1 The Evolving Role of Information Systems and Technology in Organizations: A Strategic Perspective

OUTLINE

Most organizations in all sectors of industry, commerce, not-for-profit, and government are now fundamentally dependent on their information systems (IS) and information technology (IT). In industries such as telecommunications, media, entertainment, gambling and financial services, where the product is already, or is being increasingly, digitized, the very existence of an organization depends on the effective application of IS/IT. With the commercialization of the Internet, the use of technology has become the expected way of conducting many aspects of business and some businesses exist purely online. Governments and public administrations have launched many digital services. The ubiquity of mobile devices and new forms of social media are raising consumer demands for immediacy of access and speed of response. The increasing pervasiveness of smart connected devices and 'things' of all kinds is opening up opportunities for new products and services, further operational efficiencies and new types of businesses and business models.

While organizations want to develop a more 'strategic' approach to harnessing and exploiting IS/IT, most have arrived at their current situation as a result of many short-term, 'tactical' decisions. Many would no doubt like to rethink their investments, or even begin again with a 'clean sheet', but unfortunately have a 'legacy' resulting from a less than strategic approach to IS/IT in the past; many organizations including banks, insurance companies and public administrations

still depend on systems first developed over 30 years ago. Even investments that were once seen as 'strategic' eventually become part of a costly and complex legacy. Learning from previous experience – the successes and failures of the past – is perhaps one of the most important aspects of strategic management. Much of the learning about the capability of IT is experiential, and organizations tend to learn to manage IS/IT by doing, not appreciating the challenges until they have faced them.

However, few organizations are likely to have been exposed to the whole range of IS/IT experiences; nor is it likely that those experiences have been evaluated objectively. This chapter provides an overview and appraisal of the general evolution of IS/IT in organizations, from which lessons can be learned for its future strategic management. This evolution is considered from a number of viewpoints, using a variety of models, some of which are further developed and used later in the book, when considering the particular approaches required in thinking and planning strategically for IS/IT investments.

A number of forces affect the pace and effectiveness of progress in using IS/IT and in delivering operational and strategic benefits. The relative importance of each factor varies over time, and will also vary from one organization to another. These factors include:

- the capabilities of the technology and the applications that are feasible;
- the economics of acquiring, deploying and maintaining the technology: applications, services and infrastructure;
- the skills and abilities available, either in-house or from external sources, to design and implement the applications;
- the skills and abilities within the organization to use the applications and information;
- the capability to manage any organizational changes accompanying technology deployments;
- the pressures on the particular organization or its industry to improve performance or adapt to changing circumstances, such as a new regulatory environment or 'digital disruption'.

This list is not meant to be exhaustive and could be expressed in other terms – but it is in a deliberate sequence of increasing 'stress', as the complexity and criticality of management decision making becomes more strategic. Most assessments of the evolution of IS/IT in organizations tend to focus on one or two aspects of its development, such as organizational, applications, management of technology or planning, but in this chapter these various perspectives will be brought together, as much as possible.

Information Systems (IS), Information Technology (IT) and 'Digital'

Before considering a strategic perspective, it is important to have a clear understanding of the terms information systems (IS) and information technology (IT) and how they are distinguished. While IS and IT are often used interchangeably or even casually, it is important to differentiate between them to create a meaningful dialogue between business staff and IS/IT specialists; this is essential if successful IS/IT strategies are to be developed. Recently the term 'digital' is being used more frequently in many organizations and in the practitioner and academic literature[1] – so how digital relates to IS/IT is also important to recognize.

Information systems (IS) existed in organizations long before the advent of information technology (IT) and, even today, there are still many 'systems' present in organizations with technology nowhere in sight. *IT* refers specifically to technology, essentially hardware, software and telecommunications networks, including devices of all kinds: computers, sensors, cables, satellites, servers, routers, PCs, phones, tablets; and all types of software: operating systems, data management, enterprise and social applications and personal productivity tools. IT facilitates the acquisition and collection, processing, storing, delivery, sharing and presentation of information and other digital content, such as video and voice. Sometimes the term Information and Communication Technologies (ICT) is used instead of IT to recognize the convergence of traditional computer technology and telecommunications.

Information systems (*IS*) are the means by which people and organizations, increasingly utilizing technology, gather, process, store, use and disseminate information.[2] The domain of interest for IS researchers includes the study of theories and practices related to the social and technological phenomena which determine the development, use and effects of information systems in organizations and society. It is thus concerned with the purposeful utilization of information technology, not the technology *per se*. IS is part of the wider domain of human language, cognition, behaviour and communication. Consequently, 'IS will remain in a state of continual development and change in response both to technological innovation and to its mutual interaction with human society as a whole.'[3]

Some information systems are totally automated by IT. For example, airlines, comparison websites, banks and some public agencies have systems where no human intervention is required.[4] Dell went further with its 'build-to-order' model for its PCs, including an element of 'intelligence' to help the customer in making decisions regarding the configuration of components, ensuring that 'non-optimal' configurations or configurations not technically possible are not selected. Once a customer order has been confirmed, purchase orders for components are automatically generated and electronically transmitted to suppliers. This enables Dell to achieve a stock turn of 30.7 times per year (competitor Lenovo has a stock turn of 22.2).[5] Dell also feeds real-time data from technical support and manufacturing lines directly through to suppliers on a minute-by-minute basis. This 'suite' of interconnected information systems is underpinned by a variety of different technologies – servers, storage, software, routers, sensors and networks.

People can find it difficult distinguishing between IS and IT because the technology (the T of IT) seems to overwhelm their thinking, obscuring the business information system that the technology is intended to support or enable.[6] This perhaps also gives a clue as to why organizations may fail to realize benefits from many of their investments in IT. Technology investments are often made without understanding or identifying the business benefits that could or should result from improving the performance of activities by using IT. We have even heard stories recounted of senior executives returning from business trips abroad, demanding that a new technology be purchased or a new application be implemented because they have seen an advertisement in an airline's in-flight magazine! It is important to acknowledge that IT has no inherent value – the mere purchase of IT does not confer any benefits on the organization; these benefits must be unlocked,[7] normally by making changes to the way business is conducted, how the organization operates or how people work.[8] Achieving organizational change on any scale can be difficult, even without the introduction of new technology.

Another term that is frequently used along with IS and IT is *application*, i.e. an application of IT to handle information in some way. Essentially, an application refers to software, or a combination of software and hardware, used to address or enable a business or personal activity: for example, in businesses for general accounting, production scheduling, patient administration, customer order management or enabling collaborative working; or for an individual to book theatre tickets, check in for a flight or pay for parking. Other examples include general uses of hardware and software to carry out tasks such as word processing, email, preparing presentation materials or conducting online meetings. They are usually large, general-purpose programs that can do many different things, built on top of operating systems.

These applications can be purchased, pre-written software programs for a particular business activity or developed 'in-house' to provide particular functionality. Many applications for personal productivity as well as business use are now delivered via mobile devices of all kinds and increasingly they are being provisioned from the cloud (see Box 1.1 for an overview of cloud computing). Some business application software packages can be tailored or customized to the specific requirements of an organization. One of the key selling points of large Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) software suites is that they can be configured, to some extent, to meet the specific way in which an organization operates.[9]

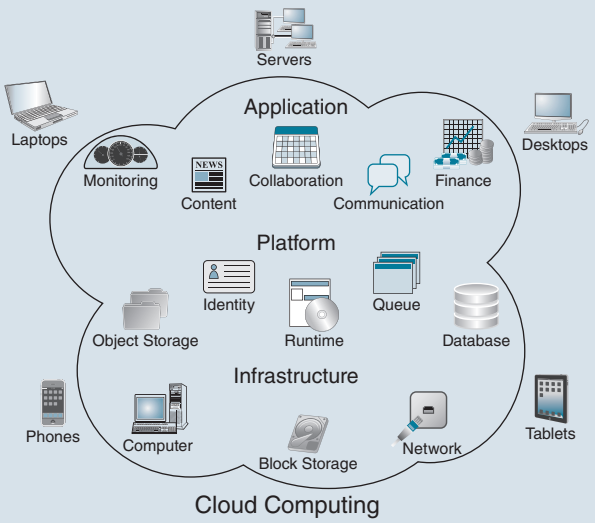
BOX 1.1

An introduction to cloud computing

Software has evolved from custom-coded, proprietary applications to pre-packaged or off-the-shelf applications and now to the development of Internet-centric applications. The convergence of software and IT infrastructure to an Internet-centric environment has enabled the concept of cloud computing to emerge. In its simplest form, a cloud provider is a third-party service firm that deploys, manages and remotely hosts a pre-packaged software application through centrally located servers in a 'rental', lease or 'pay-as-you-go' arrangement. In exchange for accessing the application, the client renders rental-like payments (see the following figure). An early example of a cloud-based service, although it wasn't referred to as such at the time it was launched, is Hotmail (www.hotmail.com), which provides an email address with storage and access from any browser. Individuals with a Hotmail account can access their email and send email from any location as long as they are connected to the Internet.

No matter how the cloud provider is structured, the ultimate objective is a 'seamless' service, in which the client interacts only with the cloud. The most significant elements of a 'seamless' integration of services include providing the hardware and software, integration and testing, a secure network infrastructure, reliable mission-critical data centre facilities and a highly qualified team of IT experts managing the entire solution. The primary categories of cloud services provided to date are:

- Applications provisioning – essentially providing an information handling capability, either through proprietary applications such as property management, specialized healthcare patient record keeping



Schematic of cloud computing. (Source: Sam Johnston, 3 March 2009, CC BY-SA 3.0)

or analytical/mathematical services, or widely used software packages from the leading ERP and CRM vendors. This is often referred to as Software as a Service (SaaS).

- Infrastructure operations – which can include provisioning the customer's desktop environment, as well as operating data centres to host the applications. Data centre operations include the full range of hardware/systems software management, provisioning services, security and disaster recovery as well as the necessary back-office systems such as service usage, monitoring, accounting and billing. This is often referred to as Infrastructure as a Service (IaaS).
- A computing platform – typically including an operating system, programming language execution environment, database, and web server. Application developers can then develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers. This is known as Platform as a Service (PaaS). Some PaaS providers like Microsoft Azure and Google App Engine offer underlying computer and storage resources that scale automatically to match application demand so that the cloud user does not have to allocate resources manually.
- Network connectivity – providing connections to the Internet for end-customers or the application provider (essentially acting like an Internet service provider (ISP)). Reliability, performance and security of network communications are potentially weak links in the chain.
- Supporting services – providing hardware installation and maintenance services at customer sites or end-to-end management services for all aspects of implementation and operations across the entire cloud delivery chain for the duration of the service contract.

Services are accessed, via the Internet or a private network, without having to pay for the installation, the hardware or the software. Price per user per month (PUPM) has emerged as the standard pricing method for cloud services. The roots of this model stem directly from user-based licence pricing for applications and the PUPM model allows providers to manage pricing based on numbers of users as well as by categories of users. User categories include designations such as 'power user' or 'inquiry or casual user', which refer to

access privileges and functionality. Cloud service models are seen as:

- Reducing 'costs of ownership'. Although costs and service levels vary widely according to the types of service provided, studies have indicated that by renting an application from the cloud, a company can save between 30% and 60% over purchasing and managing the hardware and software for the application themselves.
- Shifting IT spend from capital expenditure (CapEx) to operating expenditure (OpEx) and providing more predictable costs with less financial risk. Pay-as-you-go pricing takes the economic burden of buying software and attendant hardware and transfers it to the cloud.
- Flexibility to exit or radically change operating scale. Cloud contracts are typically for one year with minimal or no exit fees. Many clouds represent multiple software package vendors, and clients are generally free to add or change services as needed.
- Quicker deployment of new applications and IT capabilities. There can be a significant reduction in the overall cycle time to put a new information system into productive operation.

