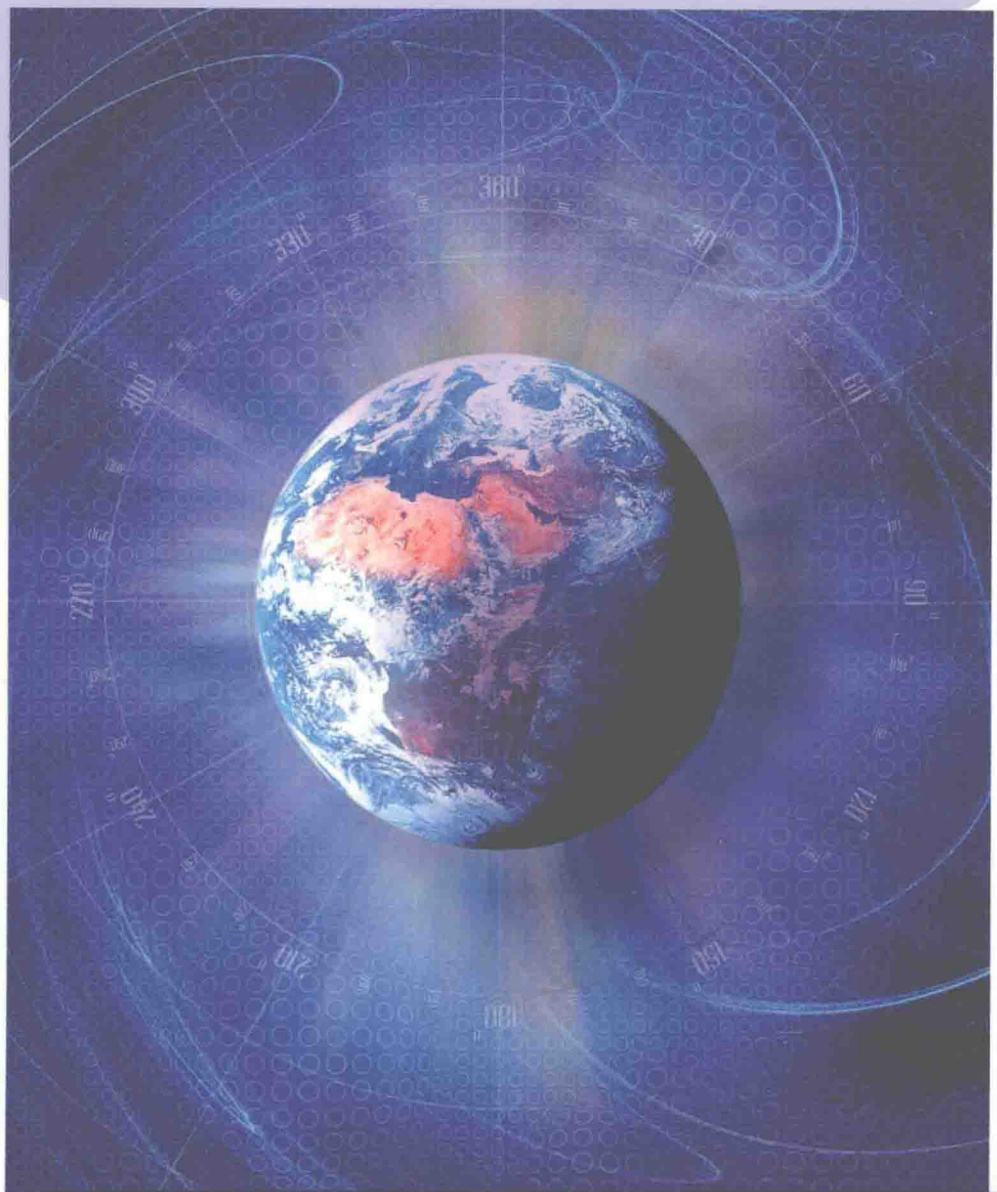
Technology Management

Text and International Cases



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Text and International Cases

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Preface

This book focuses on two themes. The first theme is that technology and its management are becoming increasingly important and pervasive in businesses and the community. The second core theme is that managers of the future will need to be globally oriented in every respect, and hence need to understand technology and all other aspects of management and leadership in an international context.

Consider briefly the history of technology. Since the origin of the human species, our distinguishing feature has been our ability to use our intellect to build and use tools to leverage our efforts to gain control within and over our environment. From early hunting tools, through the wheel, the steam engine, electricity, and more recently manufacturing automation and the Internet, new technologies have given people, individually and collectively, increasing power to accomplish goals.

