CHAPTER 2

Emerging technologies for information systems

Learning objectives

By the end of your work on this topic you should be able to:

- Explain the changing role of information systems
- Compare information systems in terms of formality, purpose, reach and complementarities
- Discuss the management issues of IS applications that are especially relevant for organisations:
  - enterprise systems
  - knowledge systems
  - customer relationship management systems
  - inter-organisational systems and
  - customer participation systems

CHAPTER CASE: PART 1

Siemens' e-strategy

www.siemens.com

Siemens, a German company, is the world's fourth largest electrical and electronics manufacturer, with operations in almost every country. Its activities are grouped into 15 divisions, which themselves are part of 3 business sectors – industry, power and healthcare. In 2008 it employed about 400,000 people, many of whom work in scientific research laboratories linked with universities around the world.

Mr von Pierer, who was for many years the CEO, was well aware of the need for the company to develop what he called an 'e-mindset':

> *for me the Internet has two parts. One is technology and the other is the mindset – how we view our business.*

He developed a vision of how Siemens, as well as making and selling advanced technologies in its products, would use these information technologies to transform the way Siemens itself worked. His vision had four elements.

The first is knowledge management – through its ShareNet system. The second is online purchasing – e-procurement. He expected this to bring large administrative savings, mainly from economies of scale by pooling the demands of several purchasing departments, using a company-wide system called click2procure. The third part of the strategy is to improve internal administrative processes – such as by handling 30,000 job applications a year online or expecting employees to book their business travel arrangements over the Internet. There is more to this than paperless administration. The idea is to make sure that the whole supply chain – from customers, through Siemens, and then on to its suppliers – runs smoothly. Different bits of Siemens have developed e-business applications independently, which has caused problems:

> *it was almost impossible to connect all these different systems in order to get information to flow from your customer to your supplier.*

The fourth element is Siemens' dealings with its customers, most of whom are other companies. An early application was an Order and Request System (ORS) that provided the (then) Fujitsu-Siemens Computers division with a simple way of presenting its configurable products for sale via the Internet. This reduced the time a customer had to spend to place an order, and also reduced the number of incorrect orders. All sales executives and customers were able to place orders online at any time and track their progress. To simplify ordering, major customers had dedicated pages showing the products and configurations they ordered most frequently. Access was by passwords, which controlled the areas of the site any individual could reach.

They also believed that they needed to develop their information systems so each customer had a single view of the company. Being so large, it was likely that several business units could sell something to a major customer. A manager commented:

> *That is a big advantage of the company's wide range of activities. But I don't think that in the future such a customer will tolerate four or five different views of Siemens. They want one view of our capabilities. Even if a customer is buying from several divisions, they should deal directly with only one, which should act as a sort of lead manager within the company. Inside Siemens, the customer should be identified by only one code.*

Of the four elements of this strategy, von Pierer expected e-procurement to yield the quickest returns. However:

> *If you want to transform a company to an e-business company, the problem is not so much e-procurement and the face to the customer. All this can be done rather fast. What is truly difficult is to reorganise all the internal processes. That is what we see as our main task and where the main positive results will come from.*

Sources: *The Economist*, 31 May 2001; www.siemens.com and www.my-siemens.com; company website.

Introduction

Siemens is an example of a company that both supplies and uses advanced information systems. A successful global player by any standards, managers are well aware of the competition, and of the need to improve performance continually. Senior managers have identified four main ways in which modern IS can support the business – and acknowledge how human issues and organisational structures can help or hinder that transformation.

Information systems are influenced by three forces: relentless business pressures, fast-changing technology and rapidly evolving organisations that need to manage information of all kinds more effectively to add value to resources. This chapter illustrates the evolution of such systems and shows how, if properly managed, they enhance the competitive ability of an organisation.

The chapter begins by outlining the evolution of computer-based IS from **back office systems** to **customer-facing systems**, and from there to systems that transform value chains and industries. It outlines alternative ways of classifying IS and then describes five applications with significant management implications:

- enterprise integration;
- knowledge management;
- customer relations;
- inter-organisational working; and
- customer participation.

Together these illustrate the expanding role of information systems.

CASE QUESTIONS 2.1

IS and the Siemens business

Visit the Siemens website to gain an understanding of the main activities and the breadth of its geographical spread.

- What are its main products, and how would you broadly describe the nature of its businesses?
- Identify three ways in which you would expect modern IS to be used in the company.

2.1 The evolution of information systems

Between 1965 and 1975 managers concentrated on automating those functions where they could make large efficiency gains. These typically included those that processed many routine transactions, such as payroll, stock controls and invoices. Department managers often delegated responsibility for information management to an emerging IS department, which became very skilled at running large, routine and usually centralised systems. This function became very influential as managers of the main operating departments left IS matters to the specialists. The technologies did not yet affect many smaller organisations.

In the following decade automated systems spread widely. Technical developments made smaller systems possible and more attractive to managers in other parts of the organisation. Departmental managers discovered many new uses for information technology and so became familiar with issues of budgeting for hardware, requesting support, defining requirements and setting priorities. Suppliers developed systems for smaller organisations.

Since the mid-1980s technical developments have brought IS to the foreground of corporate policy. Systems that for decades have supported core business functions, such as finance, manufacture and distribution, continue to develop and employ more modern technology. Computer-based systems have now been extended to serve many other business functions and are used to support business processes in more integrated ways. Software suppliers have expanded product lines to support functions as diverse as production forecasting, supplier rating and project management. Information systems now support managers and professional staff directly in most business areas.

The rise of the Internet since the mid-1990s has further stimulated these developments. It challenges traditional organisations to innovate their processes and to integrate them with those of suppliers and customers. This clearly leads to corporate transformation, reinvention of value chains and new ways of doing business. Developments in mobile phone technology have freed the Internet from the desktop, allowing people to access information for business or social purposes almost wherever they are.

These developments affect most, though not all, established organisations and have led to the creation of many new services and industries, such as social networking, online gambling and interactive entertainment. Many markets are becoming more transparent and customers show new buying patterns and behaviours. Many commentators interpret this as a fundamental change from an industrial economy to a global network economy where companies can only survive if they are agile, flexible and adaptive to these new technologies.

2.2 Classifying information systems

There are several ways of classifying information systems and, although not definitive, such schemes help to understand and compare examples in a complex field. Here we use the criteria of formality, purpose, reach and the complementarities they require.

Classifying IS by their formality

Information systems range from informal human or paper-based ones to those which are highly automated and computer based. Many begin as human systems, become paper based and then computer based. In small firms, the owner determines the price of a product depending on (say) the specification and the customer – a human information system. If the business grows the owner will usually find it useful to make a price list on paper to guide pricing decisions: even if it is scanned and available on computers, it is basically paper or document based. At the other extreme, large businesses usually include all aspects of the sales process in their computer software together with customer data, inventory, production schedule and purchasing functions. This would clearly be a computer-based system.

Human information systems

These are informal information systems. Everyone uses sense organs to receive impulses from the environment; the brain interprets these impulses, leading to decisions on how to respond. From this perspective everyone is an information system. People observe events and use this information as they manage their responsibilities. Managers who believe that the best way to manage is to communicate directly with subordinates and to see for themselves what is happening 'manage by walking around' – they realise the value of human information systems.

Studying is also a human information process. The study material available is data, but the student has to remember relevant information and use it in tutorials and written examinations.

Paper-based information systems

People still use many paper-based systems as they are cheap to implement and easy to understand. Paper systems have some virtues, and the genuinely paperless office is rare. Companies often define their procedures on paper, and staff are confident with information on paper. They can file a hard (paper) copy and use it easily for audit purposes. They often use paper systems when it is important to be able to trace all stages of a transaction, and when responsibility is high. Hospital staff keep most patient records on paper, sometimes alongside computer-based systems. The format of paper information systems is often a piece of A4 paper with printed instructions or boxes to complete. It may be a label attached to a part being routed through a shopfloor with instructions on what work to do. A manual, paper-based attendance list kept by a lecturer is another example, as is a paper address book or a diary.

Computer-based information systems

Most information systems beyond the smallest now use electronic means to collect data and to provide information. Electronic devices often now collect the initial data – such as the barcodes and scanners that capture product details in shops. Thereafter electronic systems process, manipulate, distribute and record the data, providing paper output when required. Examples are the till receipt for the customer or a summary report on the pattern of sales. Table 2.1 lists some examples.

Table 2.1 Examples and descriptions of computer-based information systems

Sector and example	Description
Retailing: electronic point-of-sale (EPOS) terminals.	Provide faster customer checkout, identify customer preferences and improve inventory control by direct links with suppliers' computer systems.
Financial services: automated teller machines (ATMs), telephone or online banking.	Support 24-hour banking services and enable customers to make transactions without visiting a branch.
Travel: computer-based reservation systems.	Enable customers to check fares and availability, and to make and pay for reservations without working with an agent.
Manufacturing: computer-aided design and manufacturing.	Linking design and manufacturing increases the speed of introducing new products, especially when there are electronic links to suppliers and customers.

Activity 2.1 Information systems you use

Identify two formal but paper-based information systems that you use or affect you.

- What are their advantages and disadvantages?

Identify two computer-based information systems that you use or affect you.

- What are their objectives?
- Could you achieve those objectives without using a computer?
- What are their advantages and disadvantages?
- Are computer-based systems always better?

Classifying IS by their purposes

Information systems can serve many purposes, four of which are: operational, monitoring, decision support (including knowledge) and communication.