Despite all the hype around the cloud, 90% or more of what is deployed today are really private clouds – in-house data centres taking advantage of cloud technologies – rather than services provisioned from a public cloud. To date, most deployments of cloud computing are for infrastructure while applications tend to be point-to-point solutions for business areas such as sales force automation and human resource management.

With the emergence of smartphones and tablets, the concept of 'an app' has entered the lexicon and it is usually seen as differing from an application.[10] In general, an app is designed for a single purpose, i.e. it has one piece of functionality, not as a means to an end but an end in itself. An application, on the other hand, may handle a wide variety of functions. Many of the standard apps on a smartphone are small bits of what a web browser can do: stock quotes, maps, YouTube, weather, messaging. Google.com is an app; the one function it performs is search, and it provides a highly usable interface for that function. And, of course, Google's search app is delivered through desktops, laptops, phones and tablets. Enterprise applications from Oracle, SAP, Workday and Salesforce and most internally developed software applications contain a larger number of capabilities packed into a single program or suite of programs.

In recent years, 'digital' has been gaining attention, with the label being increasingly used. Many consultancies and IT vendors are now promoting their wares under the label of 'digital disruption', 'digital transformation' or the 'digital enterprise'. Governments have relabelled e-government as 'digital government'.[11] Organizations of all types are looking to build 'digital strategies' or 'digital business strategies'. We have even encountered one company where they refer to their digital strategy as social media, mobile devices, analytics and cloud computing (so-called SMAC); everything else is seen as IT! In our parlance, these are all IT. The challenge is figuring out the purpose for which these are going to be used by the organization.

In this book we are using the label 'digital' to embrace both IS and IT. For us, digital has both an IS component and an IT component. We emphasize that in building a digital strategy it is imperative to understand how information and systems (IS) will be leveraged and used as well as the underpinning technological (IT) capabilities that will be required.

'Digital Disruption': The Impact of IS/IT

Disruption caused by IS/IT actually began many decades ago when it was known at the time as 'business transformation' or 'business process re-engineering'. Today's focus on 'big data' and analytics is another iteration of the promised 'information revolution' that was predicted in the late 1970s, became more feasible in the 1990s with the arrival of Data Warehousing and OnLine Application Processing (OLAP) tools, but as yet has been more a data deluge for many organizations rather than the source of strategic opportunities. Indeed, back in 1985, Porter and Millar wrote a seminal article titled 'How information gives you a competitive advantage' with prescriptions that still resonate today.[12] Microsoft founder Bill Gates noted:

> "I have a simple but strong belief. The most meaningful way to differentiate your company from your competition, the best way to put distance between you and the crowd, is to do an outstanding job with information. How you gather, manage, and use information will determine whether you win or lose.[13]"

However, many still struggle with this quest.

Despite the irritating 'relabelling' habit of the IT industry, advances in IT continue to challenge established, even dominant, views about organizations and organizing, markets and competition.

Digital Disruption of Organizations

For some decades now, technology has been undermining the very logic of the organization, particularly those that are vertically integrated.[14] Nobel economist Ronald Coase, in his seminal 1937 article 'The Nature of the Firm',[15] argued that organizations were created because the 'transaction costs' of doing business in the open market were too great for complex enterprises, like building railroads, manufacturing cars or creating telephone networks. Large, vertically integrated companies were established to reduce these transaction costs. Coase's work was later extended by Oliver Williamson with his transaction cost economics.[16]

A transaction cost is incurred in making an economic exchange, i.e. the cost of participating in a market. Information is at its core. Transaction costs include search and information costs such as: those incurred in determining that the required good or service is available on the market, which provider has the lowest price etc.; bargaining costs required to come to an acceptable agreement with the other party to the transaction; drawing up an appropriate contract; and policing and enforcement costs to make sure the other party sticks to the terms of the contract, and taking appropriate action if necessary.[17] Many economists argue that the value of organizing (and therefore organizations) is based on the principle of exploiting information asymmetries (i.e. specialization), culminating in thinking of organizations as knowledge 'engines' or 'information processors' operating in a knowledge economy.[18]

But since the commercialization of the Internet and the accelerated shift online, all these transaction costs have plummeted[19] as technology made it easier to search for information and transact with workers, suppliers and customers. Companies can focus on their so-called core competences and outsource or buy in others.[20]

For example, through automated supply chains, information sharing and transparency, manufacturers no longer have to hold raw material stocks 'just in case' a supplier has production or logistics problems. By providing visibility, suppliers essentially become an extension of the manufacturer.

Work by Shapiro and Varian has highlighted the difference between 'physical goods' and 'information goods' in the digital world and the profound implications of those differences for strategy.[21] One critically defining attribute is that the market value of information goods is derived from the information they contain. So an immediate stock price is likely to be more valuable to a trader than a family photo, even though the latter will be larger in terms of bytes. Other core distinguishing features of information goods are listed in Box 1.2.

BOX 1.2
Distinguishing features of information goods

Information goods are *experience goods*; that is, the customer has to experience them in order to value them. How do you know the value of a newspaper until you have read it? Or whether you like a piece of music until you have listened to it? Or the usefulness of a report until you have read it? Therefore customer choice decisions are influenced by emotional expectations rather than cognitive product attributes. Informational inputs such as critics' reviews, word of mouth and advertising, as well as latent product interest, are also important determinants of consumer choice.[a]

The lack of tangible cues for the customer to assess the quality of information products poses particular problems for their marketing. A way around this problem is to distribute samples or previews of parts of the information product for free. Building a brand and reputation, which provide some sort of guarantee that the content will have a certain quality or profile, also becomes a critical activity. For example, Gartner Group conducts research in the IT industry and makes it available to its membership, who pay a subscription to have access to their analysis and reports. Prospects can browse its website to get samples of the information products it sells. Gartner has established a strong brand that sees chief information officers (CIOs) from many of the world's largest corporations look to it for advice and trends in the technology area.

Information products are *non-rivalrous*, in an economic sense. That is, one person's consumption does not diminish the amount available to others. Reading a report, for example, does not mean that the information it contains is now not available to others. In fact, any number of people can read the same report at the same time. And, unlike a traditional physical asset, it does not depreciate through usage. This is why the issue of transfer of ownership becomes complex. The seller of an information product still retains the valuable information, no matter how many people it is sold to. However, by becoming widely available its value may reduce; scarcity often means that a higher price can be extracted for particular information. On the other hand, the opposite situation may also be true; it is only when an information product has become widely known (e.g. a book or a movie), or there are a sufficient number of other compatible information products available on the market, that the information product reaches a critical mass and thus has a greater value to the users (e.g. Facebook or MS Windows). This is the network effect, and it can be particularly powerful for digital information products because of their ease of distribution.[b]

Finally, information products have a *different cost structure* than physical products. Traditional financial models are built upon cost. The initial cost of creating

the first copy of an information product can be very high, but the marginal cost is generally very low, with perfect fidelity (no quality loss). With information goods, reproduction costs are next to nothing, as are distribution costs. Nor are there any capacity limitations for production and distribution. This means that traditional economic pricing models, calculated by using fixed cost divided by number of products plus marginal cost, are inapplicable. When the initial cost for a certain number of producers is sunk, the competitive forces tend to force price towards the marginal cost – which in the case of information goods is close to zero. The implication is that it is very difficult to make money from undifferentiated information goods, a lesson that many pure-play Internet start-ups found to their peril.

Notes:

[a] R. Neelamegham, and D. Jain, 'Consumer choice process for experience goods: an econometric model and analysis' *Journal of Marketing Research*, XXXVI, 1999, 373–386.

[b] B. Arthur, *Increasing Returns and Path Dependence in the Economy*, University of Michigan Press, Ann Arbor, 1994.

Other organizational models are emerging that are a synthesis of firms and markets – often called 'platform' companies. Uber (the online taxi organization) is one example – it is already a big, global company and growing larger by shaping and creating a new marketplace. Platform companies have been gathering momentum, both in terms of numbers and market shares, for the past two decades: for example, the online retail and auction markets created by Amazon and eBay, the information and media marketplaces created by Google and Facebook, or the music and app markets built by Apple. More recently these new hybrids have extended into human resources, with services like Freelancer, TaskRabbit and WorkFusion, and even to clean energy, at companies like Sungevity. The growth rates of these platform businesses are often phenomenal and they are redefining some of the boundaries of other firms. Platform and network effects, and the economics of networks, are more important now than before and both drive the adoption of IS/IT and are enabled by IS/IT.[22]

The changes can also be seen at older, more established industrial companies. The process of innovation at many firms has changed in recent decades. Traditionally the whole model for innovation was internal but now, between government funding for R&D, collaboration with small companies, joint ventures and crowdsourcing ideas using Internet sites like Innocentive, it is often very different. Companies now have to work out how to innovate in an open and collaborative environment.

Digital Disruption of Industries

While no industry is immune to the impact of IT, some have been more affected than others.[23] Gambling and real estate, for example, have largely moved from the physical to the virtual world, making it no longer necessary to have a physical presence to compete.[24] IT also accelerates the speed of disruption. With its iTunes store, it took Apple only five years to become America's largest music retailer, and just seven to become the world's largest. In 18 short months, search engine Google erased 85% of the market capitalization of Garmin and TomTom after launching its mobile maps app. Alibaba, China's equivalent to Amazon, became China's largest seller of money market funds in only seven months. Six years after it came into existence, Airbnb had more rooms available than IHG or Hilton, the world's top hotel groups. As technology puts new tools into innovators' hands, the old boundaries between sectors

are breaking down. Amazon has transformed bookselling, branched out into general retail and is now experimenting with delivery by drones (and apparently considering opening retail outlets!).

For retailers, technology advances in mobile computing and augmented reality are blurring the boundaries between traditional and online retailing, enabling them to interact with consumers through multiple touch points and expose them to a rich blend of off-line sensory information and online content. As the industry evolves towards a seamless 'omnichannel retailing' experience, the distinctions between physical and online are likely to disappear.[25]

As banks recover from the economic downturn, non-banks are taking advantage by proceeding aggressively with digital innovations and capturing more and more of the banking value chain. Payments, a source of up to 25% of traditional bank revenues, are one of the most contested areas. PayPal is now the number one online payment method in some countries, and start-up companies like Square and Stripe are earning multi-billion dollar valuations. Apple has launched Apple Pay, which lets customers pay in hundreds of thousands of stores accepting contactless payments. Retailers are also moving in as well: nearly one-third of Starbucks' US revenues are paid through its own loyalty cards and Google recently introduced a plastic debit card for its Google Wallet. Technology giants, telcos and retailers have a long way to go to compete against banks product for product and service for service, and many believe that regulatory barriers will dampen disruption. But new entrants already pose a threat to banks by raising service expectations and creating distance between banks and their customers. The risk for banks is that new competitors will consign them to a limited role as back-office utilities, while non-banks become the new face of their customers' financial lives.