In the modern organisation, three key variables are thought to drive competitiveness:

1. Strategic leadership, meaning that the firm is set on a path and well led towards doing the right thing in terms of products, markets, etc.
2. A motivated and committed workforce, achieving the "high performance" work culture
3. Effective use of technology in driving effective and competitive outcomes for the organisation

This book focuses on the third of these factors, but cannot and does not ignore the first two. The first element of business strategy and leadership is in a general sense assumed as a given when we address technology and its management, although the technological opportunities should themselves be an input to strategy formulation.

In respect of employee motivation, it is difficult to implement anything successfully if the workforce is not committed, but we observe that in many workplaces around the world, "people management" in organisations has improved over the past two decades, even though there is always room for improvement. Once a company or set of companies achieves and sustains high levels of motivation within its workforce, where is the next major competitive battlefield to be found? The answer lies in the field of technology and its management, and more specifically in how well these firms can capture or develop technology, then use that technology to drive their market power and operational effectiveness forward.

Consider the competitive battles that are fought each day in marketplaces in every region of the world between Ford, GM, and Toyota; IBM, Toshiba, Compaq, and Dell; Microsoft, Netscape, and Apple; Deutsche Bank and Citigroup; and many thousands of other companies, from gigantic multinationals to small businesses. They compete on the value that their products and services offer to customers, including the benefits based on the technical features of these, and the cost effectiveness that allows them to competitively price these offerings. The effectiveness through which technology can be developed, introduced, and managed is a major consideration in these competitiveness factors, and hence in determining which companies will be the winners and losers in every market. Indeed, we believe that as business leaders and government policymakers become better at formulating policy and strategy, and as managers and supervisors improve their people-management skills, technology-based, competitive advantage increases in relative importance in most corporate environments.

Some key factors that are explored in this book are expressed as questions below:

- How can companies best source technology in terms of both their products' technical content and features, and their organisations' productive processes?
- When introducing new technology into an organisation, what lessons have been learned by companies around the world in terms of what works?
- What "soft" organisational or cultural and leadership factors relate to success in introducing and implementing new technology?
- What processes, routines, and disciplines tend to lead to success in implementing new technology?
- How do these key success factors vary across different cultures in the world, and what generic elements of success might exist that managers could use in implementing technological change?

These questions are addressed in both the text and cases in this book. Further, this is done through addressing the cultural differences that exist in companies in a variety of industries throughout the world, and across a vast range of technologies, from product to process, from hard to soft technologies, and from manufacturing through services to Internet-based technologies. The issues are examined in case studies drawn from large multinational companies to smaller single site businesses.

We want to thank the many case study contributors who worked with us in developing the many new cases in this book and who formed a great global team:

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This book has been designed for courses in the management of technology that combine both the conceptual frameworks and foundations of the field with the practical, real issues that are best highlighted via the case study method.

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Brief Contents

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Cases

CHAPTER 1 A Review of Technology Management

Technology management and its subfields are relevant to the needs of government policymakers, industry leaders, and business management students. The subfields covered in this book, which collectively define the field of technology management, include:

- Technology strategy.
- Development of technological capability.
- Innovation management.
- Technological forecasting.
- Technology management, manufacturing strategy, and business competitiveness interfaces.
- Barriers to the adoption of technology.
- Technology and manufacturing flexibility.
- E-business, a rapidly developing field of new technology.

An acute awareness of the issues and complexities associated with managing technology, on behalf of all stakeholders—including policymakers and industry leaders in particular—is a prerequisite for successfully managing wealth creation. We begin this text with a general introduction to the open questions in this field, followed by specific coverage of each of the subfields listed above.

What constitutes technology management and why is it important in the new millennium? We address the first part of this question in Chapter 1, which examines the key issues and the existing knowledge base of the "management of technology" field, both in concept and in practice. This chapter aims to highlight a series of questions and issues about the management of technology, each of which can be further explored in the other chapters of this book. In addition, this book's case studies, taken from most corners of the globe, offer another avenue for exploration in an applied setting.

Why are these fields of technical knowledge and technology management practice important? The answer is simple and demonstrates the power inherent in the field of technology management:

> Technology management is the ultimate battleground that will determine which companies and owners will be the winners and losers in the wealth creation game.