Operational

Early computer systems were **operational** in the sense that management introduced them to process routine transactions. This is still a major function as they rationalise and standardise transactions in an efficient, reliable and uniform way. If a student informs the university administration that they have a new address, they expect the change to apply quickly and to all the relevant files. The university would use a transaction processing system to do this. Banks and other financial institutions use operational systems to process millions of transactions such as payment instructions. Other examples are payroll and order entry systems.

Operational (or transaction processing) systems also exchange data between organisations. They help retailers to control stock and to manage the supply chain. The attraction of **electronic point-of-sale systems (EPOS)** is that they instantly record each sale, using a laser scanner that reads the barcode on the product. There is a direct link between the shops and the supplier so that stock can be reordered automatically in line with actual sales.

Staff in operating theatres can use barcoding or RFID tags to 'check in' and 'check out' all the tools used during an operation to prevent any being left inside the patient. **Radio frequency identification (RFID)** technology is an automatic identification method that stores and retrieves data remotely, and is widely used to keep track of goods and materials in a production process.

Monitoring

Monitoring systems check the performance of activities, functions or people at regular intervals. The factor being monitored can be financial, quality, departmental output or personal performance. Being attentive to changes or trends gives the business an advantage as it can act promptly to change a plan to suit new conditions.

Universities in the Netherlands use student trail systems that monitor the academic progress of students. These systems link to the national institution that provides scholarships. This information enables this institution to stop or reduce the scholarship when results are below the required standard.

Decision support

Decision support systems (DSS), sometimes called expert or knowledge systems, help managers to calculate the likely consequences of alternative actions. A DSS incorporates a model of the process or situation, and will often draw data from operational systems. Knowledge systems also support decision-making by incorporating human knowledge. A knowledge engineer works with experts in the domain to learn how they make decisions, and incorporates this into that part of the software known as the knowledge base. Here are some examples.

- Businesses use DSS to calculate the financial consequences of investments.
- Universities use them to optimise room allocation and lecturer times.
- Banks use knowledge systems to analyse proposed loans. These incorporate years of lending experience and enable less experienced staff to make such decisions.
- NHS Direct in the UK uses an expert system to enable nursing staff in a call centre to deal with calls from patients who would otherwise visit their doctor. The system proposes the questions to ask, interprets the answers and recommends advice.

Computer-based systems are not as good as people at interpreting new knowledge and experience. Many people now use the term 'knowledge systems' rather than 'expert systems' (Balch et al., 2007) for systems that support people in their work. While knowledge systems can replace the experts to some extent, most only provide support to them (Balachandra, 2000; Voelpel et al., 2005) – they make suggestions to the human experts, but do not make decisions.

Communication

People design **communication systems** to overcome barriers of time and distance. They make it easier to pass information around and between organisations. E-mail enables people to communicate electronically, irrespective of time or place, as does the World Wide Web. A third type of communication system is groupware (Artail, 2006; Cormican and O'Sullivan, 2007), also known as a 'workflow system', which supports cooperation among people working in physically separate teams. Multinational companies use virtual teams to develop new products, and the Research Summary overleaf describes a project to develop a groupware system to support them.

Companies often integrate these IS purposes – as when their website combines communication with customers with operational features which manage online purchase and delivery processes.

Activity 2.2 Information on new applications

The media regularly report new applications of computer software.

- Collect examples of new systems that seem to have implications for how people manage their organisations.
- Try to find one example for each of the four purposes identified in this section.
- Compare notes with others and decide which of these systems is likely to be of greatest significance over the next two years.

Research Summary **Developing groupware modules**

Cormican and O'Sullivan (2007) worked with ten multinational manufacturing companies to design a groupware system that would meet the particular communication challenges of teams developing new products. This is a knowledge-intensive process, so managers need a method that enables information from all members of the group (usually located at sites around the world, and including customers and suppliers) to be captured and used. The researcher team designed and tested a web-based groupware system with seven modules.

Customers: structured forms capture customers' views, complaints and statistics, and can be linked to customer relationship management (CRM) systems (see Section 2.5).

Goals: identifies and communicates stakeholders' requirements, and sets measures of team performance.

Ideas and Problems: These modules encourage members to communicate problems and to generate ideas towards their solution.

Projects: Clarifies the processes for creating and resourcing projects.

Teams: Helps teams to monitor and review their performance and suggest improvements.

Results: Incorporates tools such as project reviews and reporting systems that enable teams to measure their results.

Source: Cormican and O'Sullivan (2007).

Classifying IS by their reach

Computer-based IS vary in the geographic reach of their operation and this affects their influence on organisations.

Individual systems

Common examples of **individual systems** are word-processing, spreadsheets and database systems to manage individual professional work, perhaps downloading data from company-wide systems as required. The advantage is that the individual decides what to use the system for and can control the way they work. The disadvantages are that the software may not be compatible with that used by other staff, and the data from the corporate database may date before someone uses it.

Local or departmental systems

If separate units or departments in companies have a distinct task to perform, management can create a **local IS** to support this. They have the same advantages and disadvantages as individual systems and there is usually pressure to integrate them into organisation-wide systems. A university may use a system that provides information about courses and assessments on the local departmental network, which students can access.

Company-wide systems

Company-wide systems integrate departments and people throughout the organisation. Units in hospitals can use centralised patient data systems to retrieve or update information

about a patient, as these make it easier for all staff to work from the same information. If managers want to implement a hospital-wide system they will discourage standalone systems, such as a doctor's list of patients held on a spreadsheet that she or he considers the definitive list.

Inter-organisational systems (see also Section 2.6)

Many systems link organisations electronically by using networks that cross company boundaries. These inter-organisational systems (IOS) enable firms to incorporate buyers, suppliers and partners in their business processes, in the hope of enhancing productivity, quality, speed and flexibility. New distribution channels can be created and new information-based products and services can be delivered. In addition, many IOS radically alter the balance of power in buyer–supplier relationships, raise barriers to entry and exit and, in many instances, shift the competitive position of industry participants.

MIS in Practice **Electronic links at Albert Heijn**

Albert Heijn, a Dutch chain of retailers belonging to Ahold, requires 100 per cent electronic data interchange with all suppliers. This 'continuous inventory replenishment system' captures data through scanning at the checkout to control inventory and to transmit orders to restock automatically. Amand Schins, manager of data optimalization, comments: 'new regulations, customer expectations and the ever increasing need for cost reductions make it necessary to have full electronic links'.

This IOS gives managers at Albert Heijn, and their suppliers, an immediate insight into the process performance, and hence into profitability.

Source: *Food Magazine*, 29 May 2006.

Community systems

A topical example of **community systems** is the growth of social network sites such as MySpace or YouTube. **Blogging** is one major use, as well as exchanging music and videos amongst people with similar interests. Although not related to an organisation (apart from those that own the site), they are significant for managers, since customers can use them to exchange positive or negative information about the company.

Combining the purposes of systems with their reach leads to Figure 2.1, which gives a systematic way of distinguishing IS. A spreadsheet application in Excel developed and used by one employee would fit in box O1 while a computer-aided design system used by engineers in a company and its suppliers would probably fit boxes O3 and O4. Systems such as e-mail or groupware extend beyond the company, so they would be C4 or C5 if, for example, it was a corporate blog that supported communication with customers. Customer relationship management systems (CRM) would be in areas D3 to D5.

The significance of this is that the organisational implications of systems vary across the figure. Those in the top left-hand area – largely individual, operational – will be easy to implement and affect few staff. Those towards the lower right-hand area raise increasingly complex technical and organisational issues.

	Reach				
Purpose	Individual	Local/departmental	Organisational	Inter-organisational	Community
Operational	O1	O2	O3	O4	O5
Monitoring	M1	M2	M3	M4	M5
Decision support	D1	D2	D3	D4	D5
Communication	C1	C2	C3	C4	C5

Figure 2.1 **Purposes and reach of IS combined**

Activity 2.3 Electronic links at Albert Heijn

- What is the reach and what are the purposes of the system at Albert Heijn?
- What benefits may the company gain from this?
- The manager claims that the system helps the company to respond more effectively to changing customer demands. How does it do that?

Classifying IS by their complementarities

The implications of Figure 2.1 are illustrated by McAfee (2006), who classifies IS according to the extent of complementary organisational changes they require. Some information technologies (functional) can deliver results without the complements being in place; others (networks) allow the complements to emerge over time; and still others (enterprise) impose the complements they need as soon as companies deploy the technologies. The significance of this is that it helps managers to understand the scale of the organisational changes they are likely to need to make to benefit from the investment. It can also indicate which projects will be relatively easy to implement.

Functional systems

Functional systems help people to perform standalone tasks more efficiently – word processors and spreadsheets are common examples. Designers, accountants, doctors and many other specialists use these technologies in the normal course of their work. As they work individually with a high degree of professional independence, they can use the technology as a standalone system, with few if any complementary changes required elsewhere in the organisation. An R&D engineer may be able to use a computer-aided design (CAD) program without requiring changes in how the rest of the department functions:

> *Furthermore, [functional systems] don't bring their complements with them. CAD software, for example, doesn't specify the processes that make the most of its power. Companies must identify the complements that [functional systems need].* (McAfee, 2006, p. 144)

Network systems

Network systems help people to communicate and include e-mail, instant messaging, blogs and **groupware** such as Lotus Notes. These allow people to interact, but do not

define how they should do so: people can experiment. These systems bring some complements with them, but allow users to implement them gradually, and to modify them. They allow people to work together, but do not specify who should send or receive messages. Their effective use will probably depend on some complementarities – such as rules on who can access which parts of the system or who is responsible for responding to customer comments on a blog – but users can modify these in the light of experience.

