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KNOWLEDGE AND TECHNOLOGY

The importance of organizational knowledge has been recognized for a long time. Classical economists of the eighteenth and nineteenth century such as the Englishman Nassau Senior pointed out that workers apply skills as well as physical labour to their tasks, skills resulting from their personal knowledge and experience of carrying out these tasks. The level of skill has an influence on how well the task is carried out. Karl Marx pointed out that work did not have to be physical labour at all, but could also be the 'mental labour' carried out by scientists, engineers and artists. A few years after Marx the British economist Alfred Marshall noted how mechanization was increasing the importance of 'mental labour' by requiring even ordinary workers to have more and more knowledge in order to work effectively.

By the late 1980s and early 1990s theorists were beginning to think in specific terms about the role of knowledge. Some conceived of knowledge as a kind of catalyst, necessary in order to make capital and labour productive. Others thought of knowledge as a form of capital in its own right, a factor of production (see Chapter 6).

Today, we understand that knowledge is critical to businesses in many ways. Knowledge of the market is vital to understanding what customers want, and whether and how the company can provide for their needs. Knowledge of technology is necessary to make processes more efficient and more effective; knowledge of people and human motivation is necessary to focus the efforts of the company on meeting its goals; knowledge of financial instruments and accounting methods is necessary to manage capital

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effectively. Everything that we do requires knowledge in some way.

But, beyond passively accepting that knowledge is important and all around them, managers can also actively use knowledge to make their organization more innovative, competitive and successful. One of the primary effects of the information technology revolution, which began in the 1980s and is still unfolding, has been to make access to knowledge, all kinds of knowledge, much more widespread around the world. The competitive advantage that new knowledge gives does not last for long, meaning that organizations and managers need to create new knowledge on a continuous basis. In 1989 the Dutch writer Arie de Geus, formerly a senior manager with the oil company Royal Dutch/Shell, wrote in *Harvard Business Review* that in the future, a company's only sustainable competitive advantage may be its ability to learn. Today, that statement is more true than ever.

DEFINITIONS

Data Data are 'facts', things that we see or hear or otherwise take in through our senses. Data can be columns of numbers in a spreadsheet or table in a book, or simple statements of fact such as 'The company made a profit last year of $3.2 million'. Sometimes a distinction is made between 'hard' data, usually facts expressed as numbers and easily proven to be true or false, and 'soft data', more general sensory impressions such as seeing that a traffic light has changed from green to red.

Information Information is conveyed to people by means of data. When we read, hear or see data, we interpret them in light of our own prior knowledge. Reading in a company annual report that 'The company made a profit last year of $3.2 million', informs us that the company is profitable and in a healthy position (unless we happen also have another piece of data suggesting that the previous year's profits had been $5 million, in which case we may begin to wonder if something is going wrong). Seeing a traffic light change from green to red conveys the information that the cars around us are about to stop and that we should do so as well.

Knowledge Knowledge is the accumulated store of information and data we carry around in our minds, together with our own

interpretation of them based on reason, instinct and prior experience. If we read that the company's profits have declined from $5 million to $3.2 million, then we will know – thanks to our experience of such matters – that declining profits mean the company may be having troubles, and profits might decline still further next year. If we see a traffic light turn from green to red, our experience of driving tells us to stop and wait until the light turns green again before moving off. We would know these things: but a Kung hunter from the Kalahari desert, who has never seen a traffic light and never read a company annual report, would not, simply because the data and the information would convey nothing to them. Knowledge is thus both contingent on data and information, and has an effect on our understanding of them.

Knowledge management Knowledge management is a new subdiscipline of management which focuses on how to deliberately create and use knowledge more effectively, and aims to turn knowledge into value. It is usually seen as a 'general' management task, something which all managers do; it is not a separate function, like marketing or human resources, but a basic element to all management. Central to knowledge management is the knowledge transformation process, through which knowledge is acquired or created, stored and used.

Technology When we think of technology we usually think of modern advanced technology, ranging from mobile phones and tablets to artificial intelligence and blockchain. Actually, anything that we use to create something, other than our bare hands, is technology. A hammer is technology, as is a drinking straw, as were the stone axes and knives that our distant ancestors used to develop the earliest civilisations

Innovation Innovation is the development of new ideas and turning them into either products or services that organizations deliver to their customers and clients. Innovation can also refer to improvements in the processes we use to produce and deliver those services, and finally we can speak of management innovation, or improvements in the way we manage organizations and people. Again, there is a temptation to think of the big headline-grabbing innovations: hydrogen-powered cars, space telescopes, particle accelerators. But most innovation is *incremental innovation*, small tweaks and changes to existing products to improve them and

bring them up to date. Software upgrades fall into this category, as do the constant small changes to their recipes that soap manufacturers make to their products.

