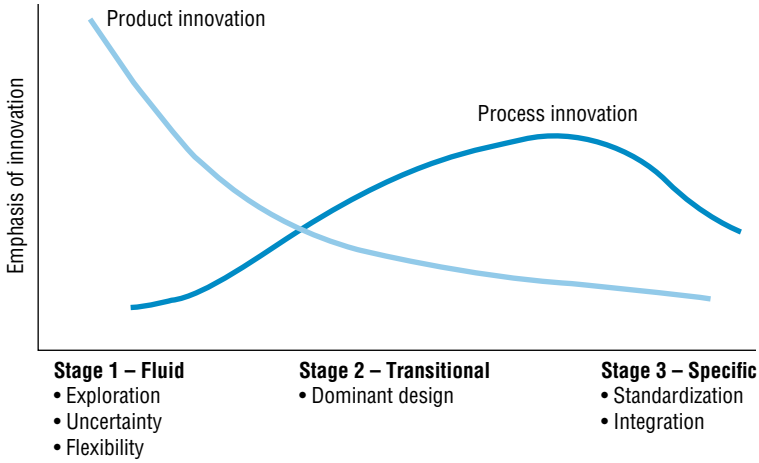

FIGURE 1.10 The innovation life cycle

Source: Based on W. Abernathy and J. Utterback, 'Patterns of industrial innovation', *Technology Review*, vol. 80, pp. 40–47, 1978.

or elegant) solution to the emerging configuration. At this point, a 'bandwagon' begins to roll, and innovation options become increasingly channelled around a core set of possibilities – what Dosi calls a 'technological trajectory' [53]. It becomes increasingly difficult to explore outside this space because entrepreneurial interest and the resources that it brings increasingly focus on possibilities within the dominant design corridor.

This can apply to products or processes; in both cases, the key characteristics become stabilized, and experimentation moves to getting the bugs out and refining the dominant design. For example, the nineteenth-century chemical industry moved from making soda ash (an essential ingredient in making soap, glass and a host of other products) from the earliest days where it was produced by burning vegetable matter through to a sophisticated chemical reaction that was carried out on a batch process (the Leblanc process), which was one of the drivers of the Industrial Revolution. This process dominated for nearly a century but was in turn replaced by a new generation of continuous processes that used electrolytic techniques and that originated in Belgium, where they were developed by the Solvay brothers. Moving to the Leblanc process or the Solvay process did not happen overnight; it took decades of work to refine and improve each process and to fully understand the chemistry and engineering required to get consistent high-quality output.

A similar pattern can be seen in products. For example, the original design for a camera is something that goes back to the early nineteenth century and – as a visit to any science museum will show – involved all sorts of ingenious solutions. The dominant design gradually emerged with an architecture that we would recognize – shutter and lens arrangement, focusing principles, back plate for film or plates and so on. But this design was then modified still further – for example, with different lenses, motorized drives, flash technology – and, in the case of George Eastman's work, to creating a simple and relatively 'idiot-proof' model camera (the Box Brownie), which opened up photography to a mass market. More recent development has seen a similar fluid phase around digital imaging devices.

The period in which the dominant design emerges and emphasis shifts to imitation and development around it is termed the 'transitional phase' in the Abernathy and Utterback model. Activities move from radical concept development to more focused efforts geared around product differentiation and to delivering it reliably, cheaply, with higher quality, extended functionality and so on.

As the concept matures still further, incremental innovation becomes more significant and emphasis shifts to factors such as cost – which means that efforts within the industries that grow up around these product areas tend to focus increasingly on rationalization, on scale economies, and on process innovation to drive out cost and improve productivity. Product innovation is

increasingly about differentiation through customization to meet the particular needs of specific users. Abernathy and Utterback term this the 'specific phase'.

Finally, the stage is set for change – the scope for innovation becomes smaller and smaller while outside – for example, in the laboratories and imaginations of research scientists – new possibilities are emerging. Eventually, a new technology that has the potential to challenge all the by-now well-established rules emerges – and the game is disrupted. In the camera case, for example, this is happening with the advent of digital photography, which is having an impact on cameras and the overall service package around how we get, keep and share our photographs. In our chemical case, this is happening with biotechnology and the emergence of the possibility of no longer needing giant chemical plants but instead moving to small-scale operations using live organisms genetically engineered to produce what we need.

Table 1.8 sets out the main elements of this model.

Although originally developed for manufactured products, the model also works for services – for example, the early days of online banking were characterized by a typically fluid phase with many options and models being offered. This gradually moved to a transitional phase, building a dominant design consensus on the package of services offered, the levels and nature of security and privacy support, the interactivity of website and so on. The field has now become mature with much of the competition shifting to marginal issues such as relative interest rates and targeting specific customer niches.

We should also remember that there is a long-term cycle involved – mature businesses that have already gone through their fluid and transitional phases do not necessarily stay in the mature phase forever. Rather, they become increasingly vulnerable to a new wave of change as the cycle repeats itself – for example, the lighting industry has entered a new fluid phase based on the applications of solid-state LED technology, but this comes after over 100 years of the incandescent bulb developed by Swann, Edison and others. Their early experiments eventually converged on a dominant product design after which emphasis shifted to process innovation around cost, quality and other parameters – a trajectory that has characterized the industry and led to increasing consolidation among a few big players. But that maturity has now given way to a new phase involving different players, technologies and markets. Something similar is happening in the automobile industry; after the initial fluid phase in the late nineteenth century, the industry adopted the dominant design led by Ford's Model T and the factory making it. But we are now seeing a new fluid phase characterized by new technologies around autonomous driverless vehicles, shifting ownership patterns, strong regulatory pressures around emissions and the entry of new players such as Google, Apple and Tesla.