Technology has always been the mechanism through which humankind has leveraged its efforts, both individually and collectively, to improve its quality of life. Early forms of "technology," broadly defined, included simple tools such as the axe, the spear, bows and arrows, and other similar implements that helped people to survive many thousands of years ago. Later came the wheel, the steam engine, electricity, the telegraph, the automated combine harvester, the steam engine, the internal combustion engine, the automobile, penicillin, nuclear power, aircraft, computers, the Internet, automated manufacturing equipment, biotechnologies, and so on. Each of these inventions either provided new technology or used technology as a lever of control over the natural environment to improve the quality of life for people. Technology can be conceived of as artificial or human-devised tools or aids for accomplishing tasks that have a goal or purpose. Control over the natural environment, usually enabled or enhanced through technologies, can be thought of as defining the difference that sets apart the human race from other species such as chimpanzees.

Technology has become a key factor in defining competitive advantage in the modern business world, and it is likely to become an even more pervasive factor of production in the future. Imagine a global corporate environment in which the key issue facing corporations is not employee relations, due to the achievement of appropriate skill levels by every member of the work force, high work force commitment levels, and their reflection on managerial controls and policies. Leaders are getting better at managing workers, and leadership is now better understood and practised than ever before. Once you have a high performance work culture, what is next and what do you do with it? Further, if a number of the major players in your industry have a high performance work culture, how will they strive for competitive advantage? The answer is through being better at the management of technological innovation.

We all have heard CEOs say things like, "People are our most important resource." That will always be true and is a useful motivational line for CEOs to regularly repeat. But they say that partly because there is still a competitive advantage to be gained by achieving superior motivation and partly because people can listen to them—and their technology resources cannot. In fact, it is reasonable to mount a case that technology resources are very important indeed to many companies. Intellectual property mostly relates to technology, not people. We invest in it, protect it, develop and nurture it, and try to exploit it for commercial advantage.

This clearly applies in spades to high technology industries such as advanced engineering, electronics, biological sciences, aerospace and aviation, hardware, and electronic commerce and software. But it also applies to industries in which the technology does not at first seem nearly so "high." An example is the tire industry, in which the technology of tire design and the design of tire-building technology does not at first appear very sophisticated to those of us who use them on a daily basis. In fact, there are

really only three major companies in the world that are capable of making the technological investments necessary to stay independently competitive through tire product and process technology. The many smaller tire companies that exist in the world must acquire this level of technology by licensing it or establishing technical agreements with the big three. This was the case with the South Pacific Tyre Company. Previously a local company in Australia, South Pacific found it needed to join one of the big three groups to keep its products and processes competitive. It investigated more than one of these three major players, ended up with a 50:50 venture with the Goodyear Group, and then was able to get access to its technology and technical support. This joint venture was not about that "most important resource"—people—but about competitiveness and survival of the local firm, which hinged primarily on technological competitiveness.

As we have generally become better at managing our work forces, we have moved on from the paradigm of "management coercion and worker recalcitrance" (Adler, 1993). In the past, the context of technology management often has been that little or no freedom exists to make the changes involved in acquiring, developing, introducing, and exploiting new technology. Managers' attention over the past 50 years has been taken up predominantly with "people problems," which often have stopped them from properly resourcing technological developments. However, all this is changing, and in well-led companies the change is complete. Technology management and innovation in particular are becoming the ultimate battleground for leading companies.

As of the end of the twentieth century, the world's best firms have already achieved this freedom in respect to their human resources—major elements of which are the freedom to be flexible and responsive, introduce rapid change, and innovate. The rest of the global economy is following slowly but surely and, as this freedom spreads, strong forces of innovation are becoming unleashed. As a result, the importance of competence and indeed excellence in the management of technology (both in product and process) can be expected to increase substantially.

Consider leading international competitors such as Xerox versus Canon, Toyota versus GM, Ford versus Honda, IBM versus Apple, Motorola versus numerous Japanese counterparts, and Fuji versus Kodak. The ability of these companies to develop, implement, and achieve speedy returns on technology investments in product and process innovations is their key competitive battleground. The enabling conditions for technological innovation that now exist have permitted major performance improvements to occur—to the benefit of all key stakeholders, including customers, suppliers, employees at all levels, shareholders, and the economy. As the new cooperative relationship between the suppliers of capital and labour becomes widespread, opportunities for the improved management of technology will also increase.

As we know from lessons learned by industry, usually the hard way, competence in the technical content of technology is not enough. The key drivers of success or failure are the managerial conditions, systems, and decisions that surround the technology. This is generally true whether one considers new product successes or failures, manufacturing processes, or conspicuous examples, such as the space shuttle *Challenger* disaster.

The adoption and implementation of technology can be thought of as one important aspect of innovation. Innovation is generally considered in terms of new products, new processes, new managerial approaches, and indeed, combinations of these three.