CASE QUESTIONS 2.2

Classifying IS at Siemens

Consider the types of business Siemens is in, and the kinds of IS it is using.

- Where would you place them in these classification schemes? Either from the case or from the Siemens website, identify at least one system they are using that would be an example of each category.
- Can you suggest which of these systems may have been the most difficult to implement?

Enterprise systems

Enterprise systems allow companies to restructure interactions amongst groups of employees or with business partners. Applications that structure entire business processes or enable data to pass between organisations fall into this category. Unlike network technologies, which percolate from the bottom, enterprise technologies are top-down; they are purchased and imposed by senior management.

> *Companies can't adopt enterprise systems without introducing new interdependencies, processes, and decision rights. Moreover, companies can't slowly create the complements to enterprise systems; changes become necessary as soon as the new systems go live.* (McAfee, 2006, p. 145)

Enterprise systems allow companies to redesign business processes, and to ensure that employees follow the correct procedures. They also enable companies, once they have identified complementary business processes, to implement them widely and reliably throughout the organisation. They also enable close monitoring of what is happening around the enterprise, bringing a high degree of management control.

The value of McAfee's analysis is that it alerts managers to the organisational implications of different systems. Functional systems raise few organisational issues, as the professionals themselves decide whether or not and how to use them. Network systems require more organisational decisions (such as who can have access to a system, and on what conditions), but these can emerge with experience. Enterprise systems require significant organisational changes if the company is to benefit, and will be correspondingly difficult to implement.

Activity 2.4 Listing IS by complementarities

Identify and list five information systems that you use, such as e-mail, intranet or electronic learning environment.

- To which of McAfee's three categories does each most closely correspond?
- What might that have implied for those managing or implementing the system?

In the following sections we illustrate the evolution of IS by discussing four widely used systems that support, respectively:

- enterprise resource planning (ERP);
- knowledge management (KM);
- customer relationship management (CRM); and
- inter-organisational systems (IOS).

Each section describes one of these systems and introduces the management issues they raise.

Summary

- IS can be classified by their formality, purpose, reach and complementarities.
- The formality of IS ranges from human, paper to computer-based systems.
- Purposes include operational, monitoring, decision support and communication.
- Reach can be individual, departmental, organisational, inter-organisational and community.
- Combining the classifications by purpose and reach gives some clues about the relative difficulties of implementing different systems.
- McAfee (2006) reflects this in distinguishing between systems in terms of the complementary organisational change that they require, depending on whether they are functional, network or enterprise systems.

2.3 Managing information flows with enterprise-wide systems

Fulfilling a customer order requires people in sales, accounting, production, purchasing and so on to cooperate with each other to exchange relevant information. However, the IS on which they depend were often designed to meet the needs of a single function or organisational level. They were built independently and cannot automatically exchange information. Manufacturing might not know the number and types of product to make because their systems cannot easily obtain information from the systems that process orders. A common solution is to use **enterprise systems (ES)**, also known as enterprise resource planning (ERP) systems. These coordinate activities, decisions and knowledge across many different functions, levels and business units in the hope of increasing efficiency and service.

Enterprise systems aim to create an integrated platform to coordinate internal processes. Discrete functions become integrated into company-wide business processes that flow between levels and functions, as shown in Figure 2.2.

At the heart of an enterprise system is a single database that draws data from and feeds data to applications throughout the company. Table 2.2 shows examples of business processes and functions supported by enterprise systems. These 'modules' can be implemented separately, but promise greater benefits when they are linked to exchange information continuously through the database.

ERP systems give management direct access to current operating information enabling them to:

- integrate customer and financial information;
- standardise manufacturing processes and reduce inventory;
- improve information for management decisions across sites;
- enable online connections with suppliers' and customers' systems with internal information processing.

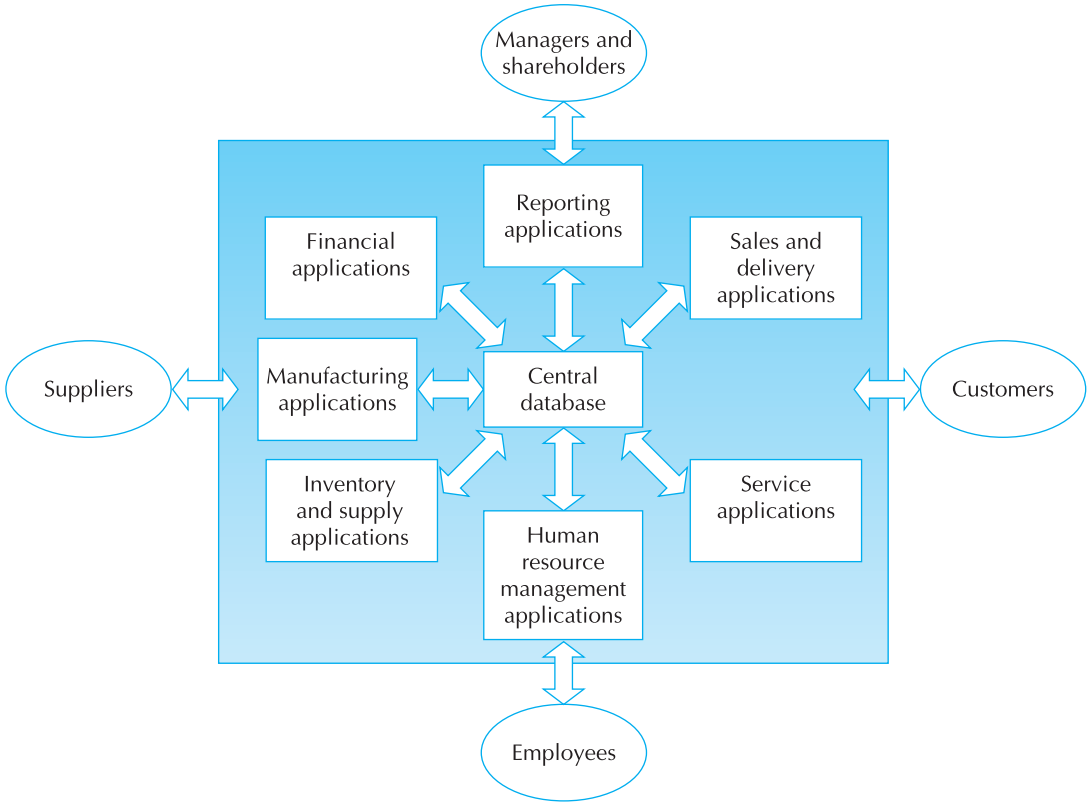


Figure 2.2 Anatomy of an enterprise system

Table 2.2 Examples of business processes supported by enterprise systems

Business function	Enterprise system
Financial	Accounts receivable and payable, asset accounting, cash management and forecasting, executive information system, general ledger, product-cost accounting, profitability analysis, profit-centre accounting, financial reporting.
Human resources	Payroll, personnel planning, travel expenses, benefits accounting, applicant tracking.
Operations and logistics	Inventory management, material requirements planning, materials management, plant maintenance, production planning, project management, purchasing, quality management, routing management, shipping, vendor evaluation.
Sales and marketing	Order management, pricing, sales management, sales planning, billing.

Leading suppliers of ERP systems include SAP, PeopleSoft, Oracle and J.D. Edwards, each tending to specialise in particular industries – some of which have themselves standardised on a particular vendor (McKeen and Smith, 2003).

ERP systems are semi-finished products that user organisations must tailor to their needs, called **configuration**. For example, financial software must be configured so that it knows which companies exist, which companies are subsidiaries of which other companies, the currency for each subsidiary, the sales tax regimes for each subsidiary and so on. Adding non-standard features to the software by adding or changing program code is usually called **customisation**. This ranges from relatively simple changes such as developing a new report, to major changes that require work on code in the software. Customisation is costly and risky, and new software releases may require recustomisation. Companies can avoid this by changing their processes to match those supported by the software – but the risk then is that the processes embedded in the system software may not suit the company. Changing an organisational process is itself difficult.

Organisational and management issues of ERP systems

There is controversy about whether adopting an ERP system gives a competitive advantage or not (McKeen and Smith, 2003). A company may not benefit if using the generic models provided by standard ERP software prevents it from using unique business models that had given it a competitive edge. ERP systems promote centralised coordination and decision-making, which may not suit a particular firm.

Another problem is inflexibility. Some analysts argue that ERP systems lock companies into rigid processes that make it hard, if not impossible, to adapt quickly to changes in the marketplace or in organisation structure. A study by Markus et al. (2000a) shows that many ERP problems relate to a misfit between the system and the characteristics of the organisation. Enterprise systems are completely intertwined with corporate processes and it may take years to implement them all. It is difficult to change integrated systems because a change in one part affects the others, so that the company may become inflexible and hard to change.

ERP systems are expensive to install, and few companies build enough post-implementation costs into their budgets, and frequently underestimate training costs. ERP implementation should be viewed and managed as an organisational change process, rather than as the replacement of a piece of technology. It impacts strategy, structure, people, culture, decision-making and many other aspects of the company. The MIS in Practice feature, right, illustrates these issues.

Chapter 5 discusses ERP systems further from a business process perspective.

Activity 2.5 Researching ERP systems

Read this section on enterprise systems, including the Invacare example – and also the FFC dairy food example in Chapter 5 – and compare the descriptions of ERP use and implementation. You could also use sources from the Internet (e.g. Wikipedia and ERP user communities).

- Gather specific examples showing the opportunities and advantages of such systems, and also their disadvantages and limitations.
- If possible, compare your conclusions with others in your class.