Table 1.8 Stages in the Innovation Life Cycle

Innovation Characteristic	Fluid Pattern	Transitional Phase	Specific Phase
Competitive emphasis placed on . . .	Functional product performance	Product variation	Cost reduction
Innovation stimulated by . . .	Information on user needs, technical inputs	Opportunities created by expanding internal technical capability	Pressure to reduce cost, improve quality and so on
Predominant type of innovation	Frequent major changes in products	Major process innovations required by rising volume	Incremental product and process innovation
Product line	Diverse, often including custom designs	Includes at least one stable or dominant design	Mostly undifferentiated standard products
Production processes	Flexible and inefficient – aim is to experiment and make frequent changes	Becoming more rigid and defined	Efficient, often capital-intensive and relatively rigid

The pattern can be seen in many studies, and its implications for innovation management are important. In particular, it helps us understand why established organizations often find it hard to deal with discontinuous change.

DISCONTINUOUS INNOVATION – WHAT HAPPENS WHEN THE GAME CHANGES?

Most of the time innovation takes place within a set of rules of the game, which are clearly understood, and involves players trying to innovate by doing what they have been doing (product, process, position, etc.) but better. Some manage this more effectively than others, but the 'rules of the game' are accepted and do not change .

But occasionally, something happens, which dislocates this framework and changes the rules of the game. By definition, these are not everyday events, but they have the capacity to redefine the space and the boundary conditions – they open up new opportunities but also challenge existing players to reframe what they are doing in the light of new conditions. This is a central theme in Schumpeter's original theory of innovation, which he saw as involving a process of 'creative destruction' [20].

Case Study 1.8 discusses the example of the ice industry and its experience of discontinuous innovation.

Change of this kind can come through the emergence of a new technology – similar to the ice industry example (see Case Study 1.8). Or, it can come through the emergence of a completely new market with new characteristics and expectations. In his famous studies of the computer disk drive, steel and hydraulic excavator industries, Christensen highlights the problems that

CASE STUDY 1.8 The Melting Ice Industry

Back in the 1880s, there was a thriving industry in the north-eastern United States in the lucrative business of selling ice. The business model was deceptively simple – work hard to cut chunks of ice out of the frozen northern wastes, wrap the harvest quickly, and ship it as quickly as possible to the warmer southern states – and increasingly overseas – where it could be used to preserve food. In its heyday, this was a big industry – in 1886, the record harvest ran to 25 million tons – and it employed thousands of people in cutting, storing and shipping the product. And it was an industry with strong commitment to innovation – developments in ice cutting, snow ploughs, insulation techniques and logistics underpinned the industry's strong growth. The impact of these innovations was significant – they enabled, for example, an expansion of markets to far-flung locations such as Hong Kong, Bombay and Rio de Janeiro, where, despite the distance and journey times, sufficient ice remained of cargoes originally loaded in ports such as Boston to make the venture highly profitable [54].

But at the same time, as this highly efficient system was growing, researchers such as the young Carl von Linde were working in their laboratories on the emerging problems of refrigeration. It wasn't long before artificial ice making became a reality – Joseph Perkins had demonstrated that vaporizing and condensing a volatile liquid in a closed system would do the job and in doing so outlined the basic architecture that underpins today's refrigerators. In 1870, Linde published his research, and by 1873, a patented commercial refrigeration system was on the market. In the years that followed, the industry grew – in 1879, there were 35 plants, and 10 years later, 222 making artificial ice. Effectively, this development sounded the death knell for the ice-harvesting industry – although it took a long time to go under. For a while, both industries grew alongside each other, learning and innovating along their different pathways and expanding the overall market for ice – for example, by feeding the growing urban demand to fill domestic 'ice boxes'. But inevitably, the new technology took over as the old harvesting model reached the limits of what it could achieve in terms of technological efficiencies.

Significantly, most of the established ice harvesters were too locked into the old model to make the transition and so went under – to be replaced by the new refrigeration industry dominated by new entrant firms.

arise under these conditions [55]. For example, the disk drive industry was a thriving sector in which the voracious demands of a growing range of customer industries meant that there was a booming market for disk drive storage units. Around 120 players populated what had become an industry worth $18 billion by 1995 – and – similar to their predecessors in ice harvesting – it was a richly innovative industry. Firms worked closely with their customers, understanding the particular needs and demands for more storage capacity, faster access times, smaller footprints and so on. But just as our ice industry, the virtuous circle around the original computer industry was broken – in this case, not by a radical technological shift but by the emergence of a new market with very different needs and expectations.