New business models that are being shaped by the capabilities of new technology are also disrupting industries; in particular, harnessing information to deliver new value propositions to customers. Gambling exchanges like Betaq and Betfair offer a means for consumers to negotiate bets (and set odds) directly with other consumers and disintermediate traditional betting shops. Rolls-Royce, for example, like many manufacturers, has moved away from selling products to selling services.[26] Its value proposition is based on the availability of an engine rather than the sale of an actual engine. To deliver this service requires a significant application of IS/IT. Every engine has an Engine Monitoring Unit where sensors collect data on the 'health' of the engine, which is transmitted, in real time, via satellite to an engine monitoring centre in Derby. There engineers, using both diagnostic and prognostic tools as well as advanced analytics, determine the health of the engine and make maintenance decisions about not only individual engines but a fleet of engines to maximize availability for the airline customer.

This instrumenting of physical products, assets and all 'things' physical has led to the emergence of the so-called Internet of Things (see Box 1.3).[27] These smart, connected machines are generating prodigious amounts of data. Gas and oil companies, for example, are looking to harness data collected from off-shore platforms to reduce unplanned downtime.[28] Other companies are now seeking to capitalize on all this data and create innovative business models and new value propositions for customers. For example, power generation corporations, energy retail companies, domestic appliance manufacturers, heating companies and even Google and Apple are now vying to carve out leadership positions for 'smart homes'.

Governments are also making data available for external parties to leverage.[29] So-called 'open data' initiatives have seen new services being offered to citizens

BOX 1.3

The Internet of Things

The Internet of Things (IoT) is the global network of physical objects or 'things' embedded with electronics, software, sensors and connectivity to enable it to achieve greater value and service by exchanging data with the manufacturer, operator and/or other connected devices.[a] Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Typically, IoT is expected to offer advanced connectivity of devices, systems and services that goes beyond machine-to-machine communication and covers a variety of protocols, domains and applications. The interconnection of these embedded devices (including smart objects) is expected to usher in automation in nearly all fields, while also enabling advanced applications like a Smart Grid for energy providers.

'Things' can refer to a wide variety of devices such as heart monitoring implants, biochip transponders on farm animals, cars with built-in sensors, or field operation devices that assist firefighters in search and rescue. These devices collect data with the help of various sensor technologies and other miniaturized computer devices and then autonomously flow the data between other devices. Current market examples include smart thermostat systems, security alarms and washer/dryers that utilize WiFi for remote operation and monitoring. In manufacturing, the focus is on automating inventory management, real-time monitoring and controlling of machine operations.[b]

Besides the plethora of potential new application areas for Internet connected automation, the IoT is expected to generate large amounts of data from diverse locations, aggregated at a very high velocity, thereby increasing the need to better index, store and process such data.

Notes:

[a] GE refer to the IoT as the Industrial Internet. See P.C. Evans and M. Annunziata, Industrial Internet: *Pushing the Boundaries of Minds and Machines*, GE, November 26, 2012.

[b] In Germany, this is referred to as Industry 4.0. See M. Russmann, M. Lorenz, P. Gerbert, M. Waldner, J. Justus, P. Engel and M. Harnish, *Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries*, BCG, April 2015.

based on apps that use this public data.[30] To spur citizen creativity and practical applications, Data.gov,[31] the data portal of the US government, makes available data from agencies such as the US Census Bureau, the Centers for Disease Control, the Environmental Protection Agency and the Department of Interior, without focusing on specific 'customer' needs. Trafikverket, the transportation agency in Sweden, publishes real-time data on train departure and expected arrival times and track numbers for all trains travelling through the country. Third parties have used these data to create applications that allow travellers and shippers to make better informed decisions on travel modes and routes.

The Characteristics of Digital Disruption

There seem to be a number of fundamental pillars that characterize digital disruption and the shifts that those building the IS/IT strategy must be aware of (see Figure 1.1).[32]

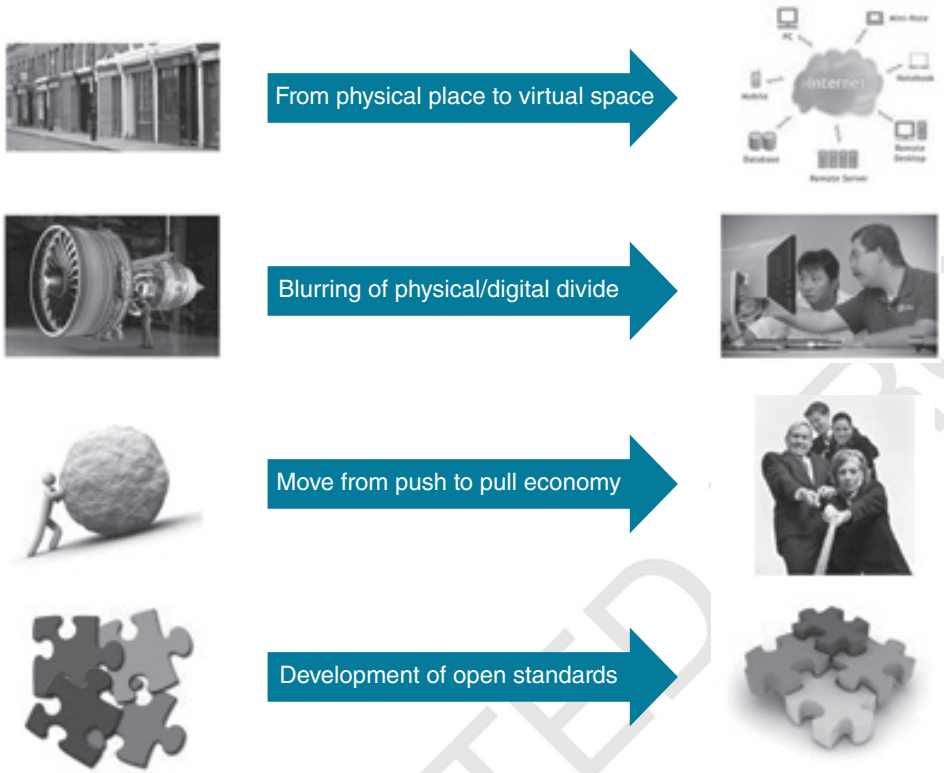


FIGURE 1.1 The pillars of digitization.

From marketplace to marketspace With the opening up of the Internet for commercial activity over 25 years ago, business has been steadily moving from being conducted in the physical marketplace to the virtual marketspace.[33] This online environment has a number of distinctive features. First, it is pervasive, directly reaching end-customers, facilitating the conduct of business directly with them. Second, the trade-off between richness (the degree to which a firm can facilitate the exchange of information to deliver products/services that match customers' exact wants) and reach (the degree to which a firm can manage its activities to connect its customers) made in the physical world does not apply in an online environment.[34] Third, it is interactive, which is of crucial importance as much business and public sector activity consists of interactions: human and machine-to-machine (M2M) communication, data gathering, collaborative problem solving and negotiation.[35] It is these interactions that generate the majority of transaction costs, as discussed earlier. This is a transformation in much of business activity – moving from a physical place with fixed locations, inventories and products to an information-defined 'virtual' transaction space.

This shift ranges from basic business transactions such as ordering and invoicing to utilizing sophisticated business-to-business (B2B) exchanges and electronic marketplaces[36] that bring together industry players in a neutral market setting. This has implications for organizations' brands, for understanding trust, product and service pricing, issues of location, collaborative ventures and, as is becoming an increasingly hot topic for governments, collecting duties and taxes.[37]

However, the absence of physical and tangible artefacts in this information-defined space can have significant implications for consumer behaviour: their absence has implications for trust, for building brands and for establishing customer relationships. For example, one of the principal reasons that many pure-play Internet banks failed was the lack of trust that existed between the online venture and customers. Confidentiality and security are key components of trust.[38] Traditional banks with large imposing branches and staff, apparently managing your account, contribute to the creation of trust. Online such cues are absent, which has resulted in many people being reluctant to deposit their money with such virtual institutions. Contrast this with the relative success of online brokerages where an 'intelligent' customer base, trading process and the dematerialization of the product over many years made them more suited to new start-ups. Researchers in consumer behaviour have found that consumers recognize differences in size and reputations among Internet stores, which influence their assessment of store trustworthiness and hence their willingness to shop with a particular store.[39] A customer who believes that there is a physical store behind a website is more likely to trust the site on first encounter,[40] although younger customers who know nothing but online do not have such constraints.

Online retailers also contribute to a phenomenon known as the long tail.[41] In the physical world, retailer have limited space and will carry only content that can generate sufficient demand to earn its keep. Stores can pull in customers only from a limited local population – perhaps a 15 kilometre radius for a typical cinema, less than that for music and bookstores. The online world does not have such constraints. Consequently, products in low demand or that have a low sales volume can collectively make up a market share that rivals or exceeds the relatively few current bestsellers and blockbusters, if the store or distribution channel is large enough.[42] A significant portion of Amazon.com's sales comes from obscure books not available in brick-and-mortar stores.[43] These sales are often helped by its recommendation engine: 'readers who liked this book also liked this one'. The long tail is a potential market and, as the examples illustrate, the distribution and sales channel opportunities created by the Internet often enable businesses to tap that market successfully. The long tail has grown longer over time, with niche books accounting for a larger share of total sales for many retailers.

Also the advent of massive new datasets and the spread of mobile devices mean that services can now be personalized cost-effectively to a much higher degree.[44] A large credit-card provider, for example, partners with retailers to create personalized, real-time discounts for products and services through a mobile app. The app generates offers by matching customers' locations (determined from their smartphones) to products and services that should appeal to them, given their purchasing habits and preferences. The credit-card company also works with social media players to draw on the preferences of participating customers, using 'likes' and other markers to refine its offers. The initiative helps the company to strengthen its relationships with merchants and serve them better, while also staying relevant to (usually) younger, digitally savvy customers.

Blurring of physical/digital divide Physical products are becoming increasingly digitized, blurring the traditional distinction between physical and virtual products. For example, the engineers at Rolls-Royce previously had to take an engine 'off wing' to inspect it: the inspection task in the physical world was all about collecting data and information in order to be in a position to make maintenance decisions.

Even some of this decision making has been automated using prognostic and diagnostic software, whilst the advanced analytical tools augment the knowledge, experience and capabilities of the engineers.

In the business-to-consumer (B2C) markets, Nest (acquired by Google) uses machine-to-machine (M2M) connectivity to link its smart thermostats to other home devices, including washing machines and personal-fitness bands, thus positioning the company as providing the network hub in a digitally connected home. The prevalence of connected devices opens up possibilities for proactive, remote or 'touchless' servicing and new business models quite unlike traditional 'fee-for-service'.

Move from push to pull economy As products, buildings, roads and assets of all types are 'instrumented' and able to gather data on their 'health', and become ever more connected, machine intelligence will be able to make decisions, or at least suggest answers, for us. The modern car, for example, with its inbuilt diagnostic software, can detect when a component needs to be replaced or a maintenance service is required and thus can automatically book an appointment with a garage. The garage will 'know' what components need replacement and can order them from the manufacturer, scheduling them to be delivered when the car arrives at the garage. This data can also be very useful to manufacturers in designing the next generation of components.

Using analytics, retail organizations in particular are trying to predict which customers are likely to demand particular products and services. Rather than waiting for an approach from the customer, they seek to be proactive, even influencing their demand. Garanti, for example, one of Turkey's largest banks, offers a free mobile app that gives customers personalized offers and advice based on their location and past spending. It uses GPS and Foursquare to tell them if they are close to a store with a special offer, provide saving suggestions, and to estimate how much customers will have in their account for the rest of the month based on past spending.