DISTINCTIONS

In definitions, above, we made a distinction between three key concepts, *data, information* and *knowledge*. It is worth talking a little bit more about this, because the three terms are often confused. People often talk about 'taking another look at the data', when they might really mean looking again at the information the data are conveying to us. Information and knowledge are similarly often confused. This matters, because managers often talk about 'knowledge' and 'information' without bothering to check whether there is any data to support them. Knowledge without underlying data is not really knowledge; it is belief, or folklore.

The distinction between these is admittedly a fine one. Max Boisot, a theorist of culture and communication who currently teaches in Barcelona, Spain, perhaps summed it up best when he said that data is a property of things, where as knowledge is a property of people. Data have an existence independent of ourselves; they exist all around us. Information is the messages the data send us. Knowledge is the interpretation and understanding that we then give to that information.

Let us go back to our example of the company annual report. These reports tend to provide columns of data, summarizing the company's financial position and often giving current financial ratios of the kind we described in the previous chapter. Those data are simply numbers. If we have just arrived from the Kalahari desert and have never seen an annual report, we will not know what these numbers mean; we might not even recognize them as numbers! However, if we have some background knowledge (what numbers are, what the figures in the columns actually mean), we can see that the numbers are actually sending us signals: the company is doing well (or is not doing well), or the company is working efficiently with low costs. These signals are what we call information.

But we still need to interpret that information. On their own, these signals do not necessarily mean much. The company is

making a profit: what action is then called for on our part? Costs are low: do we need to do anything to make them still lower? But if we can put all these signals together and form a clear picture of what the company is doing, we can then *know* what the real position is. If we are aware of the company's past history and competitive environment, we can see that although profits are good, they could be better; costs are low, but they could be lower.

This leads us to an important conclusion: prior knowledge is needed in order to create future knowledge. We need prior knowledge in order to interpret the signals and information that come to us. That is why in management today, so much stress is placed on learning, both before managers start their careers and then continuously throughout their careers. Learning is how managers acquire the knowledge they need to make them effective at their jobs.

TYPES OF KNOWLEDGE

Knowledge comes in different types and forms, but the most important division is between tacit knowledge and explicit knowledge. The distinction between these was first made by the sociologist Michael Polanyi in the 1950s, but has since been greatly amplified by theorists of knowledge management such as Nonaka Ikujiro and Max Boisot.

Explicit knowledge is knowledge that we can easily formulate, write down or put into speech and pass on to others. In the terminology of knowledge management, it can be easily codified. Explicit knowledge is often based heavily on easily provable factual data and on reason. Teaching someone how to drive an ordinary road car, or play the piano, or write a marketing plan constitutes passing on explicit knowledge. Explicit knowledge is often widely available, or if not, can be easily communicated.

Tacit knowledge, on the other hand, is hard to formulate and express. Often it is very personal to ourselves; we *know* what we are doing, but we cannot express it to others in terms that make any sense. Tacit knowledge is often based on soft data and on intuition. Teaching someone to drive a Formula One racing car, or conduct an orchestra, or understand what is going on in the minds of consumers as they make purchasing decisions, are all examples of passing on tacit knowledge.

Tacit and explicit knowledge often exist simultaneously. In this book, I have provided a considerable quantity of explicit knowledge. I have explained what strategy is, how organizations are structured, the importance of marketing, the nature of production systems. But what I have almost certainly not done is actually provided you with the knowledge of what it is actually like to *be* a manager. Even though I have both managed my own business and taught other managers for many years, I cannot simply lay out for you in writing on a printed page what it really feels like to practice management. That is tacit knowledge, and you will only be able to learn that by experiencing management for yourselves.

Which is more important, tacit knowledge or explicit knowledge? In Western organizations, we have tended to emphasize explicit knowledge, partly because it is easier to transmit but also for cultural reasons; since the seventeenth century, at least, our societies have tended to value 'scientific' (i.e. explicit) knowledge over that obtained through intuition. According to Nonaka, however, Eastern organizations tend to value tacit knowledge more highly, because it tends to be deeper and more creative, and also unique to the individual or organization that holds it. Nonaka gives the example of a famous Japanese baseball player, a man who broke records in Japan but who could not articulate why he was so successful. For Nonaka, unlocking this man's tacit knowledge would make his gifts available to other players, but this is almost impossible to do.