The key point about this sector was that disruption happened not once but several times, involving different generations of technologies, markets and participating firms. For example, while the emphasis in the minicomputer world of the mid-1970s was on high performance and the requirement for storage units correspondingly technologically sophisticated, the emerging market for PCs had a very different shape. These were much less clever machines, capable of running much simpler software and with massively inferior performance – but at a price that a very different set of people could afford. Importantly, although simpler, they were capable of doing most of the basic tasks that a much wider market was interested in – simple arithmetical calculations, word processing and basic graphics. As the market grew so, learning effects meant that these capabilities improved – but from a much lower cost base. The result was, in the end, just as that of Linde and his contemporaries in the ice industry – but from a different direction. Of the major manufacturers in the disk drive industry serving the minicomputer market, only a handful survived – and leadership in the new industry shifted to new entrant firms working with a very different model.

Discontinuity can also come about by reframing the way we think about an industry – changing the dominant business model and hence the 'rules of the game'. Think about the revolution in flying that the low-cost carriers have brought about. Here the challenge came via a new business model rather than technology – based on the premise that if prices could be kept low, a large new market could be opened up. The power of the new way of framing the business was that it opened up a new – and very different – trajectory along which all sorts of innovations began to happen. In order to make low prices pay a number of problems needed solving – keeping load factors high, cutting administration costs, enabling rapid turnaround times at terminals – but once the model began to work, it attracted not only new customers but also increasingly established flyers who saw the advantages of lower prices.

What these – and many other examples – have in common is that they represent the challenge of *discontinuous* innovation. None of the industries were lacking in innovation or a commitment to further change. But the ice harvesters, minicomputer disk companies or the established airlines all carried on their innovation on a stage covered with a relatively predictable carpet. The trouble was that shifts in technology, in new market emergence or in new business models pulled this carpet out from under the firms – and created a new set of conditions on which a new game would be played out. Under such conditions, it is the new players who tend to do better because they don't have to wrestle with learning new tricks and letting go of their old ones. Established players often do badly – in part because the natural response is to press even harder on the pedal driving the existing ways of organizing and managing innovation.

In the ice industry example, the problem was not that the major players weren't interested in R&D – on the contrary, they worked really hard at keeping a technological edge in insulation, harvesting and other tools. But they were blindsided by technological changes coming from a different field altogether – and when they woke up to the threat posed by mechanical ice making their response was to work even harder at improving their own ice harvesting and shipping technologies. It is here that the so-called *sailing ship* effect can often be observed, in which a mature technology accelerates in its rate of improvement as a response to a competing new alternative – as was the case with the development of sailing ships in competition with newly emerging steamship technology [56].

In a similar fashion, the problem for the firms in the disk drive industry wasn't that they didn't listen to customers but rather that they listened too well. They build a virtuous circle of demanding customers in their existing market place with whom they developed a stream of improvement innovations – continuously stretching their products and processes to do what they were doing better and better. The trouble was that they were getting close to the wrong customers – the discontinuity that got them into trouble was the emergence of a completely different set of users with very different needs and values.

Table 1.9 gives some examples of such triggers for discontinuity. Common to these from an innovation management point of view is the need to recognize that under discontinuous

Table 1.9 Some Examples of Sources of Discontinuity

Triggers/Sources of Discontinuity	Explanation	Problems Posed	Examples
New market emerges	Most markets evolve through a process of gradual expansion, but at certain times, completely new markets emerge, which cannot be analysed or predicted in advance or explored through using conventional market research/analytical techniques	Established players don't see it because they are focused on their existing markets May discount it as being too small or not representing their preferred target market – fringe/cranks dismissal Originators of new product may not see potential in new markets and may ignore them, for example, text messaging	Disk drives, excavators, mini-mills Mobile phone/SMS where the market that actually emerged was not the one expected or predicted by originators
New technology emerges	Step change takes place in product or process technology – may result from convergence and maturing of several streams (e.g., industrial automation, mobile phones) or as a result of a single breakthrough (e.g., LED as white light source)	Don't see it because it is beyond the periphery of technology search environment Not an extension of current areas but completely new field or approach Tipping point may not be a single breakthrough but convergence and maturing of established technological streams, whose combined effect is underestimated Not invented here effect – new technology represents a different basis for delivering value – for example, telephone versus telegraphy	Ice harvesting to cold storage Valves to solid-state electronics Photos to digital images
New political rules emerge	Political conditions that shape the economic and social rules may shift dramatically – for example, the collapse of communism meant an alternative model – capitalist, competition – as opposed to central planning – and many ex-state firms couldn't adapt their ways of thinking	Old mind-set about how business is done, rules of the game and so on are challenged and established firms fail to understand or learn new rules	Centrally planned to market economy, for example, former Soviet Union Apartheid to post-Apartheid South Africa – inward and insular to externally linked Free trade/globalization results in dismantling protective tariff and other barriers and new competition basis emerges
Running out of road	Firms in mature industries may need to escape the constraints of diminishing space for product and process innovation and the increasing competition of industry structures by either exit or by radical reorientation of their business	Current system is built around a particular trajectory and embedded in a steady-state set of innovation routines, which militate against widespread search or risk-taking experiments	Kodak, Polaroid and the digital imaging shift Encyclopaedia Britannica

(continued)

Table 1.9 Some Examples of Sources of Discontinuity (*continued*)