Development of open standards An important lesson from past experiences in the technology world is that adoption and innovation are accelerated by open standards, which make the interchange and flow of data both easy to achieve technically and seamless to users. While establishing proprietary standards, where equipment and software from one vendor would not interconnect easily with another, was once a competitive strategy seen as building customer 'lock-in', customer backlash and the negative impact on overall industry growth have confined it to some niche areas. Even competitors are more likely to work together to develop standards for interconnection as they recognize that they too can benefit with market expansion – the so-called network effects.

It is against this backdrop of a rapidly changing, complex and volatile environment that managers have to decide what investments to make in IS/IT. Some decisions may see IT deployed to improve organizational efficiencies by reducing transaction costs. Other investments might be made to make it easier for customers to transact business. Some IS/IT spend might enable a new value proposition, suggesting a new business model. At the same time, getting the IS/IT investment decision wrong can have serious implications; there are examples of companies that have ceased trading as a result of bad IS/IT decisions. As we will see later in the book, IS/IT can also hardwire a company, framing what it can and cannot do, severely limiting its strategic options. But let us first look at the ways IS/IT use in organizations has evolved.

A Three-era Model of Evolving IT Application in Organizations

The evolution of the role of information systems and technology in organizations can be described as encompassing three eras. The first early investments in IT – traditionally known as the Data Processing (DP) era – were concerned with automating manual information processes using computers. Later, the concern was about providing information from operations for managerial decision making – the so-called Management Information Systems (MIS) era. In the early 1980s a third era began and continues today – it is often called the Strategic Information Systems (SIS) era – which refers to the search for opportunities to create or achieve strategic advantages from IS/IT.

Although it is tempting to simplify nearly 60 years of often-haphazard, uncertain progress with the benefit of hindsight into three, albeit overlapping, eras, it must be remembered that it is never that simple. However, while the 'three eras' view is easy to criticize as being over-simplistic, it has proved popular with many IS/IT theorists, researchers and practitioners, resulting in some useful analyses from which valuable insights and conclusions can be drawn. It is first worth clarifying the fundamental differences and interdependencies of the three eras.

The prime objective of using IS/IT in the eras differs:

- Data Processing (DP): *to improve operational efficiency* by automating information flows and processes (often referred to as digitizing processes today).
- Management Information Systems (MIS): *to increase management effectiveness* by satisfying their information requirements for decision making.
- Strategic Information Systems (SIS): *to improve competitiveness* by changing the nature or conduct of business (i.e. IS/IT investments can be a source of strategic advantage).

The objectives of DP and MIS are, strictly speaking, a subset of the SIS objective – to improve competitiveness, but this tends to be achieved indirectly by using IS/IT to improve current business processes and practices. While the SIS objective is more immediately related to the business, achieving the DP and MIS objectives can contribute considerably to business success, and further improvements are always possible as IT capabilities are extended and costs decrease. Although the DP label has long disappeared, the ever-improving economics have enabled the technology to extend the automation of processes to those involving documents, images and voice. So, too, with MIS: a combination of improved economics, more powerful processing capability, sophisticated analytics software and the greater availability of external data enables the collection, analysis and presentation of information to be more comprehensive and useful. This is not to suggest that it is easy and many challenges remain.

This arrival of so-called 'big data' has shifted the emphasis away from information enquiry and presentation, the focus of MIS, to knowledge discovery. While MIS can sometimes aid with new knowledge discovery or 'insights', this is not their primary objective. While the decision support systems (DSS)[45] of the 1970s represented the forerunner of advanced analytical tools, today's technology is more powerful and when coupled with machine learning technologies, the knowledge discovery process can be significantly enhanced. Previously unseen patterns, correlations and relationships can be surfaced, which can lead to novel insights about, for example,

customers, processes and product performance. However, it must be remembered that people, not technology, make sense of any patterns and give meaning to information; business intelligence resides in the minds of managers and professionals, not in the data warehouse.[46]

Moreover, to be of value, any new knowledge has to be acted upon. Some well-defined decisions and decision-making processes can be automated using a combination of workflow and rules engines so that, *if* a certain event, condition or situation occurs, *then* some specific action is taken. However, the types of decisions that the use of analytical tools mainly support have to be consciously made by people. For example, interrogating customer data from internal operational systems and external sources revealing a pattern explaining why customers defect, still needs managerial action to be taken about how best to correct the causes of the problem. Such applications seek to augment human cognitive processes. Figure 1.2 illustrates the relationships between DP, MIS, analytics and SIS. The role of big data and analytics in innovation leading to strategic advantages is explored in depth in Chapter 5.

We can describe the relationship between the three eras and the evolving application objectives as follows:

- Just as good MIS systems rely on comprehensive, operational DP systems for accurate and timely information, SIS (such as those linking the company directly to its customers via the Internet and mobile devices) rely on sound DP or MIS systems for appropriate information provisioning or efficient processing. Many companies have established websites permitting customers to place orders online, but have not always fully integrated them with resource management, replenishment and other back-office systems. Similarly the data underpinning analytics can come from high-volume, operational DP systems as well as from external sources.

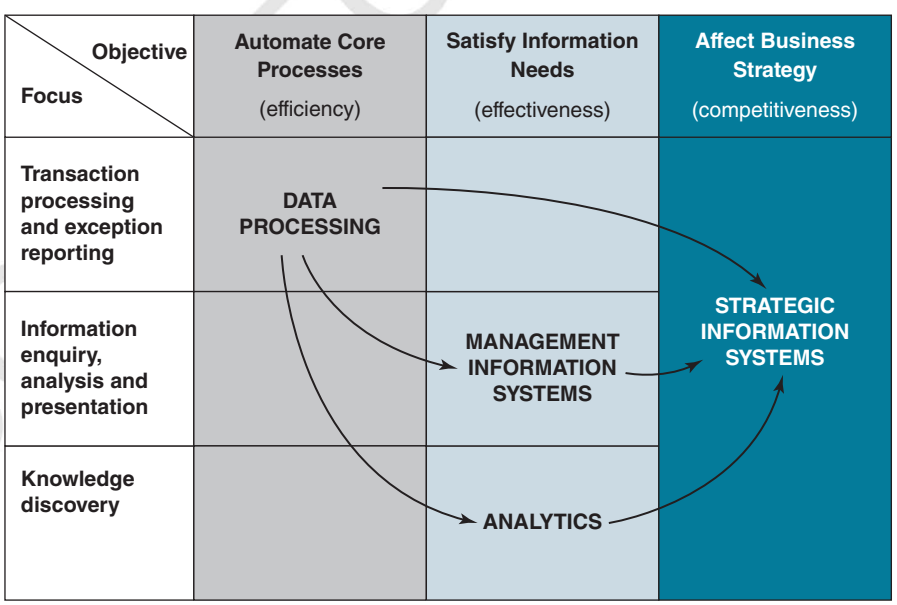


FIGURE 1.2 Relationship between DP, MIS, analytics and SIS.

- SIS are not essentially different types of applications – the functions they perform are often the same as for DP or MIS applications – it is their impact on the business due to the changes they enable or cause that is the source of advantage. Thus automating an element of a supply chain process can create a source of competitive advantage or using analytics to uncover new knowledge about customers can similarly enable an organization to develop a new business model to differentiate itself.
- The strategic applications may put considerable stress on the DP and MIS applications that were developed for a less demanding environment – they may need to be redeveloped not because of intrinsic shortcomings but because they inhibit the benefits to be gained from the SIS. We have seen this happen as some organizations struggle to deliver apps to customers via smartphones.

A Classification of the Strategic Uses of IS/IT

From a research base of over several hundred examples and case studies spanning nearly 40 years of cases of claimed 'strategic systems', the following classification is helpful in considering the implications of strategic IS/IT use. In general, these examples and cases can be classified into one of four types, although some clearly exhibit the characteristics of more than one type.

The four main types of strategic system are those applications that:

1. share information via technology-based systems with customers/consumers and/or suppliers and change the nature of the relationship;
2. produce more effective integration of the use of information in the organization's value-adding processes;
3. enable the organization to create, develop, produce, market and deliver new or enhanced products or services or new value propositions based on information;
4. augment people's cognitive processes in generating knowledge and insight from information; they provide executives, management and professionals with information to support the development, implementation and evaluation of strategies.

A similar approach was adopted by Venkatraman[47] in assessing how the strategic benefits from IT resulted from increasing the extent of business change (and risk). He described three types of 'revolutionary' uses of IT, which require considerable transformation in terms of what the organization does or how it does it:

Business process redesign – using IS/IT to realign business activities and their relationships to achieve performance breakthroughs.

Business network redesign – changing the way information is used by the organization and its trading partners, thereby changing how the industry overall carries out the value-adding processes.

Business scope redefinition – extending the market or creating new products, based on information, or changing the role of the organization in the industry, such as with the introduction of a new information-enabled business model.

Though not identical, these are similar to our classification; plus they have a clear emphasis on the extent of the changes required to achieve a strategic advantage (or more generally, benefits) from IS/IT. Hence, the four categories suggested above seem to cover many of the possibilities. Each type of strategic IS/IT application has different implications in terms of identification, planning and implementation. Box 1.4 describes a selection of case examples of strategic applications of IS/IT that have gained organizations advantages since the 1970s.

BOX 1.4

Examples of IS/IT and competitive advantage through the decades

1970s

Merrill Lynch

In the US, Merrill Lynch launched its Cash Management Account in 1978. This combined traditionally separate banking products such as line of credit, cheque, investment and equity accounts into a single monthly statement, with idle funds being swept automatically into a high interest-bearing account. The new accounts attracted $1 billion of assets in the first year. Merrill Lynch set out to permanently change the shape of the financial marketplace by taking several existing but separate services and tying them together through information technology to create a new service that shattered the traditional boundaries between the banking and securities industries.

Although it dates back to the 1970s, this is an example of product innovation using IS/IT and was a game changer at the time.

American Hospital Supply

American Hospital Supply competed in the wholesale healthcare industry in the 1970s and 1980s. To gain an important edge over its rivals, AHS pioneered an order entry distribution system that linked most of the firm's customers to its computers. AHS owned terminals were placed directly in the purchasing departments of hospitals, giving them an early mover advantage – hospitals didn't wish to have multiple terminals from different vendors cluttering up their offices. In addition to ordering merchandise, the system allowed customers to control their inventories by having direct access to AHS's stock records, increasing the likelihood of their coming to rely upon AHS as a key supplier. The fact that the company's initial move to electronic ordering was spearheaded by a regional manager seeking to meet the needs of a single customer suggests that starting small may be the key to success.

AHS is an example of innovation in the customer interface using information systems. As a first mover, it erected significant entry barriers that made it difficult for competitors to develop an equivalent system and get it into hospitals. An example also of how the company culture enabled an individual manager to start the process of strategic change.

1980s

Thomson Holidays

Thomson Holidays is a UK tour operator selling holidays to the general public through travel agents. Until 1982, enquiries and bookings were made by telephone, often resulting in chaos during peak periods. When its online reservation system, TOP, was introduced, agents could make on-screen bookings of holidays via a Viewdata system. This immediately reduced some of the double handling costs of bookings (in the travel agency and at Thomson's) and speeded up the process

of booking, hence saving agency time and cost. Later, Thomson developed similar links to their suppliers (airlines, hotels and other service providers).