One of the features of great coaches and teachers is that they help people unlock their own tacit knowledge. But explicit knowledge cannot simply be dismissed. As well as the tacit knowledge that makes a baseball star able to divine the pitcher's intentions and swing the bat at exactly the right moment to hit a home run, he (or she) also needs some more mundane explicit knowledge, such as familiarity with the rules of baseball, how to hold and grip a bat, where to stand over the plate and so on. Explicit knowledge may be less exciting, but it also tends to make up the background knowledge that we turn to when interpreting information and creating new knowledge for ourselves.

KNOWLEDGE MANAGEMENT

Organizations and individuals process knowledge in much the same way that they process raw materials and parts to create

products. The ultimate purpose of knowledge management is to turn knowledge into value. It does this by *transforming* knowledge from 'raw' knowledge created or gleaned from the environment into something that is of use to the organization or its customers. The uses to which knowledge can be put are nearly endless, and span the whole range of management activities: new products and services for customers, new and better ways of making things, better information about the market or about competitors, more skills and learning by employees; the list goes on.

This transforming of knowledge is a three-stage process. First, the organization acquires knowledge, either by creating it internally or by learning from sources outside the organization. Second, it then catalogues and stores knowledge in ways that make it accessible when needed and easily transmitted. Finally, it puts knowledge to use in practical ways that create value.

KNOWLEDGE ACQUISITION

Knowledge acquisition is simply the process of learning knowledge from other sources. We acquire knowledge by reading books, by taking training courses, by looking around and taking in information from the environment. Most of the knowledge we acquire in this way is explicit knowledge, though sometimes we find teachers or coaches or mentors who help us learn tacit knowledge as well. Much of this knowledge, as noted, is background knowledge, and it is said that the primary purpose of most education programmes is to teach people how to learn, to give them the techniques and background skills they need in order to contextualize information and absorb new knowledge.

It has been shown that organizations learn very much in the same way that individuals do, and just as an organization is greater than the some of its parts, so the learning an organization gains is greater than the total learning of its individual members. Members of an organization who learn – especially if they learn together – will share experiences, impressions and items of knowledge, thus ensuring a broader learning experience and general outlook. Most organizations engage in knowledge acquisition, even if informally, on an ongoing basis; managers read the financial papers, staff go on training courses, etc. and people then swap experiences and

knowledge circulates through the group. Nonaka Ikujiro found that this kind of informal learning was probably the best way to acquire both tacit and explicit knowledge.

KNOWLEDGE CREATION

Not everything can be learned in the wider world, and organizations that wish to be competitive must ultimately begin to learn for themselves. Again, this can be done two ways: formally, though specially constituted research and development (R&D) departments or teams, and informally through the circulation of knowledge around the business as a whole.

R&D departments or teams consist of managers and other staff whose sole function is to generate new knowledge which may be of use to the company. Technology businesses like Google will employ many thousands of people engaged in R&D around the world. Some of these people will be engaged in theoretical or 'blue skies' which has no direct relation to customer value, but is intended instead to push back the frontiers of knowledge more generally, creating opportunities that can be exploited later. Others will be looking at emerging technologies and their potential for exploitation; still others will be actively engaged in designing and building new products and services.

But although the R&D department may be the creative hub of the organization, other departments and teams will engage in research as well. Marketing, as noted in Chapter 5, carries out research often on an ongoing basis into customer needs and consumer behaviour. Human resources studies the views and motivations of staff. Financial managers may research new accounting methods or financial instruments, sometimes alone, sometimes in partnership with academic researchers in business schools. All of this work adds to the amount of knowledge the company creates.

Organizational knowledge is also created through casual, informal conversations as people relate experiences, compare notes and bounce ideas off each other through WhatsApp or Teams discussions, during coffee breaks or over lunch. Many good ideas have been developed through such informal exchanges, and organizations often try to foster such discussions in hopes of generating new ideas. Companies such as Sony and Intel are famous for their

discussion forums where people throw new ideas into the ring and let others discuss them and improve upon them.