MIS in Practice **Invacare struggles with ERP**

Invacare is the world's leading manufacturer and distributor of non-acute healthcare products, including wheelchairs, motorized scooters, homecare beds, portable compressed oxygen systems and skin and wound care products. It conducts business in over 80 countries, maintaining manufacturing plants in more than 12 countries.

In 2004 Invacare began to replace a collection of legacy systems with modules from Oracle's E-business Suite. Invacare had been using Oracle database software and had implemented the financial modules four years earlier with no significant difficulties. However, it experienced significant problems when it went live with an 'order-to-cash' module, which let the company receive an order, allocate the supplies, and enable customers to track the status of their order.

Amongst the problems were that call centre staff were unable to answer customer queries promptly, and delivery performance declined rapidly, leading to a loss of sales. It also affected the company's internal financial reporting controls, so it had to take special steps to validate the figures used in financial statements.

Invacare had expected implementation problems, but not on this scale. According to the financial officer, the problems were not caused by the software, but by the way the company had configured the software and linked it with its business processes. He also believed that the company should have done more testing.

Source: Laudon and Laudon (2007), p. 287.

Summary

- ERP systems are software packages that enable the integration of transactions-oriented data and business processes throughout an organisation.
- Such systems have to be configured and can be customised to create a fit with the organisation. Organisational processes can also be adjusted to fit with the system.
- ERP implementation is an organisational change process, rather than the replacement of a piece of technology. It impacts strategy, structure, people, culture, decision-making and many other aspects of the company.

2.4 Knowledge management systems

Developments in IS are of great interest to those who want to improve their organisation's ability to create and mobilise knowledge. Many businesses depend on the skill with which they are able to create and acquire knowledge and ensure that people use it throughout the organisation. Knowledge is vital to innovation and many see it as the primary source of wealth in modern economies. People often believe that the knowledge they need to improve performance is available within the business – but they cannot find it.

Knowledge management (**KM**) refers to attempts to improve the way organisations create, acquire, capture, store, share and use knowledge. This will usually relate to customers, markets, products, services and internal processes, but may also refer to knowledge about relevant developments in the external environment.

Table 2.3 Knowledge management processes and the potential role of IS

Knowledge management processes	Knowledge creation	Knowledge storage/retrieval	Knowledge transfer	Knowledge application
Supporting information technologies	Data mining. Learning tools.	Electronic bulletin boards. Knowledge repositories. Databases.	Discussion forums. Knowledge directories.	Expert systems. Workflow systems.
IT enables	Combining new sources of knowledge. Just-in-time learning.	Support of individual and organisational memory. Inter-group knowledge access.	More extensive internal network. More communication channels. Faster access to sources.	Knowledge can be applied in many locations. More rapid application of new knowledge through workflow automation.
Platform technologies	Groupware and communication technologies. Intranets and sometimes extranets.			

Source: Based on Alavi and Leidner (2002), p. 125.

Managing knowledge is not new – the Industrial Revolution occurred when people applied new knowledge to manufacturing processes. What is new is the degree to which developments in IS make it easier for people to share data, information and knowledge irrespective of physical distance. This has encouraged many managers to believe that implementing knowledge management will enhance performance and some studies, such as that by Feng et al. (2004), claim that companies adopting KM systems perform better than non-adopters. Three common purposes are to:

- code and share best practices;
- create corporate knowledge directories; and
- create knowledge networks.

Table 2.3 illustrates how IS can potentially support each element of knowledge management – these subdivisions are of course arbitrary, and systems typically support several.

Echikson (2001) outlined how the oil company BP uses advanced IS to enable staff in this global business (including those in recently acquired companies) to share and use information and knowledge. These include a web-based employee directory (an intranet) called 'Connect', which contains a home page for almost every BP employee. Clicking on someone's name brings up a picture, contact details, interests (useful for breaking the ice between people who have not met) and areas of expertise. When a manager in a BP business needed to translate their safety video into French, he used Connect to identify French-speaking employees who could do the work, rather than an external translation service. At the core of the business, decisions on where to drill are now informed by an Internet system that brings geological data to one of several high-tech facilities. Engineers view the images and make, in hours, decisions that used to take weeks – and help reduce the danger of expensive drilling mistakes.

It is important to recall the distinctions made in Chapter 1 about data, information and knowledge – in which we referred to knowledge as 'embodying prior understanding,

experience and learning' (p. 7). Many systems that people refer to as 'knowledge' management systems appear on closer examination to deal with data and information rather than knowledge. While computer-based systems are effective at dealing with (structured) data and information, they are much less effective at dealing with (unstructured) knowledge. As Hinds and Pfeffer (2003) observe:

> *systems [to facilitate the sharing of expertise] generally capture information or data, rather than knowledge or expertise. Information and information systems are extremely useful but do not replace expertise or the learning that takes place through interpersonal contact.* (p. 21)

Nonaka and Takeuchi (1995) distinguish **explicit** from **tacit knowledge**. Explicit knowledge is that which people have codified, structured, perhaps written down – formulae, instructions, historical trends – and which can be identified, extracted and passed on to other users. Tacit knowledge is inherent in individuals or groups, and is not written down – it is a sense about the way to do things, how to relate to each other and to situations. Because it is personal and specific to the context it will often be the most useful kind of knowledge – yet the hardest to transmit by even the most sophisticated technology.

CHAPTER CASE: PART 2

Siemens' ShareNet

www.siemens.com

Voelpel et al. (2005) describe what they call one of the few success stories in creating global knowledge-sharing systems – Siemens' ShareNet. The company's customers increasingly expect it to provide complete solutions to complex engineering problems and staff had, by the mid-1990s, become aware that managing the company's knowledge was vital to continued success.

ShareNet began as an initiative in the (then) Information and Communication Networks (ICN) Division, with a system linking the 17,000 sales and marketing employees. In addition to providing a database containing all project results, it enabled employees at ICN to communicate and exchange their know-how, experience and comments. An example of its value was when staff were bidding for a telecommunications project in China. Sales staff using ShareNet found out that similar systems had already been implemented in Thailand and Chile, which meant that their colleagues in those countries could give them valuable information about the hardware and software features that would be needed.

However, getting people to contribute to, and use, ShareNet was a significant challenge. Managers realised that the hierarchical structure within isolated business units discouraged collaboration:

> *there were always excuses. People said, 'I don't have the time to spend on this.' Others were reluctant to share. [Some said] 'Sure, we have knowledge, but it's for sale, it's not for free'.* (Voelpel et al., 2005, p. 15)

The project team responded by introducing incentives to motivate employees to use the knowledge network. Posting of queries and suggestions steadily increased, and was adopted by other businesses within the group. Although the project faced challenges over its cost, and the difficulty of demonstrating a business benefit, Voelpel et al. (2005) conclude that ShareNet shows:

> *the thoughtful implementation of a knowledge-sharing system enhances the transfer of knowledge within a global organisation, and can therefore create value.*

Sources: Voelpel et al. (2005); article 'Heading for Knowledge-Guided Networks' on company website, Spring 2004.

MIS in Practice **Problems with KM in a consultancy**

The company is one of the leading global management consultancies, with over 75,000 consultants in over 40 countries. As do most such firms, it considers the knowledge of its staff to be a core capability for achieving competitive advantage. To ensure that this knowledge is widely shared it has spent large sums on KM systems, especially Knowledge Exchange (KX) – a repository of internally generated knowledge about clients, topics, best practices and so on – to which consultants were expected to contribute ideas as they completed projects for clients.

Paik and Choi (2005) found that few East Asian consultants contributed, and identified three reasons: 1 a perception amongst East Asian consultants that others did not appreciate their regional knowledge; 2 a requirement to provide ideas in English (East Asian consultants were conversant in English, but found it difficult and time consuming to translate documents into English before submitting them); 3 cultural differences (staff in some countries were not motivated to contribute if there was no direct personal incentive – which the global reward system did not take into account).

They conclude that global companies seeking a common approach to knowledge management need to make allowances for local cultural differences.

Source: Paik and Choi (2005).

Scarbrough and Swan (1999) also note that, while technological systems deal well with data and information (explicit knowledge), tacit knowledge cannot be processed and passed around as people continuously create and re-create it as they work together. They interact with each other and their work, creating new knowledge and shared understandings that are unique to that situation. While a 'cognitive' model of knowledge management is appropriate for dealing with explicit knowledge, a 'community' model is a more suitable perspective from which to consider tacit knowledge. Table 2.4 contrasts these features.

Table 2.4 Two views of the knowledge management process

Cognitive model	Community model
Knowledge is equated with objectively defined concepts and facts.	Knowledge is socially constructed and based on experience.
Knowledge is transferred through text, and information systems have a crucial role.	Knowledge is transferred through participation in social networks including occupational groups and teams.
Gains from KM include the recycling of knowledge and the standardisation of systems.	Gains from KM include greater awareness of internal and external sources of knowledge.
The primary function of KM is to codify and capture knowledge.	The primary function of KM is to encourage knowledge-sharing between groups and individuals.
The dominant metaphor is human memory.	The dominant metaphor is the human community.
The critical success factor is technology.	The critical success factor is trust.

Source: This material is taken from *Case Studies in Knowledge Management* (1999) written by Scarbrough, H. and Swan, J., with permission of the publisher, the Chartered Institute of Personnel and Development, London (www.cipd.co.uk).