Triggers/Sources of Discontinuity	Explanation	Problems Posed	Examples
Sea change in market sentiment or behaviour	Public opinion or behaviour shifts slowly and then tips over into a new model – for example, the music industry is in the midst of a (technology-enabled) revolution in delivery systems from buying records, tapes and CDs to direct download of tracks in MP3 and related formats	Don't pick up on it or persist in alternative explanations – cognitive dissonance – until it may be too late	The rise of file sharing in the music industry Shifts towards meat-free food-stuffs Growth of sharing economy and decline in ownership of cars and other consumer goods
Deregulation/ shifts in regulatory regime	Political and market pressures lead to shifts in the regulatory frame-work and enable the emergence of a new set of rules – for example, liberalization, privatization or deregulation	New rules of the game but old mind-sets persist and existing player unable to move fast enough or see new oppor-tunities opened up	Old monopoly positions in fields such as telecommunications and energy were dismantled and new players/combinations of enterprises emerged. In particular, energy and band-width become increasingly viewed as commodities
Fractures along 'fault lines'	Long-standing issues of concern to a minority accumulate momentum (sometimes through the action of pressure groups) and suddenly the system switches/tips over – for example, social attitudes to smoking or health concerns about obesity levels and fast foods	Rules of the game suddenly shift and the new pattern gathers rapid momentum, often wrong-footing existing players working with old assumptions. Other players who have been working in the background developing parallel alternatives may suddenly come into the limelight as new conditions favour them	McDonald's and obesity Tobacco companies and smoking bans Oil/energy and others and global warming
Unthinkable events	Unimagined and therefore not pre-pared for events that – sometimes literally – change the world and set up new rules of the game	New rules may disempower existing players or render competencies unnec-essary	9/11
Business model innovation	Established business models are challenged by a reframing, usually by a new entrant who redefines/ reframes the problem and the consequent 'rules of the game'	New entrants see opportunity to deliver product/service via new business model and rewrite rules – existing players have at best to be fast followers	Amazon, Alibaba Charles Schwab Southwest and other low-cost airlines
Architectural innovation	Changes at the level of the system architecture rewrite the rules of the game for those involved at the component level	Established players develop particular ways of seeing and frame their interactions – for example, who they talk to in acquiring and using knowledge to drive innovation – according to this set of views. Architectural shifts may involve reframing, but at the component level, it is difficult to pick up the need for doing so – and thus new entrants better able to work with new architecture can emerge	Photolithography in chip manufacture
Shifts in 'technoeconomic paradigm' – systemic changes that impact whole sectors or even whole societies	Change takes place at system level, involving technology and market shifts. This involves the convergence of a number of trends, which result in a 'para-digm shift' where the old order is replaced	Hard to see where new paradigm begins until rules become established. Existing players tend to reinforce their commitment to old model, reinforced by 'sailing ship' effects	Industrial Revolution Mass production

conditions (which thankfully don't emerge every day), we need different approaches to organizing and managing innovation. If we try and use established models that work under steady-state conditions we find – as is the reported experience of many – we are increasingly out of our depth and risk being upstaged by new and more agile players.

Organizations build capabilities around a particular trajectory and those who may be strong in the later (specific) phase of an established trajectory often find it hard to move into the new one. (The example of the firms that successfully exploited the transistor in the early 1950s is a good case in point – many were new ventures, sometimes started by enthusiasts in their garage, yet they rose to challenge major players in the electronics industry such as Raytheon.) This is partly a consequence of sunk costs and commitments to existing technologies and markets and partly because of psychological and institutional barriers. They may respond but in slow fashion – and they may make the mistake of giving responsibility for the new development to those whose current activities would be threatened by a shift.

While some research suggests that the existing incumbents do badly when discontinuous change triggers a new fluid phase, we need to be careful here [57]. Not all existing players do badly – many of them are able to build on the new trajectory and deploy/leverage their accumulated knowledge, networks, skills and financial assets to enhance their competence through building on the new opportunity [58,59]. Equally, while it is true that new entrants – often small entrepreneurial firms – play a strong role in this early phase, we should not forget that we see only the successful players. We need to remember that there is a strong ecological pressure on new entrants, which means only the fittest or luckiest survive.

It is more helpful to suggest that there is something about the ways in which innovation is *managed* under these conditions, which poses problems. Good practice of the 'steady state' kind described is helpful in the mature phase but can actively militate against the entry and success in the fluid phase of a new technology. How do enterprises pick up signals about changes if they take place in areas where they don't normally do research? How do they understand the needs of a market that doesn't exist yet but that will shape the eventual package, which becomes the dominant design? If they talk to their existing customers, the likelihood is that those customers will tend to ask for more of the same, so which new users should they talk to – and how do they find them?

The challenge involves trying to develop ways of managing innovation not only under 'steady state' but also under the highly uncertain, rapidly evolving and changing conditions, which result from a dislocation or discontinuity. The kinds of organizational behaviour needed here will include things such as agility, flexibility, the ability to learn fast, the lack of preconceptions about the ways in which things might evolve and so on – and these are often associated with new small firms. There are ways in which large and established players can also exhibit this kind of behaviour, but it does often conflict with their normal ways of thinking and working.