It should be added that a great deal of the knowledge that an organization and its people acquire may have no immediately apparent relevance to the business or its customers. One of the tasks of knowledge management is to determine what kinds of knowledge or which particular areas are most important, and try to focus attention on these as far as possible. However, it is equally important not to narrow the field of study or research too far. Many kinds of knowledge may prove to be relevant, but sometimes not until long after they have been acquired. This means that the storage of knowledge until it is needed becomes a second major issue for knowledge management.

KNOWLEDGE STORAGE

Once created or acquired, knowledge then has to be stored. The main issues when considering knowledge storage are capacity, preservation and accessibility.

Prior to the invention of the computer, knowledge was stored on 'hard copy' records, ranging from the clay tablets and papyrus of the ancient world to hand-written or typewritten paper in our own times. Books, magazines, films and microfilms stored knowledge that had been acquired or learned, while paper notes, file cards and the like stored knowledge generated within the firm. In large firms especially, physical capacity for storing records was limited, and in some cases companies had to destroy older records in order to make room for new ones. Technology has solved the capacity problem, with an ordinary mobile phone capable of storing the equivalent of thousands of books. Cloud storage means even small organizations have access to almost limitless data storage.

Accessibility, however, remains an issue. The huge capacity of our data storage systems presents a problem of its own; where do you start looking? One management consultancy company decided to create a database of every consulting engagement it had ever undertaken, with detailed accounts of the problem the consultants were asked to solve and the solutions they had developed. In future, managers reasoned, any time consultants faced a similar problem, they could look in the database to find out what others

had done, and learn from their experience. Millions of dollars were spent developing this system, but in the end it was so vast and unwieldy that no one knew how to use it. Consultants went back to doing what they had done before, which was phoning around their friends and asking what they had done. The same problem is true of management information systems (MIS) or customer relationship management (CRM) systems. These can be very valuable repositories of information and knowledge, but only if they are structured in such a way as to allow quick, easy use.

Preservation also remains an important issue. Capacity is limitless, but do we really want to store every single e-mail message? And, are we allowed to? Should confidential data and information be kept, or should they be destroyed? Privacy is becoming an ever more important issue in information storage; for example in the UK and in the European Union, General Data Protection Regulations strongly restrict what kinds of information can be preserved or disclosed.

Closely related to knowledge storage is knowledge transmission which allows knowledge, once stored, to freely circulate around the organization. In general, the principle of transparency suggests that knowledge should circulate as freely as possible and everyone in the organization should have access. However, this may not always be desirable. Senior management may feel, for example, that it does not wish lower-level employees to have knowledge of sensitive financial issues such as potential take-overs – or indeed, of the salaries being paid to the senior managers themselves. There may be ethical and legal considerations here; by barring some employees from access to knowledge but granting it to others, is the organization behaving ethically, and is it within the boundaries of local laws?

Finally, while the cloud gives us seemingly infinite amounts of storage, we should not forget about the very first information storage technology, the human brain. Although the mind is far from perfect, and can forget or lose knowledge in ways that computers cannot, only the mind can make the kinds of connections that create and store tacit knowledge. The brains of an organization's people contain some its most valuable knowledge; and in the end, an organization is only as smart as its people.

KNOWLEDGE USE

Finally there comes the point where knowledge is put to use, in the form of new products, new processes or new ways of doing business more generally. To repeat, the ultimate aim of knowledge is to add value. Opinions still differ as to whether and how the value of knowledge can be measured, but increasingly the view is that an organization's collected knowledge should be measured and reported in financial statements as it represents an asset.

The problem with this view is that knowledge of itself is static, and is therefore a potential asset only. Not until knowledge is actually employed by people working on a new product or new process does that value actually become real. Further, we have seen that people use knowledge in a variety of small, incremental ways such as developing better understandings of markets, or employee motivation for example that, although ultimately contributing to value, is hard to define. Ultimately, the use of knowledge and its management is partly, at least, subjective and intuitive. It is for this reason that one of the great management thinkers, Peter Drucker, has described management as an art and not a science. Judgement and intuition as well as calculation are required, and nowhere is this more apparent than in the field of knowledge.

TECHNOLOGY

When we think of technology we think of 'things', the tools that we use to do a job. We need to recognise, however, that human knowledge and skills also play a role. A hammer or a mobile phone are merely inert objects until they are placed in the hands of someone who knows what they are and how to use them. We often talk of the value of technology, but as the American organization theorist Paul Strassman once commented, the value of a computer on it is own is precisely what it will fetch at auction. Even semi-autonomous systems such as artificial intelligence require some sort of human interface.