Organisational and management issues of KM systems

Presenting the community model alongside the cognitive model helps to identify the issues in the success or failure of KM projects:

> *whilst it might be relatively easy to share knowledge across a group that is homogenous, it is extremely difficult to share knowledge where the group is heterogeneous. Yet it is precisely the sharing of knowledge across functional or organisational boundaries . . . that is seen as the key to the effective exploitation of knowledge.* (Scarbrough and Swan, 1999, p. 11)

Systems with a technical, cognitive perspective typically fail to take account of structures and cultures that represent people's beliefs and values about what needs to be done and what should be rewarded. They are likely to inhibit people from sharing knowledge in the way intended.

KM tools can be valuable in exploiting knowledge about previous projects, technical discoveries or useful techniques. But reusing existing knowledge may do less for business performance than creating new knowledge to suit the situation, which depends on creative interaction between people. Since most managers receive too much information it does not follow that providing them with more will improve performance. That depends not just on knowledge, but also on insight and judgement – which an information system cannot provide (Walsham, 2001, 2002).

Gupta and Govindarajan (2000) observed that:

> *effective knowledge management depends not merely on information technology platforms but . . . on the social ecology of an organisation – the social system in which people operate [made up of] culture, structure, information systems, reward systems, processes, people and leadership.* (p. 72)

People will be more likely to use a knowledge management system if the culture recognises and rewards the benefits of sharing knowledge. For tacit knowledge, a focus on encouraging effective communities of practice will be more effective than a focus on technology. We return to these issues in Chapters 6 and 8.

Activity 2.6 What knowledge do you need for a task?

- Identify for an employee (perhaps yourself) what knowledge they create, acquire, capture, share and use while doing a task.
- Identify examples of explicit and tacit knowledge in this example.
- Discuss to what extent a computer-based knowledge system could be useful in managing that knowledge.
- Would such a system be in your interests and/or the interests of the organisation?

Summary

- Knowledge management systems aim to improve an organisation's ability to create, acquire, capture, store, share and use knowledge.
- KM systems include data mining, bulletin boards, expert systems and workflow systems.

- Information systems can easily deal with explicit knowledge, but are mush less suited to tacit knowledge.
- Implementing useful KM systems depends on also dealing with organisational issues, including the homogeneity of the group, and organisation structure and culture.

2.5 Managing customer processes with CRM

It is more expensive to attract new customers than to retain existing ones, so many companies try to use the power of IS to improve the way they manage their relationship with profitable customers. Marketing staff aim to retain them, and to earn more revenue from them.

Customer relationship management (CRM) systems are intended to build and sustain long-term business with customers. They represent a move from mass markets and mass production to customisation and focused production. CRM software tries to align business processes with customer strategies to recruit, satisfy and retain profitable customers (Rigby et al., 2002). Figure 2.3 shows three approaches to customers. The first treats all customers in the same way by sending impersonal messages in one direction. The second sends one-directional but different messages to customers, depending on their profile. The third personalises the messages, which may lead to real interaction, in the hope of increasing customer loyalty.

In many businesses the key to increasing profitability is to focus on recruiting and retaining high lifetime value customers. So the promise of CRM is to:

- gather customer data swiftly;
- identify and capture valuable customers while discouraging less valuable ones;

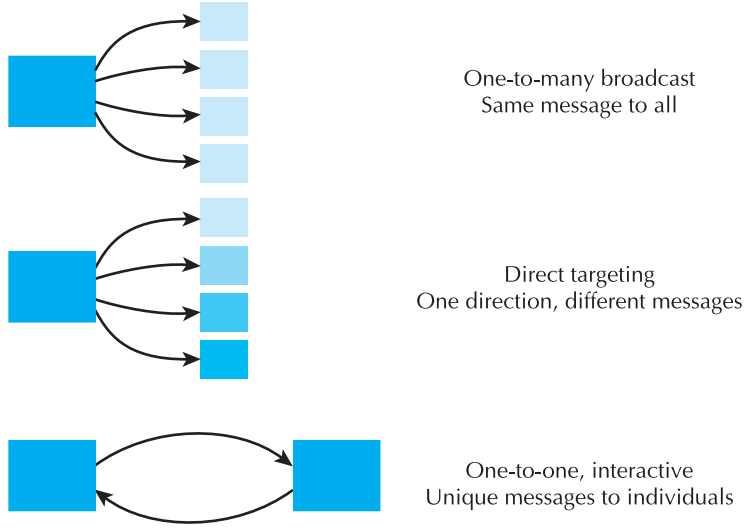


Figure 2.3 Communications methods and message

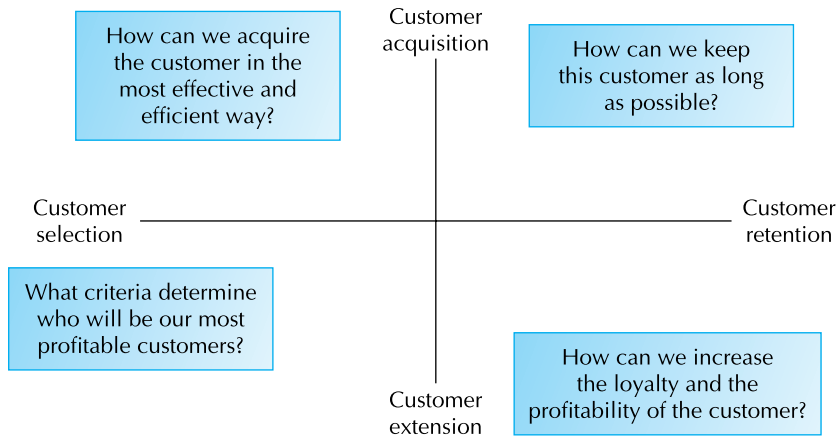


Figure 2.4 Questions with respect to customer selection, acquisition, retention and extension

- increase customer loyalty and retention by providing customised products;
- reduce costs of serving customers;
- make it easier to acquire similar customers.

CRM systems consolidate customer data from many sources and try to answer questions such as these.

- Who are our most loyal customers?
- Who are our most profitable customers?
- What do these profitable customers want to buy?

Firms can use these answers in their policy of customer selection, acquisition, retention and extension, as shown in Figure 2.4.

A common objective for a CRM system is to increase the lifetime value of customers, as measured by recency, frequency and monetary value – the **RFM model**. This model is based on three empiric principles:

- customers who purchased recently are more likely to buy again compared with customers who have not purchased in a while;
- customers who purchase frequently are more likely to buy again compared with customers who have made just one or two purchases;
- customers who spend the most money in total are more likely to buy again.

Using this approach, each customer is assigned an RFM score based on recency, frequency and monetary value. Customers with high scores are usually most profitable, the most likely to purchase again and the most highly responsive to promotions. Using the RFM scores, companies can determine the lifetime value of a customer – the expected profit a customer will contribute to a company as long as the customer remains a customer. Once a company knows who their most valuable customers are, they can concentrate their efforts on satisfying those customers. Figure 2.5 illustrates the model.

MIS in Practice **CRM at The Royal Bank of Scotland**

RBS developed a system that scans incoming documents into digital images and distributed these to processing staff through electronic 'queues' – an Image & Workflow (I&W) system. It was recognised that the I&W system offered an opportunity to more effectively address CRM service requirements and, using I&W as a basis, two new systems were developed: the Customer Event System (CES) and Concerns & Queries system (C&Q).

The CES application allows any relevant staff member to view progress with recent transaction requests for any customer. They can retrieve images of recently submitted forms or letters and advise customers as to the stage their request has reached, and any issues with it being completed. Customers can therefore make a telephone call to any of the central telephony centres and receive updates regardless of where their request is being processed.

The C&Q application was developed to manage customer complaints in a way that clearly assigns ownership to a staff member, ensures that the complaint is addressed within agreed timescales, and enables RBS to comply with regulatory requirements for complaints handling. When the bank receives a complaint by telephone or letter it is entered into the C&Q system with all relevant details (including images of any written correspondence). The complaint enters an electronic queue and is picked up by the appropriate department. Progress with investigating the complaint is recorded in C&Q, which also provides prompts to ensure that staff meet the agreed time targets.

CES and C&Q are examples of systems developed on top of a back-office processing system (I&W) to provide front-end CRM services.

Source: Information supplied by the company.

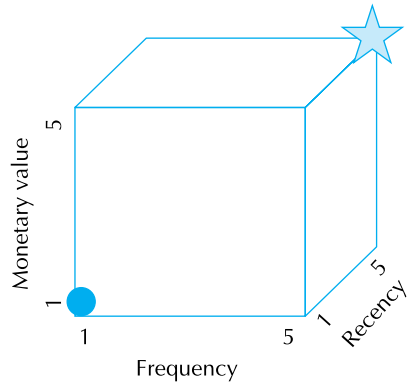


Figure 2.5 **Recency, frequency and monetary value of customers**

Mobile CRM

CRM can also be practised by using customers' mobile phones. There are 2.5 billion mobile phones around the world and CRM experts believe that these are potentially a more efficient way to reach customers than through their personal computers. Especially in poorer countries the use of mobile phones is growing more rapidly than that of

computers, and marketers hope to use this for 'relevant mobile ads'. Advertisers believe that much traditional advertising does not reach the right audiences, but that using text messages to a person's mobile phone will be much more accurately targeted. They aim to use the customer profiles of a mobile phone company's customers to tailor advertisements to match subscribers' habits (*The Economist*, 6 October 2007). The possible downside of this approach is that many consumers consider their phones as personal and may not welcome more advertising – though this would vary by country and type of customer.