Worryingly, the source of the discontinuity that destabilizes an industry – new technology, emergence of a new market, rise of a new business model – often comes from outside that industry [60]. So even those large incumbent firms that take time and resources to carry out research to try and stay abreast of developments in their field may find that they are wrong-footed by the entry of something that has been developed in a different field. The massive changes in insurance and financial services that have characterized the shift to online and telephone provision were largely developed by IT professionals often working outside the original industry. In extreme cases, we find what is often termed the 'not invented here' – NIH – effect, where a firm finds out about a technology but decides against following it up because it does not fit with their perception of the industry or the likely rate and direction of its technological development. Famous examples of this include Kodak's rejection of the Polaroid process or Western Union's dismissal of Bell's telephone invention. In a famous memo dated 1876, the board commented, 'this "telephone" has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us'.

1.12 INNOVATION MANAGEMENT

This chapter has begun to explore the challenges posed by innovation. It has looked at why innovation matters and opened up some perspectives on what it involves. And it has raised the idea of innovation as a core *process*, which needs to be organized and managed in order to enable the renewal of any organization. We talked about this a little earlier in the chapter, and Figure 1.6 sets it out as a graphic that highlights the key questions around *managing* innovation.

We've seen that the scope for innovation is wide – in terms of overall innovation space and in the many different ways this can be populated, with both incremental and more radical options. At the limit, we have the challenges posed when innovation moves into the territory of discontinuous change and a whole new game begins. We've also looked briefly at concepts such as component and architecture innovation and the critical role that knowledge plays in managing these different forms. Finally, we've looked at the issue of timing and of understanding the nature of different innovation types at different stages.

All that gives us a feel for what innovation is and why it matters. But what we now need to do is understand how to organize the innovation process itself. That's the focus of the rest of the book, and we deal with it in the following fashion:

In Chapter 2 we look at the digital revolution and what it means for the innovation game – is it a whole new game played by different rules or the old one with new tools? We explore some of the opportunities and implications opened up by this technological wave.

Chapter 3 looks at the process model in more detail and explores the ways in which this generic model can be configured for particular types of organization. It also looks at what we've learned about success and failure in managing innovation – themes that are examined in greater detail in the subsequent chapters – as well as key contextual issues around successful innovation management. Chapter 4 looks at the question *Do we have a clear innovation strategy?* and explores this theme in depth. Is there a clear sense of where and how innovation will take the organization forward and is there a roadmap for this? Is the strategy shared and understood – and how can we ensure alignment of the various different innovation efforts across the organization? What tools and techniques can be used to develop and enable analysis, selection and implementation of innovation?

In Chapter 5, we pick up the question *Do we have an innovative organization?* and examine the role that key concepts such as leadership, structure, communication and motivation play in building and sustaining a culture of focused creativity.

Chapter 6 moves on to the first of the core elements in our process model – the 'search' question – and explores the issues around the question of what triggers the innovation process. There are multiple sources and also challenges involved in searching for and picking up signals from them. Chapter 7 takes up the complementary question – *How do we carry out this search activity?* Which structures, tools and techniques are appropriate under what conditions? How do we balance search around exploration of completely new territory with exploiting what we already know in new forms? And Chapter 8 looks at the growing importance of innovation networks – the different ways in which they contribute to innovation and the lessons we have learned around configuring and managing them.

Moving into the area of selection in the core process model, Chapter 9 looks at how the innovation decision process works – of all the possible options generated by effective search, which ones will we back – and why? Making decisions of this kind are not simple because of the underlying uncertainty involved – so which approaches, tools and techniques can we bring to bear? It also picks up another core theme – how to choose and implement innovation options while building and capturing value from the intellectual effort involved. How can we build a business case, and how can we handle resource allocation for innovation projects in an uncertain world?

In the 'implementation' phase, issues of how we move innovation ideas into reality become central. Chapter 10 looks at the ways in which innovation projects of various kinds are organized and managed and explores structures, tools and other support mechanisms to help facilitate this.

In Chapter 11, we explore in more detail how firms use external relationships with suppliers, users and partners to develop new technologies, products and businesses in the context of 'open innovation'. Chapter 12 picks up the issue of new ventures, both those arising from within the existing organization (corporate entrepreneurship) and those that involve setting up a new entrepreneurial venture outside.

The last phase answers the question *How can we ensure that we capture value from our efforts at innovation?* Chapter 13 looks at questions of adoption and diffusion and ways to develop and work with markets for innovation. It picks up on questions of appropriability and value capture in the context of the commercial world. Chapter 14 extends this discussion to the question of 'social entrepreneurship' where concern is less about profits than about creating sustainable social value.

Finally, Chapter 15 looks at how we can assess the ways in which we organize and manage innovation and use these to drive a learning process to enable us to do it better next time.

The concern here is not just to build a strong innovation management capability but to recognize that – faced with the moving target that innovation represents in terms of technologies, markets, competitors, regulators and so on – the challenge is to create a learning and adaptive approach that constantly upgrades this capability. In other words, we are concerned to build 'dynamic capability'.

View 1.3 gives some examples of the top challenges facing innovation managers.

VIEW 1.3 WHERE DO YOU SEE THE TOP THREE CHALLENGES IN MANAGING INNOVATION?

1. Creating and sustaining a culture in which innovation can flourish. This includes a physical and organizational space where experimentation, evaluation and examination can take place. The values and behaviors that facilitate innovation have to be developed and sustained.
2. Developing people who can flourish in that environment; people who can question, challenge and suggest ideas as part of a group with a common objective, unconstrained by the day-to-day operational environment.
3. Managing innovation in the midst of a commercial enterprise that is focused on exploitation – maximum benefit from the minimum of resource that requires repeatability and a right-first-time process approach.