It was the first tour operator to offer on-screen bookings to high street agents. During a single day at the start of the 1986 holiday sales campaign, 105,000 holidays were booked through TOP, resulting in Thomson carrying over one million passengers that year. This ability to handle mass bookings enabled Thomson to pursue its fiercely aggressive marketing strategy, and to stimulate huge demand. The 'system' gave Thomson a major advantage when demand dropped suddenly as it did in 1987 (USA bombed Libya) and 1991 (Gulf War). In 1987 Horizon Holidays (No. 3 in the industry) failed and in 1991 International Leisure Group (No. 2 in the industry) failed. Neither was able to respond to the rapid changes in demand as effectively as Thomson, and both had lower margins due to higher cost structures. Thomson was able to adapt more quickly and was more efficient in the context of the overall industry structure.

Thomson's TOP is an example of how IS/IT can enable a more agile response to environmental changes. Cloud computing would be today's example.

American Airlines

American Airlines (AA) gained a lead over the competition as the first US carrier to offer an online reservation system to travel agents. This system, Sabre, captured 10,000 of the 24,000 travel agents in the US at that time. Sabre listed the flight schedules of over 400 airlines, but when launched, it gave AA a crucial edge by displaying its own flights first. So effective was this tactic that other US carriers persuaded the Government to intervene. American still benefited, however, by charging for every booking made, bringing in significant revenue. In fact, Sabre was more profitable than the airline itself.

This is an example of how development of a back-end inventory management system could be used to provide a marketing and sales advantage to AA. It was also an example of a first mover advantage that proved so difficult for competitors to replicate, they had to join in – a game changer.

Otis Elevators

In the 1980s Otis Elevators identified 'customer services' as being a key element of its customer strategy. It decided that one of the aspects of its service that would give its customers most satisfaction was a prompt lift repair service. So it built an automated system, called Otisline, to dispatch repairmen. When something started to go wrong with Otis's lifts, they (the lifts!) automatically called in their complaint to a computer and an engineer was dispatched – without human intervention. Otis's rivals suddenly had to compete on quality of service as well as the price and quality of lifts themselves.

Although the technology used was primitive compared to that available today, Otisline can be seen as an early example of the Internet of Things (IoT), yet predates the availability of the Internet for commercial activity.

1990s

Schneider

Schneider, a $3.9 billion company, is the premier provider of truckload logistics and intermodal services in the US: solutions include Van Truckload, Dedicated, Regional, Bulk, Intermodal, Brokerage, Supply Chain Management and Port Logistics services. Schneider has provided expert transportation and logistics solutions for 80 years.

1980 saw the advent of deregulation in this traditional industry and Schneider recognized earlier than most the strategic potential of IT. Over the years the company has developed many applications in order to stay ahead of the competition. The company moved from freight modelling applications, to EDI, to satellite technology with onboard terminals, to incorporating this satellite data into customer communications and load scheduling processes. While each application of technology gave it a significant advantage in the marketplace, its competitors soon developed similar applications and it quickly became standard for the industry. Yet while the competition was looking to imitate Schneider, it had already moved on to develop a new strategic application. In essence, the competition was continually playing catch-up. Schneider continues to

apply its IT capability as it moves into logistics outsourcing. While logistics is an entirely different business from trucking, it similarly depends on fast, cost-effective, strategic implementations of IT.

This case demonstrates that Schneider was not successful because of any particular leading-edge technology – these are also available to its competitors – but because it has developed a capability for applying IT to ever-changing business opportunities.

Amazon.com

Amazon.com was launched in July 1995 and has probably become the most famous site in cyberspace. It initially started out with a mission to use the Internet to transform book buying into the fastest, easiest and most enjoyable experience possible. Jeff Bezos, its founder, selected books as it was a fragmented industry, with the two biggest booksellers at the time accounting for less than 12% of total book sales. Customers can search for a specific book, topic or author or browse their way through the book catalogue and also read book reviews from other customers, the *New York Times* and other newspapers and magazines. Customers' orders are processed immediately and books in stock, generally bestsellers, are shipped the same day. Customers are contacted by email when their order has been dispatched. Orders for non-bestsellers are immediately placed with the appropriate book publisher by Amazon.com. All contact with the company is done either through their website or by email.

The initial idea behind Amazon was to exploit the Internet to deconstruct traditional bookselling, with a catalogue 10 times larger than that of the largest Main Street superstore, at prices 10 to 15 per cent cheaper. But that was not a sustainable advantage: competitors such as BN.com would rapidly establish comparable selections and price points. Amazon went on to exploit the emerging economics of community with its curated reviewer community, encouraging the rating of reviews and awarding badges to the best-rated reviewers. The company has also pioneered technologies such as customer profiling and '1-click' shopping. The profiling technology has enabled Amazon to recommend products based on previous purchasing history and what other customers, who have bought similar products, are also buying. On the selling side, the company launched Amazon Marketplace as a fixed-price rival to eBay: a platform hosting a community of small sellers that now numbers more than 2 million. All these strategies benefited from the network effect: the more participants, the more choices; the more reviews, the richer the experience.

Over the years, the company has also expanded into other areas and now sells a huge range of products from consumer electronics, toys and games to foods. Today, Amazon earns less than 7% of its revenue from books. Furthermore, the company has not sat back and waited for trends to emerge. Rather, it seizes the strategic opportunities presented by technology, ruthlessly cannibalizing its own business where necessary. E-books were inevitable, so it launched the Kindle. Given the scale of its own IT infrastructure, it now sells cloud computing services.

Amazon is an example of a pure-play, new entrant, online business that disrupted the retail industry.

Ryanair

Ryanair is one of the world's most successful 'low fares' airlines. To support this strategy, the company looked to the Internet to provide a low cost distribution channel for its seats. Its online booking facility was launched in 1999, migrating customers away from the more expensive travel agent and call centre channels. Customers can now search for flights online and book them with a credit or debit card. In addition to booking flights, the site also sells travel insurance, car hire and hotel accommodation. Customers can now check in for their flights online or using an app on a smartphone.

Ryanair is an example of a company that used the Internet to support its low cost strategy.

2000s ONWARDS

Uber

Uber, the ride-hailing app provider, has become Silicon Valley's poster child for disruption. The company has revolutionized the taxi market in more than 230 cities in

51 countries without owning a single car. Its marketplace connects drivers of regular cars and taxis with passengers through its smartphone app, backed by a 'big data' team that tries to ensure a ride is never more than five minutes away. Uber is not satisfied with taking on taxis alone. From burgers in Beirut and cycle couriers in New York to kittens in Seattle, it is already experimenting with moving more than just people. But in other cities, such as Paris and Delhi, Uber is facing fierce resistance from both existing taxi companies and local authorities.

Owning no taxis, Uber is an example of a platform company, facilitating a two-sided market that brings customers and suppliers together.

John Deere

US agricultural manufacturer John Deere has always been a pioneering company. It is more than a company that sells machinery: one area that it has focused on is increasing the efficiency of production of crops. It has launched several big data-enabled services which let farmers benefit from crowdsourced, real-time monitoring of data collected from its thousands of users. The company provides a suite of services to allow everything from land preparation to seeding, fertilizing and harvesting to be controlled from a central hub.

Myjohndeere.com is an online portal which allows farmers to access data gathered from sensors attached to their own machinery as they work the fields, as well as aggregated data from other users around the world. It is also connected to external datasets including weather and financial data. These services allow farmers to make better informed decisions about how to use their equipment, where they will get the best results from and what return on their investment they are providing. For example, fuel usage of different combines can be monitored and correlated with their productivity levels. By analysing the data from thousands of farms, working with many different crops in many different conditions, it is possible to fine-tune operations for optimum levels of production.

The system also helps to minimize downtime by predicting, based on crowdsourced data, when and where equipment is likely to fail. This data can be shared with engineers who will stand ready to supply new parts and service machinery as and when it is needed – cutting down on waste caused by expensive machinery sitting idle.

John Deere is an example of a company that is shifting from selling hardware to selling services.

Zopa

In March 2005, Zopa became the first company in the world to launch a peer-to-peer (P2P) lending operation. The company implemented a radical concept: the 'Zone of Possible Agreement' (from which the name is derived). The term refers to the price point where both borrower and lenders agree that a particular interest rate is fair to both sides. Borrowers are credit-checked using a credit reference agency as well as the platform's own credit test. Zopa links parties up to this price and facilitates the actual transaction. No bank is involved.

Using IS/IT, Zopa is disrupting lending which has traditionally been done through banks and other financial institutions.

Linking to Customers, Business Partners and Suppliers

Technology today enables organizations to connect cheaply and easily with customers, business partners and suppliers almost anywhere in the world; an outcome that has been described as the 'second economy'.[48] E-procurement and smartphone-based ordering systems have enabled low cost linkages with customers and suppliers, plus in many cases enabling customers to track order and delivery progress online. Many companies are placing emphasis on finding ways to leverage social media and customers' growing eagerness to share opinions on brands, products and

services, evidenced, for example, by the many comments about hotels and restaurants that customers post on TripAdvisor and video product reviews on YouTube. Insurance companies are aggressively leveraging mobile connectivity. AXA, Nationwide and NRMA, for example, now offer their auto-insurance customers smartphone apps that provide comprehensive post-accident assistance, from first-aid tips to one-touch contact with police, emergency services and garages. The app also makes it easy for policyholders to complete and file damage reports on the spot.

The key people involved in the consideration of improving these external linkages will be sales/marketing and distribution management at the customer end, and purchasing and operations managers at the supplier end. Also, they are not entirely within the organization's power to control – since suppliers, customers and competitors may take the initiative at any stage – and such applications can require the cooperation of the trading partners involved. Many organizations are now competing for consumers' attention and time, so that they now have to consider the efficiency and ease of use of the app from the consumers' perspective. In the early days of e-commerce, companies made savings by effectively transferring 'work' to the customer, but that is now something the customer is less willing to accept. In the public sector, the challenge is often changing citizen behaviour.

Identifying and exploiting these types of business opportunities are considered in more detail in Chapters 5 and 6.

Improved Integration of Internal Processes

Effective internal integration of information requires the organization to overcome some of the traditional barriers to successful IS/IT investments, such as sharing and integrating information, reorganization of job roles, new accountabilities, new performance measures and organizational changes. For instance, telemarketing can dramatically reduce the cost of generating orders. But, imagine the reaction of a good customer to a telephone call suggesting a reorder when he or she has just received a demand from the Accounts Department for payments for goods not received or when a machine is idle due to a service engineer calling without the right parts! All of the relevant information about the customer and the organization's ability to deliver is required at the point of selling to make it effective. This is what many organizations are seeking to achieve with the implementation of a single view of the customer, often enabled by Customer Relationship Management (CRM) software.

The ventures into 'direct' servicing of financial customers from call centres, pioneered by First Direct and Direct Line, were early examples of improved product and service delivery based on internal integration of processes and systems. The products were essentially the same as those of competitors, but they were delivered directly to consumers via the telephone (and later online) rather than via agents or branches – a new type of personalized service based on the availability of comprehensive customer and product information. Many more traditional banks and insurance companies have followed suit. Interestingly, Direct Line has not made its products available via comparison websites as 'disintermediation' would damage established customer relationships – Direct does mean direct.

Enterprise Resource Planning (ERP) suites are an example of configurable information systems that provide integrated information and core information processes within and across functions in many types of organization. However, there is an

argument that the use of such standard applications packages, which is a common strategy today, can limit an organization's ability to innovate.[49] At the same time, investments made in technology infrastructure are becoming increasingly significant and inappropriate decisions in this area can severely affect an organization's ability to respond swiftly and flexibly to changing market conditions and can, in some instances, become a significant competitive liability.[50]

Senior management need to understand the organizational implications of increasing degrees of integration on the roles of people and departments, since reorganization is often required if significant benefits are to be obtained and any relative advantages sustained. It is the inability to implement the necessary business and organizational changes that means many IT investments deliver fewer benefits than expected.