Properly speaking, technology is the combination of knowledge and artefacts. The range of artefacts we use in our work and our daily lives is almost endless, so rather than get drawn into a detailed discussion of technology itself, we shall instead look at issues

around the management of technology. From a managerial perspective, three things matter about technology. The first is technology strategy, including the forecasting of future technology needs. Second, there is the efficient and effective use of technology in the organization. Third, there are the ethical and moral implications of technology use.

TECHNOLOGY STRATEGY

Technology strategy refers to the process of planning for investment in technology. A key element of technology strategy is *technology forecasting*, which again has two parts: forecasting what technology the organization will need in future, and forecasting what new technologies will be available and whether the organization can make use of them. These two parts are critically interdependent. New, disruptive technologies can make existing technologies obsolete, and this in turn can pose an existential threat to organizations dependent on those technologies. A famous example is Kodak, the world leader in the market for camera film for over a century. The advent of film-free digital photography destroyed Kodak's core market in just a few years.

Technology strategy-makers thus have a difficult task on their hands. They need to predict which technologies will become dominant and in widespread use, in some cases becoming industry standards which everyone must adopt. At the same time, they also need to work out which technologies will be of most use to their own organization and make it efficient and effective at meeting customer needs.

Technologies are said to go through four phases in their life cycle, and it is important to know where each technology used by the organization is in its life cycle, in order to forecast when it will need to be replaced. The four phases are:

- **Emerging.** During this phase the technology is in its very early stages, perhaps still experimental in nature and needing to be trialled to establish whether it is of proven use. It may be worth investing in emerging technologies on a pilot basis, to see whether they can meet a particular need. Investing in emerging technologies is risky, but if the technology does turn

out to be useful, adoption at an early stage can be very rewarding and allow the organization to get ahead of more cautious competition. Many forms of artificial intelligence are currently in the emerging phase.

- **Growth.** During the growth phase, the technology's use has been clearly established and a wide range of organizations are moving to adopt it. Investing in growth technologies may be necessary in order to keep up with the competition, but the point of investment needs to be carefully judged; prices tend to fall during the growth stage and it might be worth considering delaying adoption of new technologies so long as current systems are still functioning well.
- **Mature.** The technology is now widely used and may even be the industry standard. Prices should now be relatively low, depending on levels of competition. The question for managers now is how long the situation will remain before new, disruptive technologies arrive and threaten to supersede these mature technologies; again, the example of digital photography threatening the position of film shows the nature of the problem.
- **Ageing.** In this case the technology has been superseded by newer technologies but there may be value still in using the old technology, especially for non-critical systems. Eventually the technology may decline into obsolescence, and it will become impossible to find service or support. In this case the technology will probably have to be replaced no matter what value it still offers.

TECHNOLOGY USE

Because technology is so closely linked to organizational knowledge, we can think about managing technology in much the same ways as we manage knowledge. All the technologies in which we invest must support some aspect of managing knowledge.

- **Acquisition and creation.** Technology helps us to bring knowledge into the organization in a variety of ways. Newsfeeds, industry databases and digital learning technologies help the organization and its people to soak up information and keep abreast of new developments, enhancing stocks of

organizational knowledge. Other technologies help us to experiment with new ideas, inventing concepts and artefacts which can later be translated into innovation. A famous example is the invention of a reusable glue by engineers at 3M, which later became the basis for the Post-it Note.

- **Storage.** Hard drives, databases and cloud storage are all examples of technology that allows us to store knowledge and retrieve it for later use.
- **Use.** Technology enables organizations to reach out to their customers and deliver products and services to them through digital or physical channels, or through hybrids of both. Technology also enables us to engage in innovation, developing new products and services or incrementally innovating to make improvements to existing ones (products and services also have a life cycle similar to the one defined for technology above).

When we think of technology usage, it is again important to remember that the most expensive and complex technologies are not always the best. The vital thing about any technology is fitness for purpose; will it actually do what it needs to do? Some of the most effective technologies are cheap and simple. It should be remembered too that not every organization has the money to invest in complex, cutting-edge technologies. In order to keep up and compete, these organizations often engage in 'frugal innovation', making do with what they have to hand, often recycling or reusing older technologies and adapting them to new purposes at very low cost. The concept of frugal innovation, known as *jugaad* in India, is behind the rapid success of many small Indian organizations, but frugal innovation can be a simple and cost-effective form of innovation for any business anywhere. As Navi Radjou and his colleagues point out in their book *Jugaad Innovation*, frugal innovation requires creative thinking and the ability to look at the world of innovation in new ways.