– Patrick McLaughlin, Managing Director, Cerulean

1. The level at which long-term innovation activities are best conducted, without losing connectedness with the BUs at which the innovations should finally be incubated and elaborated.
2. Having diverse types of individuals in the company motivated for spending time on innovation-related activities.
3. Having the right balance between application-oriented innovation and more fundamental innovation.

– Wouter Zeeman, CRH Insulation Europe

1. Innovation is too often seen as a technically driven issue; in other words, the preserve of those strange 'scientific' and 'engineering' people, so it's for them, not 'us' the wider community. The challenge is in confronting this issue and hopefully inspiring and changing people's perception so that 'innovation is OK for all of us'.
2. Raising awareness; coupled with the aforementioned, people do not fully understand what innovation is or how it applies to their world.
3. Managing in my opinion is either the wrong word or the wrong thing to do; managing implies command and control, and while important, it does not always fit well with the challenge of leading innovation that is far more about inspiring, building confidence and risk-taking. Most senior managers are risk-averse, therefore a solid management background is not always a best fit for the challenge of leading innovation.

– John Tregaskes, Technical Specialist Manager, Serco

1. Culture – encouraging people to challenge the way we do things and generate creative ideas.
2. Balancing innovation with the levels of risk management and control required in a financial services environment.
3. Ensuring that innovation in one area does not lead to suboptimization and negative impact on another.

– John Gilbert, Head of Process Excellence, UBS

1. Alignment of expectations on innovation with senior management. A clear definition of the nature of innovation is required, that is, radical versus incremental innovation and the 4Ps. What should be the primary focus?

2. To drive a project portfolio of both incremental (do better) and radical (do different) innovation. How do you get the right balance?
3. To get sufficient, dedicated, human and financial resources up-front.

– John Thesmer, Managing Director,
Ictal Care, Denmark

1. Finding R&D money for far-sighted technology projects at a time when shareholders seem to apply increasing amounts of pressure on companies to deliver short-term results. Every industry needs to keep innovating to stay competitive in the future – and the rate of technological change is accelerating. But companies are being forced to pursue these objectives for less and less money.
2. Managing this difficult balance of 'doing more with less' is a major challenge in our industry, and I am certain that we are not alone. Building a corporate culture that doesn't punish risk-takers. Managers in many organizations seem to be judged almost exclusively according to how well they are performing according to some fairly basic measurements, for example, sales or number of units. No one would disagree that absorbing new technologies can potentially help to improve these statistics in the long term, but new technologies can be a rather daunting obstacle in the short term. Sometimes, technology trials fail. An organization needs to recognize this and has to lead its teams and managers in a way that encourages a healthy amount of risk without losing control of the big picture.
3. Striking the right balance between in-house R&D and leveraging external innovations. The scope and scale of innovation are growing at a pace that makes it all but unthinkable that any single company can do it all themselves. But which elements should be retained internally versus which ones can be outsourced? There's never a shortage of people writing papers and books that attempt to address this very topic, but managers in the field are hungrier than ever for useful and practical guidance on this issue.

– Rob Perrons, Shell Exploration, USA

George Buckley, CEO of 3M, is a PhD chemical engineer by training. 3M has global sales of around $23 billion and historically has aimed to achieve a third of sales from products introduced in the past five years. The famous company culture, the '3M Way', includes a policy of allowing employees to spend 15% of their time on their own projects and has been successfully emulated by other innovative companies such as Google.

He argues that 'Invention is by its very nature a disorderly process, you cannot say I'm going to schedule myself for three good ideas on Wednesday and two on Friday. That's not how creativity works'. After a focus on improving efficiency, quality and financial performance for 2001–2006, under its new CEO, 3M is now refocusing on its core innovation capability. Buckley believes that the company had become too dominated by formal quality and measurement processes, to the detriment of innovation: '. . . you cannot create in that atmosphere of confinement or sameness, perhaps one of the mistakes we have made as a company . . . is that when you value sameness more than you value creativity, I think you potentially undermine the heart and soul of a company like 3M . . .,' and since becoming CEO has significantly increased the spending on R&D from some $1 billion to nearer to $1.5 billion, and is targeting the company's 45 core technologies such as abrasives to nanotechnology, but sold the noncore pharmaceutical business.

Source: Based on Hindo B., 'At 3M: A struggle between efficiency and creativity', *BusinessWeek*, 6 November 2007, 8–14.

The success of the companies we've identified as high-leverage innovators – those that outperformed their industry groups on seven key measures of financial success for the previous five years, while at the same time spending less on R&D as a percentage of sales – reaffirms one of the time-tested findings of the Global Innovation 1000 study. There is no long-term correlation between the amount of money a company spends on its innovation efforts and its overall financial performance. Instead, what matters is how companies use that money and other resources, as well as the quality of their talent, processes and decision making, to create products and services that connect with their customers.