Organisational and management issues of CRM systems

CRM projects result in high failure rates. A study by the Gartner group found that 55 per cent of all CRM projects fail (www.gartner.com). In Bains' survey of management tools, CRM ranked third from bottom in terms of users' satisfaction (Bains, 2001). CRM initiatives not only fail to deliver profitable growth but can also damage long-standing customer relationships, according to a survey of 451 senior executives (Rigby et al., 2002). According to CRM-forum, only 4 per cent are software problems and 1 per cent bad advice; 87 per cent pinned failure of CRM programmes on the lack of adequate change management.

Implementing successful CRM depends more on strategy than on technology. Without a clear customer strategy a CRM system lacks direction and may disrupt relations with important customers. A customer acquisition and retention strategy has to be implemented and a segmentation analysis has to be made.

If a customer strategy is established, other dimensions, such as business processes, other systems, structure and people, have to be adapted to make the CRM system work. If a company wants to develop better relationships with its customers it needs first to rethink the key business processes that relate to customers, from customer service to order fulfilment. Such adaptations may also include job descriptions, performance measures, compensation systems, training programmes and so on. If consumers have a choice of channels – such as e-mail, web and telephone – marketing, sales and service can no longer be treated separately. A customer may place an order by phone, use the website to check the status of the order and send a complaint by mail. Multi-channel interactions pose considerable challenges if the company is to maintain a single comprehensive and real-time view of each customer.

For companies focused on products or services, this means recentring on the customer – which can be a radical change in a company's culture. All employees, but especially those in marketing, sales, service and other customer contact functions, have to think in a customer-oriented way. For example, in some call centres, employees have been measured and rewarded on how fast they resolved a customer's problem. This reflected management thinking that shorter telephone calls lowered costs. A CRM approach would concentrate efforts on customer satisfaction per call, not just call-handling efficiency (Mahieu, 2002).

An important reason for the failure of CRM projects lies in narrow and poor change management. Much time, effort and money have to be spent exclusively on managing the organisational issues. It is a struggle to move from a conventional customer strategy to a CRM philosophy. CRM projects are cross-function undertakings: IT, marketing and production have to operate on the same wavelength, yet they have different orientations and cultures. Successful CRM depends on coordinated actions by all departments within a company rather than being driven by a single department.

Summary

- CRM systems are customer-facing systems for customer care and management supporting a CRM philosophy.
- CRM is primarily a customer-centric philosophy, and can be perceived as a move from mass market and industrial production to customisation and focused production.
- CRM can only be implemented successfully by managing a range of organisational issues, including establishing a strategy on which customers should be treated in particular ways. It also depends on adapting business processes, structure and skills.

2.6 Using IS beyond organisational borders

Networked information systems allow companies to coordinate joint processes with other organisations across great distances. Transactions such as payments and orders can be exchanged electronically, thereby reducing the cost of obtaining products and services. Organisations can share all sorts of business data, such as catalogues or mail messages, through networks. Many such systems use web technology, with labels such as extra-organisational systems, e-commerce systems, m-commerce, e-business systems and supply chain management systems. Since these systems cross organisational borders we refer to them as **inter-organisational systems (IOS)**.

These inter-organisational systems can create new efficiencies and new relationships between an organisation and its customers, suppliers and business partners, redefining organisational boundaries. Firms are using these systems to work jointly with suppliers and other business partners on product design and development, and on scheduling the flow of work in manufacturing, procurement and distribution: 'Streamlining cross-company processes is the next great frontier for reducing costs, enhancing quality, and speeding operations' (Hammer, 2001, p. 84). Inter-firm collaboration and coordination can increase efficiency, value to customers and competitive advantage.

IOS includes two commonly used terms:

- **e-commerce**, the process of selling a product or service to the customer (whether a retail consumer or another business) over the Internet; and
- **e-business**, the integration, through the Internet, of all an organisation's processes, from its suppliers through to its customers.

Figure 2.6 shows how the systems within a company can be linked with external parties by electronic networks.

Many businesses have used the Internet as an information system to support their distribution processes. Such **business-to-consumer (B2C) systems** offer products, especially banking, publications, software, music or tickets, to individual retail customers. Another way of using the Internet is to change the production system. Some companies use a website to manage information about sales, capacity, inventory, payment and so on – and to exchange that information with their suppliers or business customers. They use such **business-to-business (B2B) systems** to connect electronically all the links in their supply chain, so creating an integrated process to meet customer needs.

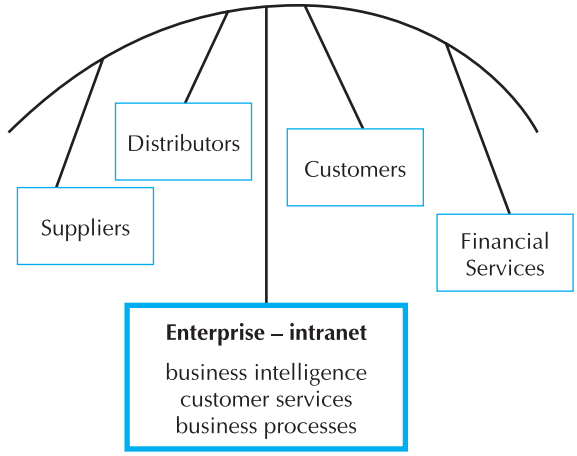


Figure 2.6 E-business: electronic linkages within the companies and in the supply chain

E-business models

When organisations use IS to communicate with business partners they have to decide which e-business models best suit their goals. A business model is defined as the organisation of product, service and information flows, and the source of revenues and benefits for suppliers and customers. The concept of an **e-business model** is the same but used for the online presence. Examples of common business models are (Li, 2007):

- e-shops: Internet shops, e.g. Amazon;
- e-procurement: the sale of supplies and services on the Internet;
- e-malls: department stores on the Internet;
- e-auctions or online auctions: the business model where participants bid for products and services over the Internet, such as eBay;
- virtual communities, also called e-communities or online communities: a group of people who interact via the Internet rather than face to face;
- information brokers: deliver requested information over the Internet, such as Google.

Roughly dividing the world into providers/producers and consumers/clients one can classify e-businesses into the following categories:

- business-to-business (B2B), e.g. ordering a product electronically through e-procurement;
- business-to consumer (B2C), e.g. a company publishing ticket prices and availablity;
- business-to-employee (B2E), e.g. using a corporate intranet to give information about rules for claiming travel expenses;
- business-to-government (B2G), e.g. licence applications;
- government-to-business (G2B), e.g. government buying office furniture;
- citizen-to-government (C2G), e.g. passport application;
- consumer-to-consumer (C2C), e.g. auction for private individuals;
- consumer-to-business (C2B), e.g. booking a ticket.

The simplest IOS applications provide information, also called 'web presence'. In B2C applications, customers can view product or other information on a company website. In B2B, business customers can place their requirements on the Internet, inviting potential suppliers to seek more information. Conversely, suppliers can use their websites to show customers what they can offer. Internet marketplaces are developing in which groups of suppliers in the same industry operate a collective website, making it easier for potential customers to compare terms through a single portal, providing links to many other sites (Hackbarth and Kettinger, 2000).

A further form of Internet use is for interaction. Customers or suppliers enter information and questions about (for example) offers and prices and the system then uses the customer information to show availability and costs. In B2B applications, a buyer can see a supplier's offer and ask further questions about optional features, volumes or delivery.

A third use is for transactions, when customers buy goods and services through a supplier's website. Conversely, a supplier who sees a purchasing requirement from a business (perhaps expressed as a purchase order on the website) can agree electronically to meet the order. The whole transaction, from accessing information through ordering, delivery (in some cases) and payment, can take place electronically.

The fourth use is integration when it links its own information systems and (within limits) links them in turn to customers and suppliers. As customers place an order, this information moves to the systems that control the seller's internal processes and those of its suppliers.

Finally, a company achieves transformation when it uses IOS to transform its internal operations as well as the value chain. It may integrate its business processes with those of suppliers and customers or use the Internet to reach the customer in more direct ways. Figure 2.7 shows these stages.

The relationship between a company and its channel partners can be changed by the Internet or by other applications of inter-organisational systems, because electronic networks can help to bypass channel partners, also called **disintermediation**. Figure 2.8 shows how a manufacturer and a wholesaler can bypass other partners and reach customers directly.

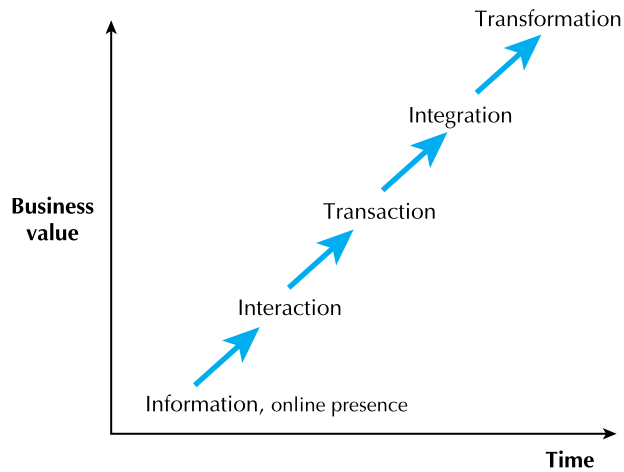


Figure 2.7 Inter-organisational systems in five phases

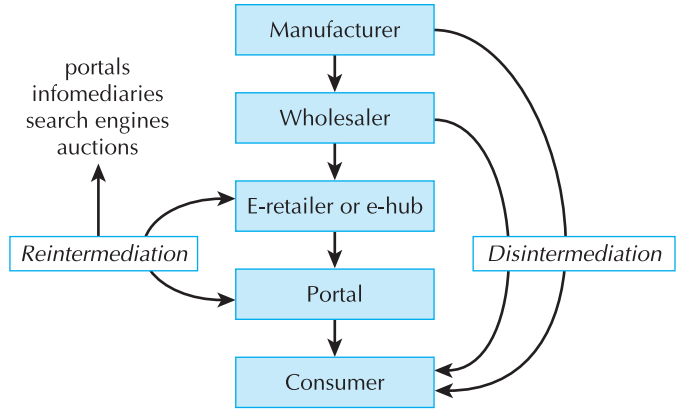


Figure 2.8 Reinventing the supply chain

The benefits of disintermediation are that transaction costs are reduced and it enables direct contact with customers. This also makes it possible to increase the reach of companies, for example from a local presence to a national or international presence. On the other hand, the Internet also creates the possibility for parties to reintermediate. **Reintermediation** is the creation of new intermediaries between customers and suppliers by providing (new) services such as supplier search and product evaluation (Chaffey, 2007). Portals that help customers to find the best price and offer to meet specified needs are examples of electronic reintermediators. The portal performs price evaluation and helps users to link automatically to suppliers. Internet-based reintermediators (also called **infomediaries**) include search engines, malls, virtual resellers, financial intermediaries and evaluators (who provide comparisons).