ETHICS OF TECHNOLOGY

It is often suggested or implied that technology is ethically neutral, as we cannot apply subjective ethical values to artefacts. Weapons,

for example, are simply artefacts; only when someone picks them up and uses them do they become dangerous. Even if we accept this point, however, the introduction of human agency brings with it a moral dimension. What we do with technology has ethical implications.

For example, if our technology stores personal information including addresses, bank account details, credit card numbers and so on, we have an ethical responsibility to those people to keep these details safe. If someone hacks the system and steals them, we cannot claim it is nothing to do with us. Even details such as lifestyle choices and consumer preferences can be of value to unscrupulous people. The Cambridge Analytica scandal which engulfed Facebook, which was accused of failing to protect user data and allowing other parties to harvest it for political purposes, shows how serious these issues can be and the kinds of reputational damage that can result from a failure of ethical responsibility.

Blockchain is technology with a number of potential uses, especially in financial services, but its most common application in the real world at the moment is the cryptocurrency bitcoin. Bitcoin is created through a process known as 'mining' which involves large amounts of computer processing power and correspondingly large amounts of electricity. By 2021, the energy consumption of bitcoin mining around world was larger than that of most countries. As a result, energy distribution networks were becoming destabilized in places, with energy being diverted from other vital uses to bitcoin miners. There is also an environmental issue; the demand from bitcoin miners is slowing the switch to renewable energy sources as older, more polluting energy generators need to be kept online to satisfy demand.

Another ethical issue in technology concerns artificial intelligence. It has been suggested that many unskilled jobs could be replaced by artificial intelligence systems, which leaves another question: if people are replaced by machines and lose their jobs, how will those people make a living? As managers, we have a responsibility to the people we employ. The argument that our sole duty is to make as much money as possible is incorrect. We are part of society, and we owe an ethical duty of care to society.

SUMMARY

- Knowledge management aims to turn knowledge into value.
- Knowledge is now regarded as one of the most important assets a company has.
- The management of knowledge includes the generation of knowledge through research and learning, the storage and transmission of knowledge, and its final use to create value.
- Knowledge and technology are closely linked, and the use of technology in business environments sometimes raises ethical issues that need to be resolved.

SUGGESTIONS FOR FURTHER READING

Knowledge management is a growing field and new works are appearing all the time, but many are technical in nature and focus on technology systems for knowledge management. The following are more thoughtful and considered works on key issues.

Boisot, M., *Information Space: A Framework for Learning in Organizations, Institutions and Culture*, London: Routledge, 1995. Technical in places, but worth sticking with; the chapters on knowledge and communication are very important.

De Geus, A., *The Living Company: Habits for Survival in a Turbulent Environment*, 1997. A very good and readable book by one of the founding fathers of modern knowledge management.

Goffin, K. and Mitchell, R., *Innovation Management: Effective Strategy and Implementation*, Basingstoke: Palgrave Macmillan, 2016. Good discussion of innovation from both a strategic and operational perspective.

Hislop, D., Bosua, R. and Helms, R., *Knowledge Management in Organizations: A Critical Introduction*, Oxford: Oxford University Press, 2018, 4th edn. More theoretical than Milton and Lambe (below) this is a good study of the key concepts.

Milton, N. and Lambe, P., *The Knowledge Manager's Handbook: A Step-by-Step Guide to Embedding Effective Knowledge Management in Your Organization*, London: Kogan Page, 2012, 2nd edn. Practitioner's guide to knowledge management.

Nonaka, I. and Takeuchi, H., *The Knowledge-Creating Company*, Oxford: Oxford University Press, 1995. Compares and contrasts the management of knowledge in Japanese and Western companies, with some valuable lessons for the latter.

Radjou, N., Prabhu, J. and Ahuja, S., *Jugaad Innovation: Think Frugal, Be Flexible, Generate Breakthrough*, San Francisco: Jossey-Bass, 2012. Fascinating look at the principles of frugal innovation and how to put them into practice.

Senge, P.M., *The Fifth Discipline: The Art and Practice of the Learning Organisation*, New York: Doubleday, 1990. A worldwide best seller in the early 1990s, now a little dated, but still worth reading.

Trott, P., *Innovation Management and New Product Development*, London: Pearson, 2016. Another good introduction to innovation management.