Source: PWC Global Innovation 1000 study, 2018. https://www.strategyand.pwc.com/gx/en/insights/innovation1000.html

SUMMARY

- Innovation is about growth – about recognizing opportunities for doing something new and implementing those ideas to create some kind of value. It could be business growth; it could be social change. But at its heart is the creative human spirit, the urge to make change in our environment.
- Innovation is also a survival imperative. If an organization doesn't change what it offers the world and the ways in which it creates and delivers its offerings, it could well be in trouble. And innovation contributes

to competitive success in many different ways – it's a *strategic* resource to getting the organization where it is trying to go, whether it is delivering shareholder value for private sector firms, or providing better public services, or enabling the start-up and growth of new enterprises.

- Innovation doesn't happen simply because we hope it will – it's a complex process that carries risks and needs careful and systematic *management*. Innovation isn't a single event, such as the light bulb going off above a cartoon character's head. It's an extended process of picking up on ideas for change and turning them through into effective reality. Research repeatedly suggests that if we want to succeed in managing innovation we need to:
  - Understand *what* we are trying to manage – the better our mental models, the more likely what we do with them in the way of building and running organizations and processes will work;
  - Understand the *how* – creating the conditions (and adapting/configuring them) to make it happen;
  - Understand the what, why and when of innovation activity – strategy shaping the innovation work that we do;
  - Understand that it is a moving target – managing innovation is about building a *dynamic* capability.
- Innovation can take many forms, but they can be reduced to four directions of change:
  - 'product innovation' – changes in the things (products/services) that an organization offers;
  - 'process innovation' – changes in the ways in which they are created and delivered;
  - 'position innovation' – changes in the context in which the products/services are introduced;
  - 'paradigm innovation' – changes in the underlying mental models that frame what the organization does.
- Any organization can get lucky once, but the real skill in innovation management is being able to repeat the trick. So if we want to manage innovation, we ought to ask ourselves the following check questions:
  - Do we have effective enabling mechanisms for the core process?
  - Do we have strategic direction and commitment for innovation?
  - Do we have an innovative organization?
  - Do we build rich proactive links?
  - Do we learn and develop our innovation capability?

FURTHER READING

Peter Drucker's 'Innovation and entrepreneurship' (Harper and Row, 1985) provides an accessible introduction to the subject, but perhaps relies more on intuition and experience than on empirical research. Since we published the first edition in 1997, a number of interesting texts have been published. Paul Trott's 'Innovation Management and New Product Development' (now in its sixth edition, Pearson, 2016) particularly focuses on the management of product development, books by Bettina von Stamm ('Managing innovation, design, and creativity' (second edition), John Wiley, 2008) and Margaret Bruce ('Design in business', Pearson Education, 2001) have a strong design emphasis, and Tim Jones' 'Innovating at the edge' (Butterworth Heinemann, 2002) targets practitioners in particular. David Gann, Mark Dodgson and Ammon Salter's book ('The management of technological innovation', Oxford University Press, 2008) looks particularly at innovation strategy and the 'new innovation toolkit', while Goffin and Mitchell's 'Innovation management' (third edition, Macmillan, 2016) also looks particularly from a management tools perspective. Brockhoff et al. ('The dynamics of innovation', Springer, 1999) and Sundbo and Fugelsang ('Innovation as strategic reflexivity', Routledge, 2002) provide some largely European views, while Melissa Schilling's 'Strategic management of technological innovation' (fourth edition, McGraw Hill, 2013) is largely based on the experience of American firms.

Some books explore the implications for a wider developing country context, notably Forbes and Wield ('From followers to leaders,' Routledge, 2002) C.K. Prahalad ('The fortune at the bottom of the pyramid', Wharton School Publishing, 2006), Prabhu and colleagues ('Jugaad innovation', Jossey Bass, 2012) and Govindarajan and Trimble ('Reverse innovation: Create far from home, win everywhere', Harvard Business Review Press, 2012). The 'Handbook of inclusive innovation', edited by Gerry George and colleagues, covers social and inclusive innovation from a number of different contexts (Edward Elgar, 2019).

There are several compilations and handbooks covering the field, the best known being Burgelman et al.'s 'Strategic management of technology and

innovation' (McGraw-Hill, 2008) now in its fifth edition and containing a wide range of key papers and case studies, though with a very strong US emphasis. A more international flavour is present in Dodgson and Rothwell ('The handbook of industrial innovation', Edward Elgar, 1996), The Routledge Companion to innovation management (eds Chen et al., 2019) and Fagerberg et al. ('The Oxford handbook of innovation', OUP, 2004). The work arising from the Minnesota Innovation Project (Van de Ven et al., 'The innovation journey', Oxford University Press, 1999) also provides a good overview of the field and the key research themes contained within it.

Case studies provide a good lens through which this process can be seen, and there are several useful collections including Bettina von Stamm's 'Innovation, design and creativity' (second edition, John Wiley, 2008), Tim Jones and colleagues' 'The growth agenda' (John Wiley, 2011), Roland Kaye and David Hawkridge's 'Case studies of innovation' (Kogan Page, London, 2003) and Roger Miller and Marcel Côté's 'Innovation reinvented: Six games that drive growth' (University of Toronto Press, 2012).

Some books cover company histories in detail and give an insight into the particular ways in which firms develop their own bundles of routines – for example, David Vise, 'The Google story' (Pan, London, 2008), Graham and Shuldiner's 'Corning and the craft of innovation' (2001, Oxford University Press), and Gundling's 'The 3M way to innovation: Balancing people and profit' (2000, New York: Kodansha International) and John Bessant' Riding the innovation wave' (Emerald, 2017), describing the German firm Hella.