MIS in Practice — E-government applications at the City of Amsterdam

The City of Amsterdam aims to be an e-government city that seeks to serve its citizens with as many e-services as possible. Relations with citizens, with companies, and with tourists are facilitated with e-services but Amsterdam also tries to support the democratic processes with information technology. Here are some examples of e-services on the Amsterdam City Portal (www.iamsterdam.com).

- **Information** – latest news such as the plan to build a new stadium and business news.
- **Interaction** – citizens can give their opinions about what's going on in Amsterdam and file complaints about services of the city. It is also possible to chat with politicians and civil servants.
- **Transaction** – citizens can order new passports and driving licences. It is also possible to make theatre and hotel bookings.
- **Integration** – Amsterdam integrated a number of its web services with its own business systems. The City Portal is also connected with the systems of the Tourist Board and with the IT systems of main tourist attractions.

Sources: websites www.iamsterdam.com and www.amsterdam.nl

M-commerce

Personal digital assistants (PDAs) and mobile phones have become so popular that many businesses are beginning to use m-commerce as a more efficient method of serving their customers. Examples of m-commerce are in ticketing and travel. M-ticketing means that tickets can be sent to mobile phones. Users are then able to use their tickets immediately by presenting their phones at the venue. The travel industry uses m-commerce to update customers on flight status, notify them when this information changes and offer to make new arrangements based on present user preferences requiring no input from the user. Therefore, a customer's entire trip can be scheduled and maintained using a mobile device. Unlike a home PC, the location of the mobile phone user is an important piece of information used during mobile commerce transactions. Knowing the location of the user allows for location-based services, such as local maps, local offers, local weather and people tracking and monitoring.

Organisational and management issues of IOS

Feeny (2001) emphasises that existing customers should not be the only focus, since IOS may make it possible to reach new customers with new products. This is consistent with Porter's (2001) view that implementing IOS and Internet applications is not a substitute for strategy. Once most companies have embraced the Internet, the Internet itself will be neutralised as a source of advantage; companies will not survive without a website, but they will not gain any competitive advantage. That comes from traditional and sustained strengths such as unique products, excellent operations, product knowledge and relationships. IOS should be used by companies to strengthen and 'fortify' those advantages.

A major concern of companies using IOS is whether or not they can handle the associated physical processes. These include handling orders, arranging shipment, receiving payment and dealing with after-sales service. This gives an advantage to traditional retailers that can support their websites with existing fulfilment processes. Given the negative effects of failure once processes are supported by IOS, it seems advisable to delay connecting systems to the IOS until robust and repeatable processes are in place.

Another important issue is the change management associated with e-business (Boonstra and de Vries, 2005) since the move to e-business affects many processes and people, as the MIS in Practice feature, right, shows.

Kanter (2001) found that the move to e-business for established companies involved a deep change. She found that top management absence, short-sightedness of marketing people and other internal barriers are common obstacles. She quotes an executive:

> *We have internal opposition from parts of the organisation that are threatened by the Internet. The sales force is obviously not keen on deploying the Internet with channel partners, which means reduced sales to them.* (p. 92)

Her research in over 80 companies showed 'deadly mistakes' as well as some lessons, including:

- create experiments and act simply and quickly to convert the sceptics;
- create dedicated teams and give them space and autonomy, sponsoring them from the wider organisation;
- recognise that e-business requires systemic changes in many ways of working.

MIS in Practice The electronic patient file

Computer systems are widely used in healthcare to support clinical and administrative procedures, but they are typically isolated systems, unable to pass information about an individual patient to other systems. This means that the different providers of healthcare (general practitioners, hospitals, pharmacies, etc.) do not have online access to all of a patient's records with their medical history, currently prescribed drugs and perhaps any problems they have had with particular drugs.

Such access is important in many clinical situations, such as: during clinical care, doctors and nurses in hospitals need full patient records; when patients leave the hospital, pharmacies and GPs need medical information from the hospital to complete their files; when patients visit hospitals for outpatient care, the hospital and the pharmacist need patients' information from GPs. All agree that patients will benefit if they are treated by people with access to one consistent medical record that includes information from the laboratory, X-rays, pharmacy, GP, etc. Software and hardware suppliers have developed such systems, which they actively promote.

The management of the main hospital in a region proposed that all relevant parties, especially GPs and pharmacies, should enter medical data into an Electronic Patient File (EPF) that would be managed by the hospital's IS-department. Within the hospital, medical staff would enter details about treatments and drugs prescribed. Traditionally hospital doctors entered this on to a paper file (one for each patient) that all staff then used when treating that patient. The new system would involve entering and retrieving information through a computer terminal; some doctors expected that nurses would do this work for them.

Most general practitioners in the region (independent businesses who also value their professional autonomy) had already invested in patient record systems to meet their needs. They have traditionally resisted attempts by government to control their expenditure on drugs, arguing that this would reduce their professional status.

The pharmacies had also invested in computer systems, and these were integrated in networks linking pharmacy businesses across the region. They enabled pharmacies to control and manage supplies of medicines in line with demand, and to track what drugs patients were buying, wherever they did so.

Source: Boonstra and Harison (2008).

Activity 2.7 Considering the electronic patient file

An important issue in IOS is change management, since they affect many processes and people. Review the account of the Electronic Patient File and make notes on the following issues.

- What are the main elements of this system?
- How would you categorise this system in terms of functions and reach?
- Who are the potential users of this system?
- What are the possible benefits of implementing it?
- What organisational difficulties might arise?
- Identify the three main issues that hospital management should be considering if they want the proposed system to be a success.

Summary

- A major management issue is the extent to which the Internet provides opportunities to improve or expand the existing business, while at the same time threatening that business by opening it to new competitors.
- When management has decided to use the Internet to develop e-commerce or e-business, strategies have to be developed as to how this will be realised. Such a strategy will have external elements (e.g. customers, suppliers, competitors) and internal elements (e.g. how to redesign the business process and the organisational structure) to support this new strategy.

Activity 2.8 A research project

If you have the opportunity in an assignment or a project, you could identify:

- current main information systems used for the operational processes;
- trends and possible future changes with respect to IS use;
- the familiarity with and the relevance of ERP, KM, CRM and IOS systems.

You can obtain this information by interviewing different people, including users, managers and IS staff. Ask also about the degree of satisfaction with current IT use and familiarity with new IT and change.

2.7 Digital search and customer participation

We are now entering what some have called a digital culture, in which traditional boundaries between producers and consumers are eroding. Wikipedia (www.wikipedia.org), the online encyclopaedia written by volunteers, became in a few years the largest encyclopaedia in the world. YouTube (www.youtube.com), a site for video exchange, was taken over by Google 14 months after its foundation for $1.6billion. Second Life (http://secondlife.com), a virtual world of Linden Lab, has also received a lot of media coverage. These are examples of **user-generated content (UGC)** – electronic platforms that are created, maintained and developed by users.

This goes beyond new ways of using technology and has many legal, social, economic and business implications. **Wikinomics**, a term introduced by Tapscott and Williams (2006), refers to this changed business culture, which sees customers no longer as consumers but as co-creators and co-producers. Amazon and Google use this principle of **co-creation**. Amazon uses customer reviews to exchange information between readers and uses the buying patterns of customers to suggest books to others with similar interests. Google analyses search requests to develop profiles and make advertisements available to searchers with certain profiles. In both cases, customers create their own content and value, while increased use leads to multiplication of value. This principle is based on **Metcalfe's law**: 'the value of a network increases with the square of the number of users connected to the network'. In other words, the more people have phones, the more useful phones become. This 'network effect' leads to rapid adoption and creates barriers for new entrants. A network effect is a characteristic that causes a good or service to have a value to a potential customer which depends on the number of other customers who