The nature of the business operating models and the implications for internal integration are considered in more detail in Chapters 4 and 6.

Information-based Products and Services

Adding information to, or 'informating',[51] existing products has become an increasingly popular strategy. The classic example of enhancing the product/service, based on information, is the Merrill Lynch Cash Management Account, described in Box 1.4. Unlike many of the examples, this concept resulted from strategic thinking in the corporate planning department, where it was realized that a whole range of financial services were converging. More recently, online and mobile banking have incorporated a similar logic. Financial service companies increasingly can provide customers with all their aggregated financial information through a couple of keyboard, voice or smartphone commands. Being able to see all of it in one place has many advantages for customers over looking at a variety of individual websites, with their different passwords and ways of displaying financial information. This convenience means customers are more likely to buy further products or services from the same company.

Achieving advantages from this type of application requires a thorough knowledge of the products of the industry, their relative merits and, in particular, which customers will buy them and how they use them and obtain value from them. Obviously, an understanding of the organization's own products and services and the economics of providing them is also required.

In going online, many organizations have also added more value to the physical products they sell by providing additional information-based services. These can include online support, order tracking, order history, product use advice etc., mostly focusing on deepening the relationship with customers or suppliers. Others have moved their trading platform either partially or entirely onto the Internet, for example the auction house Christies and the Aalsmeer Flower Auction. RS Components, a leading distributor of electronic and industrial components in the UK, permits its customers' employees to make purchases from its website of low cost (less than €300) items, with RS managing the total process, including establishing purchasing controls, which cover spending limits, barring the ordering of certain products, applying cost codes, call offs from blanket orders and security.

The creation of information-based products and 'informating' existing products and services are covered in more detail in Chapters 5 and 6.

Augmenting Human Cognitive Processes to Support Strategic Decision Making

The final type of strategic IS/IT application – to provide executives, managers and professionals with information to support strategic decisions – is dependent on other factors for success. Making strategic decisions requires a range of different types of information covering, for example, markets, customers and non-customers, industry, technologies and product developments and both global economics and the economies of the countries in which they operate. In addition, the experience of the decision maker is important, as very often intuition or 'gut feeling' plays a large part in some decisions, even some strategic ones.

Supporting management in making decisions has always been an objective of deploying IT. Early MIS were designed to provide the information that managers determined they needed to make specific decisions. Recognizing that executives frequently make 'unstructured' decisions, a modelling capability was added. While these applications were typically referred to as Decision Support Systems in the 1970s, technological developments have seen them evolve into online analytical processing (OLAP), data mining, business intelligence (BI) and analytics.

However, management information systems, historically at least, rarely satisfied strategic decision-making requirements. There are several reasons for this: the lack of external information included, the simplicity of the applications, the rawness of the data and the lack of context. The decisions are complex or 'wicked' and require the application of knowledge, judgement, and experience to information for new knowledge to be uncovered or greater sense made of a situation. Recent developments in external data sources, which are readily available via the Internet, plus the potential offered by knowledge-based and scenario planning applications, used in conjunction with analytics applied to extensive 'big data' sources enable organizations to explore and evaluate strategic options. Although this has made this type of application more practicable, it still provides the lowest number of strategic IS/IT examples.

This topic is considered in more detail in Chapters 4 and 5.

Figure 1.3 summarizes the different views of strategic information systems, their context and focus. The dimensions show the evolving role of IS/IT from efficiency and effectiveness of existing activities to changing what the business does and the changing focus of investment, from internal to external. In the figure, electronic trading or e-business, at its basic level of automating existing business transactions, is

Purpose / Focus	Operational efficiency	Management effectiveness	Knowledge discovery	Business advantage through change
Internal	Data processing—automation of business tasks and processes	Management Information Systems (and 'Executive Information Systems')	Generating new knowledge and understanding about existing business	Internal business integration by process, job and organization redesign
External	Electronic links between organizations automating data exchanges and interaction	Sharing information by direct access from one company to another's information resource	Generating new knowledge and understanding from/combining with external data	External business integration, changing the roles of the firms in the industry

FIGURE 1.3 The information systems management environment.

not considered strategic since it merely improves the efficiency of transaction handling. Also, systems to support executive decision making (so-called executive information systems (EIS)) have been included under MIS since, to date, the majority are 'higher-level' versions of MIS; only a few fit the 'strategic' description given above.

Success Factors in Strategic Information Systems

Further analysis of our research base, and published work by others, identified some of the key factors that seem to recur frequently and underpin success with strategic information systems. Few, if any, strategic information systems exhibit all of the factors, but many show more than one.

1 *External, not internal, focus: looking at customers, competitors, suppliers, even other industries and what is happening in the outside world – both business and social.* Traditionally IS/IT was focused on internal processes and issues. As can be seen from three of the four categories above, changing relationships with customers and suppliers, developing new information-based products and services and having comprehensive and meaningful information to help strategic decision making all rely on knowledge about what is happening beyond the organization boundary.

2 *Adding value, not cost reduction: although cost reductions may accrue due to business expansion at reduced marginal costs, 'doing it better, not cheaper' seems to be the maxim.* This is consistent with the requirements of companies striving to be to be innovative and differentiate themselves from competitors through better products and services which customers value. Historically, and still prevalent in some organizations, IS/IT was mainly seen as a way of increasing efficiency and reducing costs – doing the same things but cheaper. While this is obviously important in any business environment and every opportunity to use IS/IT to significantly reduce costs should be taken, it is not the only way to succeed.

3 *Sharing the benefits: within the organization, with suppliers, customers, consumers and even competitors (on occasion!).* In many cases in the past, benefits accruing from IS/IT investments have not been shared even within an organization, which discourages non-benefiting departments or functions from making changes which could increase the overall benefits realized. Or put another way: 'the issue of gainsharing is of critical importance. . . with no apparent benefits to them, stakeholders are likely to resist the system.'[52] Almost all of the examples above involve some sharing of the benefits, with suppliers, customers, consumers and even competitors, to help provide barriers of entry to the industry. For instance, the introduction of debit cards to replace cheques depended for its success on banks sharing some of the reduced processing costs with the retailers and consumers, since the benefits, mainly cost savings for the banks, depended on the acceptance by retailers and use by consumers. (Some might argue that this was achieved by increasing the cost of processing cheques!)

4 *Understanding customers and what they do with the product or service: how they obtain value from it, and the problems they may encounter in gaining that value.* In the 1980s, McKesson, the pharmaceutical wholesaler, followed this

principle very closely in providing a range of information-based services to small drugstores, starting from a simple problem of stock control, solved by delivering products in shelf-sized batches. Many distribution companies allow customers access to their tracking systems, enabling them to know when they need to be available to accept delivery. Such facilities become more important as people's expectations of service levels become more stringent. With business model innovation, organizations ask themselves what is the problem the customer needs solving, what value proposition can be defined and offered to them and how can IS/IT help make it happen. Rolls-Royce selling availability rather than engines acknowledges that many airlines do not wish to own their own maintenance, repair and overhaul (MRO) operations.

5 *Business-driven innovation, not technology-driven: the pressures of the marketplace drove developments in most cases.* On first read, this factor might cast doubt on the idea of competitive advantage from IT but, in practice, it means that new or existing IT provides or enables a business opportunity or idea to be converted into reality. The lead or the driving force is from the business, rather than technology ideas being pushed by the IT suppliers and specialists. The priority for the business issue to be resolved is paramount: why take two risks at the same time – that is, a new way of doing business based on new technology? Although sometimes it is the only way to deliver the desired solution, it tends to be a recipe for failure. Keen[53] summed it up well by saying, 'Major failures in using IT are often based on much better technology and bad business vision. Successes come from good enough technology and a clear understanding of the customer.' How organizations can exploit new capabilities of IT innovatively to create business opportunities is discussed in Chapter 5.

6 *Incremental development, not the total application vision turned into reality.* Many examples show a stepped approach – doing one thing and building on and extending the success by a further development. To some extent, this is developing applications by experimentation but also not stopping when a success is achieved but considering what could be done next. This approach is akin to an agile rather than traditional 'waterfall' approach to application development, which involves clarifying all requirements, defining all boundaries and agreeing the total deliverables of the system before embarking on the expensive process of design and construction, freezing the requirements at each stage. Prototyping applications and piloting their introduction to test how well they perform are integral aspects of agile development approaches and have a key role to play here. Many pure-play online companies consider their products in 'permanent beta'; that is, they will always evolve.

7 *Using the information gained from the systems to develop the business.* Many online and conventional retailers segment their customers very accurately based on their purchasing patterns and then target promotions and special offers 'personally', so-called *mass customization*. Product sales and market analyses plus market research information can be merged with customer sentiment data from social media, then recut in many different ways to identify more precise market segments, their shopping patterns and the effectiveness of promotions and new product introductions. Examples of generating insight from data include Tesco (loyalty card), Google (match search queries with advertisers) and Amazon (collaborative filtering).

Before one retailer introduced its loyalty card scheme, it knew virtually nothing about its customers. Now it knows, for example, that most customers are not profitable, but also which are; women are 50% impulsive, men 90%; customers shop for concepts not commodities (e.g. Sunday lunch, kids treat, Italian meal) and they can arrange the stores and product ranges accordingly.

8 *Monetizing information.* We have always known that information has, or should have, a value, although it is difficult to place an exact price on it. Normally, even though we might consider information as a business asset, it does not appear on the balance sheet of a company. Organizations generate vast amounts of data as a by-product of their operations. This is often referred to as *exhaust data*, and its potential value is now being realized in some industries such as pharmaceuticals and healthcare, given the power of analytics to find 'needles in haystacks', leading to possible new products or treatments. Mobile phone companies have demographic information about their customers for billing purposes and, via their networking technology, know the location of each customer's mobile phone. O2 are now combining these capabilities to offer a service to shopping malls and retail stores, enabling them to track shoppers. Integrating location data with customer data, it can provide stores with information about store visitors and how long they spend in the store and also where customers go after they leave. This can be valuable information, provided they do not infringe privacy legislation concerning individuals' personal data.

As discussed above, these factors, in general, demonstrate different attitudes to the use of IS/IT than prevailed historically, implying that new ways of thinking and techniques to uncover such opportunities are needed, plus new approaches to managing these applications to ensure success.

Another general observation can be made from these examples by considering what actually produces the success – information technology, information systems or information. *Technology* itself is the 'enabler', which provides short-term advantage and the opportunity to develop new processes and systems and capture and use potentially valuable information. But, normally, competitors are able to purchase the same technology, and any advantages can soon be negated. However, the new *information systems* developed utilizing the technology can provide advantages that may be less vulnerable to erosion by competitive copying. The potential gain will depend on how conclusively and exclusively the new systems alter business processes and relationships.[54] If the firm wishes to sustain its advantage, it must also use the *information* gleaned from its new applications to improve its products or services or create new opportunities that meet the requirements of the marketplace or influence its development.

A Portfolio Management Perspective on IS/IT Investments

Portfolio management is generally recognized as an integral component of any IS/IT strategy. For example, Lederer and Sethi[55] explicitly use the term 'portfolio' in their definition of strategic planning for IS, which they describe as the 'process of identifying a portfolio of computer-based applications that will assist a firm in executing its business plans and realizing its goals.' Earl[56] argued that IS strategic plans should be treated as

portfolios that 'consider the trade-offs [of] risk and return . . . and the allocation of IS resources.' Since the 1980s, many useful IS/IT portfolio management models for both new investments and ongoing application management have been proposed. Most of them categorize IS investments and projects according to the nature of assets, resources or capabilities they create or provide, or their business impact or reward and the risks involved,[57] often expressed in terms of the business changes required.