Most other texts tend to focus on a single dimension of innovation management. In 'The nature of the innovative process' (Pinter Publishers, 1988), Giovanni Dosi adopts an evolutionary economics perspective and identifies the main issues in the management of technological innovation. Julian Birkinshaw and Gary Hamel explore 'management innovation' ('The why, what and how of management innovation', Harvard Business Review, February 2006), and the wider themes of organizational innovation are explored in Clark's 'Organizational innovations' (Sage, 2002) and Gailly's 'Developing innovative organizations: A roadmap to boost your innovation potential' (Palgrave Macmillan, 2011).

The design perspective is increasingly being explored in innovation, and good treatments can be found in Roberto Verganti's 'Design driven innovation' (Harvard Business School Press, 2009) and Tim Brown's 'Change by design' (Harper Collins, 2009).

Dyer and colleagues focus on individual entrepreneurial skills ('The innovator's DNA: Mastering the five skills of disruptive innovators', Harvard Business Review Press), while Schroeder and Robinson ('Ideas are free', Berret Koehler, 2004) and Bessant ('High involvement innovation', John Wiley, 2003) look at the issue of high-involvement incremental innovation building on the original work of Imai (Kaizen, Random House, 1987).

Most marketing texts fail to cover the specific issues related to innovative products and services, although a few specialist texts exist that examine the more narrow problem of marketing so-called *high-technology* products – for example, Jolly's 'Commercialising new technologies' (Harvard Business School Press, 1997) and Moore's 'Crossing the chasm' (Harper Business, 1999). There are also extensive insights into adoption behaviour drawn from a wealth of studies drawn together by Everett Rogers and colleagues ('Diffusion of innovation', Free Press, 2003).

Particular themes in innovation are covered by a number of books and journal special issues; for example, services, (Bessant, Moeslein and Lehmann, 'Driving service productivity' (Springer, 2014); Tidd and Hull, 'Service innovation: Organizational responses to technological opportunities and market imperatives' (Imperial College Press, 2003); and Chesbrough, 'Open service innovation' (Jossey Bass, 2011)), public sector innovation (Osborne and Brown, 'Managing change and innovation in public service organizations' (Psychology Press, 2010) and Bason, 'Managing public sector innovation' (Policy Press, London, 2011)), networks and clusters (Michael Best, 'The new competitive advantage', OUP, 2001, and Phil Cooke, 'Regional knowledge economies: Markets, clusters and innovation', Edward Elgar, 2007), sustainability (Nidumolo et al., 'Why sustainability is now the key driver of innovation', Harvard Business Review, September 2009), and discontinuous innovation (Joshua Gans, 'The disruption dilemma', MIT Press, 2016; Foster and Kaplan 'Creative destruction', Harvard University Press 2002; Christensen et al., 'Seeing what's next,' Harvard Business School Press, 2007; and Augsdorfer et al., 'Discontinuous innovation', Imperial College Press, 2013).

A large number of websites are now available offering blogs posts and short case examples; these include Innovation Excellence (http://innovationexcellence.com), www.timkastelle.org and www.innovationmanagement.se, and others offer an aggregating service bringing several of these newsfeeds together – for example, https://www.businessinnovationbrief.com/.

Professional associations also offer a variety of support materials including cases, book reviews, tools and methods and audio/video resources. Good examples include ISPIM (International Association for Professional Innovation Management) http://ispim.org, R&D Society https://www.rndtoday.co.uk/ and the Product development Managers Association (PDMA) https://www.pdma.org/. The UK agency NESTA has a rich set of resources around innovation with particular emphasis on public sector and social innovation (www.nesta.org.uk).

OTHER RESOURCES

A number of additional resources including downloadable case studies, audio and video material dealing with themes raised in the chapter can be found at locations listed below.

Resource type	Details	Access
Video/audio	John Bessant talking about the importance and definitions of innovation	All at https://johnbessant.org/resources/media-resources/the-innovators-media-library/
	And explaining the 4Ps model for exploring innovation space	
	Interviews with practising innovation managers	
	Finnegan's innovative fish bar	
	Clayton Christensen on how to build a disruptive business	https://www.youtube.com/watch?v=Zn6-KksdOgE
Case studies	The dimming of the light bulb and the changing imaging industry, two examples of innovation patterns over time	All at https://johnbessant.org/case-studies/
	Marshalls and Hella, case studies of innovation over several decades within a growing business from start-up to global players	
	Spirit a highly successful Russian company whose technology underpins most voice recognition systems around the world.	
	Several cases including Zara, Lego, Philips, Kumba Resources, Dyson and 3M showing how companies use innovation to create and sustain competitive advantage	
	Examples from the public and not-for-profit world including Aravind Eye Clinics, NHL Hospitals, Lifespring Hospitals and the Eastville Community Shop	
	Kodak and Fujifilm showing how disruption can affect well-established businesses and their innovation strategies to deal with this.	
Tools	The 4Ps approach to mapping innovation space	All at https://johnbessant.org/tools-for-innovation-and-entrepreneurship/
	Blue Ocean strategy	
	Value curves	
	Competitiveness profiling	