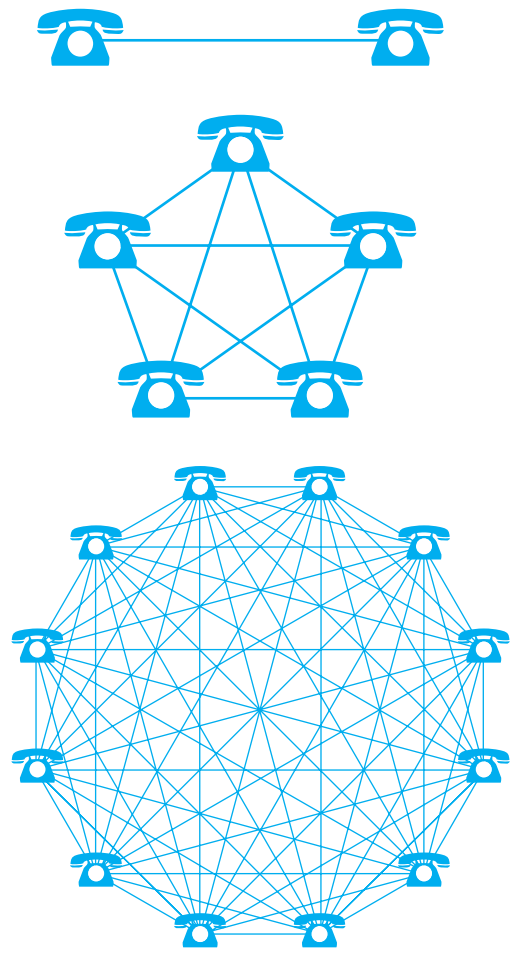


Figure 2.9 Illustration of the network effect and Metcalfe's law

Source: Metcalfe's law (26 March, 2008). Reproduced from *Wikipedia, The Free Encyclopedia*. Retrieved 14 April 2008 from http://en.wikipedia.org/w/index.php?title=Metcalfe%27s_law&oldid=201140098

own the good or are users of the service. In other words, the number of prior adopters is a term in the value available to the next adopter (see Figure 2.9).

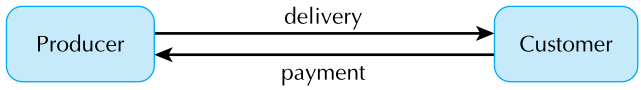
Open source initiatives, such as the development of Linux software (www.linux.org), is another example of this principle of creating value by sharing and interaction. Jenkins (2006) argues that digital technology plays an important role in the growth of a so-called 'participation culture', where people contribute actively to the development, production, consumption and assessment of products.

These new systems of producing digital products can be illustrated by the interaction model. In a traditional setting of production and consumption, producers create products or services that are ordered by and delivered to customers, who pay for that in return (see Figure 2.10a). The alternative way is that companies, such as Google, Wikipedia or Linux, provide a platform that customers use to retrieve information or software. By doing so they add to the value of the platform as more requests lead to better information and a better platform. Consumption does not lead to value reduction, but to value creation (Figure 2.10b).

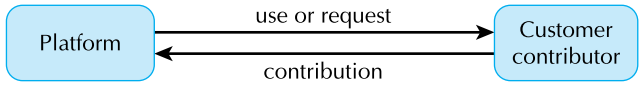
MIS in Practice **Social graphiti**

Mark Zuckerberg, 23 years old, recently announced that he was opening up Facebook, the social network he founded at Harvard University, to outside programmers. Anyone can now build little programs, or 'widgets', into the network. To illustrate his idea, Mr Zuckerberg projected on to the wall behind him a 'social graph', a pattern of nodes representing Facebook users and the links between them. Since then Facebook and the idea of the social graph have become the favourite conversation among venture capitalists and Internet investors. Mr Zuckerberg compares his graphing of human connections to the work of Renaissance mapmakers. Facebook is growing furiously and may catch up with MySpace, the biggest social network.

Source: *The Economist*, 20 October 2007.



(a) Traditional pattern of production and delivery of product or service, followed by payment by a customer.



(b) New pattern of consumption by customers, who also contribute to a platform, such as Wikipedia, Google or Linux.

Figure 2.10 **Traditional delivery versus customer participation**

Such alternative systems build on the assumption that the voluntary contributions of many contributors can create more value than the products of professionals. This principle can be used in various situations. A physician in the field of fertility treatments at the University Hospital Nijmegen, the Netherlands, spent a lot of time telling couples about the pros and cons of treatments and also provided emotional support. As an experiment he started an electronic chat platform that could be used exclusively by his clients to share information and emotions. The platform was also used for the provision of medical information on fertility treatments. From time to time, the doctor and other staff members also joined in the chat sessions. The 'electronic fertility platform' partially replaced the time spent on providing and supporting clients. Clients contributed anonymously to the platform, and these contributions helped others, who contributed in their turn.

There are successful platforms of customer participation and peer production working on both a profit and a not-for-profit basis. Amazon, Google and YouTube are for-profit peer production companies. Wikipedia, on the other hand, is a not-for-profit company that uses only a small staff to manage this concept. There are also many platforms that can be used by customers to share information on products and by doing so create market transparency and quality rankings that influence customer preferences. Organisations have to be aware of these developments and respond effectively, for instance by creating their own customer platforms or by contributing actively to other platforms.

Activity 2.9 Customer participation in various industries

- Choose an industry and find out how customers participate in and contribute to technology platforms. Possible industries are: financial services, education, government, consumer products, news and publishing, healthcare.
- Provide specific examples and reflect on the implications, the advantages but also the problems that may arise for companies within that industry.

MIS in Practice — New business models in the music industry

How can the music industry make money online? Record labels are following diverging strategies. Leading record makers, in particular, have long insisted that songs sold online should be wrapped in virtual envelopes that prevent fans from e-mailing them to friends or uploading them to a file sharing network. However, this system, called 'digital rights management' (DRM) software, is eroding and many record companies as well as retailers have started selling songs without software that prevents copying. Now record companies have to develop new business models that are profitable for music makers and the music industry.

Source: Based on 'Online Music: The slow death of digital rights', *The Economist*, 13 October 2007.

Organisational and management issues of customer participation

These developments raise new management questions for almost any company, about how it can use the ideas and experiences of its customers. Here are some examples.

- How can the company facilitate customers sharing their experiences with each other and with the developers, producers and sales staff?
- Is the organisation able to respond to these ideas and comments in adequate ways?
- Will customer participation and co-creation lead to new business models that may be hard to implement?

Summary

- Wikinomics refers to the change in business culture that sees customers no longer as consumers but also as co-creators and producers.
- Co-creation is based on Metcalfe's law (network effect), which says that the value of a network increases with the square of the number of users connected to the network.
- Platforms of customer participation and peer production can work effectively on a profit as well as on a non-profit basis.

Conclusions

Organisations have always depended on information systems to help conduct their business. Technological developments have greatly increased this dependence, as applications have moved from essentially background tasks to include foreground, customer-centred tasks. Most organisations depend heavily on computer-based information systems. For many, such systems are the basis of their business. Equally, most managers depend on accurate and timely information. We have outlined several perspectives on information systems and shown how some modern technological developments have increased the power and versatility of information systems.

The discussion has also emphasised that, while technology is central to modern information systems, it is only part of the story. Figure 1.4 showed that information systems include people and procedures as well as technology. Throughout the chapter we have shown that each perspective on information systems raises wider management and organisational issues. Smaller and more portable systems encourage changes in working arrangements. Advances in communication technology erode boundaries between functions and organisations. The capacity of the new technologies is such that they raise major questions of strategy – about the kind of business that a company is in (Chapter 4). Although the cost of the basic technology is falling, the cost of implementing new systems continues to rise. How can managers decide if the investment is worth the cost (Chapter 10)?

Looking inward, modern systems encourage companies to consider redesigning the processes through which they deliver their strategies (Chapter 5), with significant implications for the human side of organisations (Chapter 8). There are structural questions too – since information can flow more freely, it breaks down established boundaries (Chapter 6) and raises questions about the place of the information system's function itself in the organisation (Chapter 7). Finally, in Chapter 9 we examine many of the implementation issues that people have to manage in projects and programmes.

Chapter questions

1. Which functions of information systems are becoming more important? Explain your answer by giving examples.
2. Information systems are increasing their reach. What are the reasons for this and what are the consequences for businesses?
3. What are the advantages and disadvantages of local systems?
4. What are the main motives for organisations in implementing knowledge systems, enterprise systems, customer relationship management systems and inter-organisational systems?
5. What are the limitations and possible pitfalls of knowledge systems, enterprise systems, customer relationship management systems and inter-organisational systems?
6. How can organisations benefit from the popularity of search engines like Google? Can it also be a threat? What should be an appropriate management action to deal with the development towards customer participation?
7. Give an example of the use of the network effect in an organisation that you know.

Further reading

Chaffey, D. (2007) *E-business and E-commerce Management*, Financial Times/Prentice Hall, Harlow. A book that uses a wide range of informative case studies to cover the management issues raised by the Internet.

Gartner Group's website contains regular updates of developments in IS applications discussed in this chapter. Visit it at www.gartner.com.

Below are several empirical studies on the themes of the chapter:

Alavi, M. and Leidner, D.E. (2002) 'Knowledge management and knowledge management systems: conceptual foundations and research issues', *MIS Quarterly*, **25**(1), 107–36. Accessible introduction to knowledge management from an IS perspective.

McGinnis, T.C. and Huang, Z. (2007) 'Rethinking ERP success: a new perspective from knowledge management and continuous improvement', *Information & Management*, **44**(7), 626–34. A study of the relation between ERP and knowledge management.

Rigby, D.K., Reichheld, F.F. and Schefter, P. (2002) 'Avoid the four perils of CRM', *Harvard Business Review*, **80**(2), 101–9. Discusses the pros and cons of CRM and the pitfalls of relationship management systems.

Voelpel, S.C., Dous, M. and Davenport, T.H. (2005) 'Five steps to creating a global knowledge-sharing system: Siemens' Sharenet', *Academy of Management Review*, **19**(2), 9–23. Gives more information on the chapter case.