Not all IS/IT investments make the same contribution to business success and therefore their importance to the business is likely to be quite different. Adopting a portfolio management perspective is a useful way of categorizing investments according to their differing contributions, in order to select application investment and project management strategies that are appropriate to the contribution required. The portfolio framework that we advocate is derived from a matrix concept initially proposed by McFarlan.[58] He considered the overall contribution of IS/IT to the business now and in the future, based on its industry impact. Our variation on the matrix is represented in Figure 1.4.

The model proposes an analysis of all existing, planned and potential applications into one of four categories, defined as *strategic, high potential, key operational or support*, depending on each application's current or expected contribution to business performance and the organization's future strategy. Whilst this portfolio model and its use will be explored in depth later in the book, briefly these 'contribution' categories are as follows:

- **Strategic** applications and investments are *critical to future business success*. They create or enable changes in how the organization conducts its business, with the aim of providing competitive advantage. Note that, even when the technology used is 'leading edge', this does not indicate that the application is strategic; the assessment must be based on its intended or actual business contribution.
- **High potential** are (risk) investments in innovative applications of IS/IT which *may create opportunities to gain a future advantage*, but are as yet unproven in terms of either the benefits they produce or the capabilities and performance of the technology, or both.

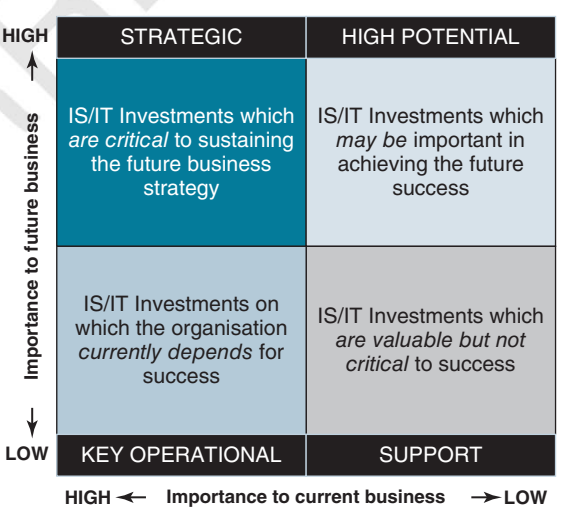


FIGURE 1.4 The applications portfolio: understanding and classifying IS/IT investments.

- **Key operational** applications and investments *sustain the existing business operations, helping to avoid any disadvantage*. These are often referred to as the organization's 'core' systems. It can be argued that, in many industries, substantial numbers of applications (e.g. EPOS [electronic point of sale], ATMs [automated teller machines] and ERP [Enterprise Resource Planning]) have become so pervasive that they have become 'mandatory' for survival. Any unavailability or failure of key operational applications will have a serious negative impact on business performance.
- **Support** applications and investments *reduce costs by increasing business efficiency, or improve management effectiveness* but do not sustain the business or provide any competitive advantage. Unlike key operational applications, failure or unavailability does not have an immediate negative effect on performance, but will eventually do so if not corrected. Most support, as well as many well-established key operational, applications are now provided by software packages and are increasingly frequently being outsourced.

Over time, the contents of the portfolio will change and, for any organization, the contents of segments of the portfolio will be influenced by a variety of internal and external factors, as described later in the book. This model has proved effective in providing a framework by which agreement on the portfolio of business applications, available and required, can be reached from the often divergent views of senior management, line managers and the IS/IT specialists. It is a simple concept which enables consensus to be achieved, both as a strategy is developed and later as the business and its requirements evolve. The usefulness of this matrix is borne out by the ease with which management is willing to and can categorize applications according to their perceived business contribution and potential.

The portfolio, as described here, shows some obvious similarities to other portfolio matrices used in other management disciplines, such as the Boston Consulting Group's 'Boston Matrix' for product portfolios. Those similarities, concerning balancing the portfolio, life cycles, management approaches, investment justification etc., will be examined in detail in Chapters 8 and 9, when the value of the matrix in the strategic management of IS/IT is explored. At this stage, it is sufficient to point out that the four segments will require quite different strategies to achieve successful planning, development, implementation and operation of the applications – because they fulfil different roles in the business.

What Is an IS/IT or Digital Strategy?

In defining IS/IT strategy, it should be noted that most definitions approach the issue from the IS perspective and in particular IS strategic planning, even though they effectively include IT strategic planning. The term Information Systems Strategic Planning (ISSP) was defined by Boynton and Zmud[59] as 'activities directed toward (1) recognizing organizational opportunities for using information technology, (2) determining the resource requirements to exploit these opportunities, (3) and developing strategies and action plans for realizing these opportunities and for meeting the resource needs'. Earl's[60] definition refers to the 'long term, directional plan which decides what to do with IT' that is concerned primarily with 'aligning IS development with business needs and seeking advantage from IT'. Over time other

topics, such as knowledge management, were introduced,[61] which expanded the domain. Our definition tries to take a broader perspective: 'thinking strategically and planning for the effective long-term management and optimal impact of information in all its forms: information systems (IS) and information technology (IT)'.

Thinking strategically about IS/IT is not just concerned with the proactive search for potential opportunities to apply IT for competitive advantage but with adopting a strategic approach to all IS and IT investments. As stated earlier, not all investments in IS/IT make the same contribution to business success; the portfolio model provides a classification of the types of contribution, one of which is to create and achieve strategic advantage. Other investments sustain performance of core business operations or facilitate the adherence to mandatory compliance, but this does not negate the need to develop a more strategic approach to their management. Balancing the often competing pressures to avoid disadvantage *and* exploit existing or new technologies for advantage is a critical aspect of formulating an appropriate IS/IT strategy for any business. The balance will inevitably need to change over time due to external pressures. In a similar way to how the nature of IT applications and the impact on both businesses and individuals has evolved over the last 40 years, IS/IT strategies have also evolved in terms of purpose, content and relationships with business strategies.[62]

As early as 1985 Sullivan[63] recognized the tensions, due to forces beyond the organization's control, that had to be reconciled in the strategic management of IS/IT. He described two axes within which an organization can consider the implications of these forces (see Figure 1.5):

- *Infusion* – the degree to which an organization becomes dependent on IS/IT to carry out its core operations and manage the business;
- *Diffusion* – the degree to which IS/IT has become distributed throughout the organization and decisions concerning its use are devolved.

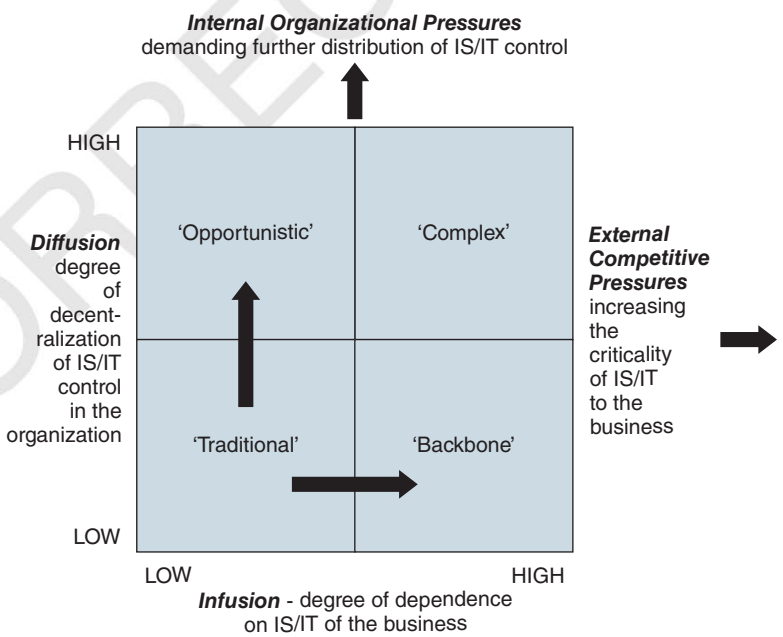


FIGURE 1.5 Environments of IS/IT strategies.

Plotting high and low degrees of infusion and diffusion produces four essentially different environments:

- *Low diffusion/low infusion* – the 'traditional' environment typical of companies using IT solely to improve efficiency on an application by application basis.
- *Low diffusion/high infusion* – where IS/IT is critical to business operations and control – the 'backbone'. The business could be seriously disadvantaged if systems fail, leading to highly centralized control of highly integrated applications and infrastructure.
- *High diffusion/low infusion* – largely decentralized control, giving business managers the ability to satisfy their local priorities and enable 'opportunistic' investment, driven by short-term priorities and the desire to create business advantage.
- *High diffusion/high infusion* – this as a 'complex' environment that is difficult to manage: too much central control to avoid poor investments will limit innovation, hence new strategic opportunities may be missed; too little control and the core systems may disintegrate. Most organizations are in this quadrant today.

The implications are that as an organization becomes more dependent on IS/IT, essentially to avoid being disadvantaged, the more centralized and structured the approach to planning and control should become. But, to facilitate the innovative uses of IS/IT to create future advantages, technology control needs to be close to the business user to enable appropriate connections between business need and technology solution to be made. Simultaneously seeking to gain advantage and avoid disadvantage implies both high diffusion and high infusion and hence, a complex, balanced set of management approaches (described by Sullivan as 'eclectic'). Probably the best interpretation of the word 'eclectic' is to say that every organization needs approaches to IS/IT strategy formulation and planning tailored to its individual circumstances, as determined by the industry and business situation and the organization culture.

IS and IT Strategies

Over 25 years ago Earl called for the distinction to be made between IS strategy and IT strategy,[64] because he found that most IT strategies, at that time, were strong on technology issues and weak on identifying application needs and business thinking; despite the passage of time, unfortunately this situation is still very common. He suggested that *IS strategy* is concerned with the organization's required information systems or application set, whereas the *IT strategy* is about the technology, infrastructure and associated specialist skills – our views of IS and IT strategies are consistent with this argument. He also argued that the most effective route to achieving strategic benefit from IS/IT is to 'concentrate on rethinking business by analysing current business problems and environmental change – and considering IT as just one ingredient of the solution.'

The *IS strategy* is firmly grounded in the business, taking into consideration both alignment with the business strategy and the potential competitive impact – the '*IS demand*'. Essentially, it defines and prioritizes the investments required to achieve the 'ideal' applications portfolio, the nature of the benefits expected and the changes

required to deliver those benefits, within the constraints of resources and application interdependencies.

The *IT strategy* is concerned with how that demand for information and applications will be enabled and supported by technology – essentially, it is concerned with '*IT supply*'. It addresses the provision of IT capabilities, assets and resources (including all hardware, software and telecommunications) and services such as IT operations, application development and user support, plus the skills and competences required by both IS/IT specialists and users. (The components of both IS and IT strategies are considered in more detail in Chapter 3.)

As mentioned earlier, one thing the IT industry is good at doing is relabelling (and recycling) concepts to suggest that they are new. This is the case with 'digital strategy', which is an emerging convenient label for what we have traditionally called IS and IT strategies, i.e. a strategy which includes both IS and IT dimensions. Suppliers have long tried to subsume IS into IT strategies to emphasize the importance of their technologies. There is clearly a danger in this – it suggests the solution is technology, not a combination of business changes in processes and information use and appropriate technology, if indeed technology is needed. For us a 'digital strategy' has both an IS strategy and an IT strategy component. When building a digital strategy it is imperative to understand how information and systems (IS) will be leveraged and used as well as the underpinning technological (IT) capabilities that will be required. Figure 1.6 summarizes that view.

Figure 1.7 depicts the relationships between business, IS and IT strategies. It illustrates how the business strategy essentially defines where the business is going and *why*; the IS strategy determines *what* is required in terms of IS applications and information to support its execution; and the IT strategy specifies *how* what is required can be delivered using technology. It also shows that IS/IT can both enable and shape the business strategy.

In contrast to the IT strategy, we caution against treating the IS strategy in a similar way to functional strategies like marketing, production or logistics and supply

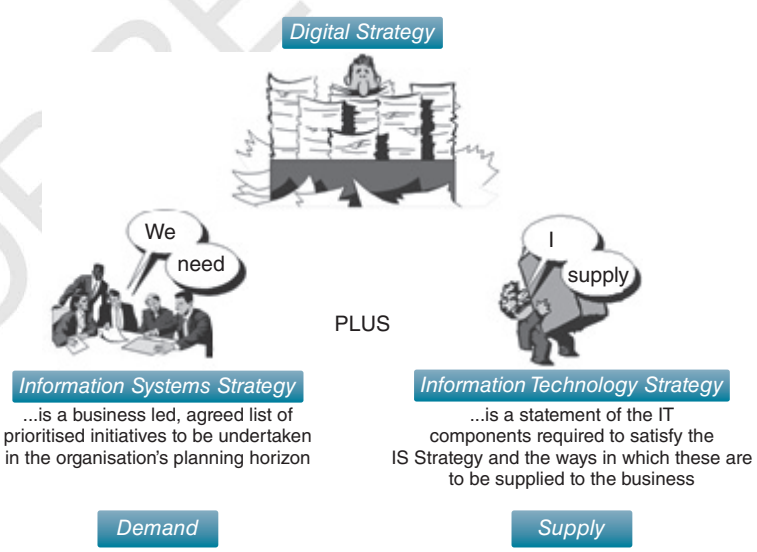


FIGURE 1.6 'Digital strategy' is a convenient label for the combined IS and IT strategies.

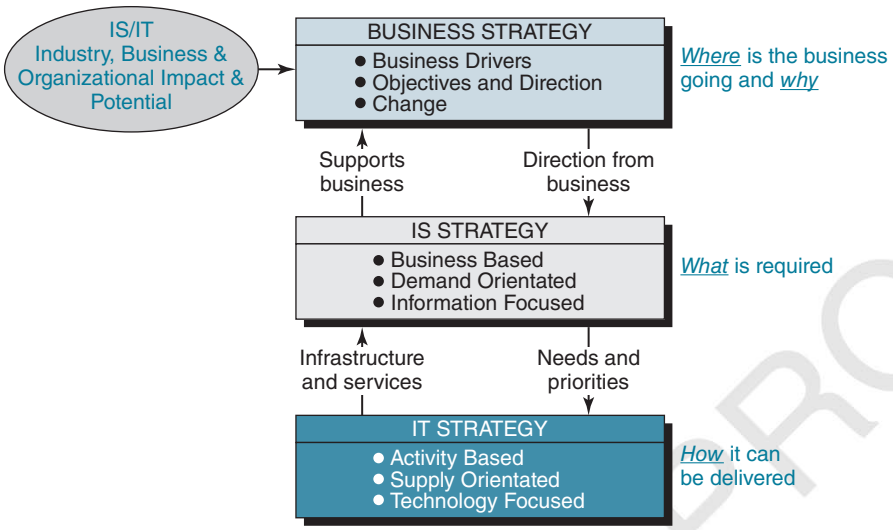


FIGURE 1.7 The relationship between business, IS and IT strategies (after Earl).

chain. Information permeates all organizational activity and is used by all employees in the performance of their jobs. In addition, the internal information network binds the organization together. Whereas organizations tend to plan other resources (e.g. people, money, materials), little effort is generally devoted to planning the type of information needed, where it is to be collected and stored, how it will be used or who is responsible for it. Equally, most employees now use IT applications as part of their role, both 'formal' applications and, less formally but probably more frequently, as productivity and communication tools, so that the strategy needs to ensure that individuals' performance is not compromised by under investment in general-purpose or utility applications and the supporting infrastructure. The IT strategy, on the other hand, can be seen in a similar way to functional strategies.

One other concept that needs to be clarified and understood in the context of IS/IT is *information management* (IM).[65] There should be a strategy in place to manage underpinning information or the implementation of the IS strategy will be fraught with problems. Information management is essentially concerned with the quality of information, its protection and overall governance and is supported by data management policies and practices which are enforced through application development standards as well as information governance policies. Box 1.5 presents a way of explaining the distinction between IS/IT and IM.

IS/IT Strategy, Implementation and Delivering Business Value

Building the IS and IT strategies is only the starting point of what is required if the available business value from IS/IT is to be optimized. Recent research suggests that making a strategic choice by itself, even if well understood and broadly bought into, does not impact business performance on its own.[66] Within the IS strategy, potential investments must be prioritized, selected and authorized. This prioritization and selection should be based not just on desirability but also having the capability to successfully deliver the investment objectives and benefits.[67] Investments have to be justified; programmes and projects have to be scoped, resourced and managed.

BOX 1.5
Explaining IS, IT and IM

Managers can sometimes struggle to understand the distinction between IS/IT and information management (IM). We have found it useful to use the analogy of water, where water flowing through a building can be seen as information flowing through an organization. Deciding what water will be used for, e.g. to drink, to clean the car, to cook in, to irrigate the lawn etc., is equivalent to determining the organization requirements for information, i.e. how the organization is going to use information and for what purpose. The IS and IT determine how these requirements will be satisfied, i.e. the systems and technology; in our water analogy, the taps, plumbing, piping and filtering that will deliver water to the shower, the kitchen tap or the garden hose etc. Moreover, water supply can be outsourced to a municipality or collected and stored by the homeowner. IM is concerned with the quality of information and its protection, equivalent to the quality of water. Obviously, water that is to be drunk should be of a higher quality than water to clean the car; however, this is a 'demand' decision; the homeowner could decide that he or she is willing to use the same quality level for all water needs, irrespective of cost.

The old computing adage 'Rubbish In, Rubbish Out' should also be borne in mind. Unfortunately, many managers are totally unaware of the quality of information they use, naively assuming that, because it is 'in the system', it is accurate. And poor information quality can have a substantial negative impact on an organization's operating costs and efficiency and even compromise the execution of corporate strategy.[a] For example, low quality information in financial systems means that managers may make poor decisions when implementing business plans.

Ensuring the quality of information is a crucial foundation for the effective management of an organization. Data quality refers to the extent to which the data created and used by business operations meets objective criteria that define whether it is fit for purpose by its different users. Information quality is a multi-dimensional concept that can be defined by a number of attributes including accessibility, appropriate amount, believability, completeness, consistent representation, ease of manipulation, interpretability, objectivity, relevance, reputation, security, timeliness, understandability and value-added.[b] A more pragmatic view of information quality is 'fitness for use'; that is, if users feel that its quality is sufficient for their needs, then, from their perspective at least, the quality of the information available to them is fine. This, of course, may be erroneous.

To ensure quality, governance is usually established around the data resource. Data governance is a set of processes that ensures that important data assets are formally managed throughout the enterprise. It ensures that data can be trusted and that people can be made accountable for any adverse event that happens because of low data quality. The areas usually addressed by data governance are policies in relation to regulatory compliance (e.g. privacy), auditing, retention and life-cycle management, metadata, data cleansing and stewardship.

Information quality is an inexact science. Methodologies for assessing information quality have been proposed,[c] usable data quality metrics have been suggested,[d] while information quality benchmarks have also been developed.[e] Poor quality can result from a range of causes relating to information systems design, business processes and the behaviour of employees.

Notes:

[a]G.L. Neilson, K.L. Martin and E. Power, 'The secrets of successful strategy execution', *Harvard Business Review*, June, 2008, 61–70.

[b]R.Y. Wang and D.M. Strong, 'Beyond accuracy: what data quality means to data consumers', *Journal of Management Information Systems*, 12, 4, 1996, 5–34; O. Kwon, N. Lee and B. Shin, 'Data quality management, data usage experience and

acquisition intention of big data analytics', *International Journal of Information Management*, 34, 3, 2014, 387–394; Y.J. Kim, R. Kishore and G.L. Sanders, 'From DQ to EQ: understanding data quality in the context of eBusiness systems', *Communications of the ACM*, 48, 10, 2005, 75–81; S. Watts, G. Shankaranarayanan and A. Even, 2009, 'Data quality assessment in context: A cognitive perspective', *Decision Support Systems*, 48, 1, 2009, 202–211; V.C. Storey, R.M. Dewan and M. Freimer, 'Data quality: setting organizational priorities', *Decision Support Systems*, 54, 1, 2012, 434–442; and P. Woodall, A. Borek and A.K. Parlikad, 'Data quality assessment: The hybrid approach', *Information & Management*, 50, 7, 2013, 369–382.

[c]Y.W. Lee, D.M. Strong, B.K. Kahn, and R.Y. Wang, 'AIMQ: A methodology for information quality assessment', *Information & Management*, 40, 2002, 133–146.

[d]L.L. Pipino, Y.W. Lee and R.Y. Wang, 'Data quality assessment', *Communications of the ACM*, 45, 4, 2002, 211–218; and D.M. Strong, Y.W. Lee and R.Y. Wang, 'Data quality in context', *Communications of the ACM*, 40, 5, 1997, 103–110.

[e]B.K. Kahn, D.M. Strong, and R.Y. Wang, 'Information quality benchmarks: product and service performance', *Communications of the ACM*, 45, 4, 2002, 184–192.

In addition to building IT assets with their requisite IT capabilities, complementary business capabilities will also need to be developed.[68] This usually requires changes to business processes and practices, individuals' job content or roles, perhaps organization structures and even changes to customers and suppliers' practices. Not achieving these changes is the primary reason IS/IT investments underachieve or fail.[69] It is only when the programme of changes is successfully delivered, the application is used effectively and the realized benefits of the investment exceed the costs incurred that business value is actually created. While the detailed discussion of managing IS/IT implementation is outside the scope of this book, the strategic management of IS/IT requires that, within any framework, strategy execution is covered. This aspect is addressed in Chapters 8 to 11, however it does point to a fourth era in the evolution of IS/IT in organizations that is introduced later in this chapter.

From Strategic Alignment to Strategy Co-evolution

Strategic alignment describes the extent to which the organization's portfolio of IS/IT investments directly enables and supports its business strategy. Lack of strategic alignment is another of the main reasons organizations fail to realize value from IS/IT investments.[70] Henderson and Venkatraman[71] developed a still widely used model that describes the dynamic alignment between the business and IS/IT strategic contexts. Their model is based on the building blocks of strategic and functional integration. They argue that alignment involves – at least – four domains of strategic choice: business strategy, organizational infrastructure and processes, digital strategy and IS/IT infrastructure and processes (see Figure 1.8).

The strategic alignment model (SAM) assesses the range of strategic choices facing managers and explores how they interrelate. Weak associations between combinations of the domains will lead to omissions or inadequacies in the degrees of alignment between IS/IT and both business strategy and operations. It should be noted that this can be due to poor alignment of the business strategy with internal organizational infrastructure and processes as well as how well IS/IT investment is aligned.

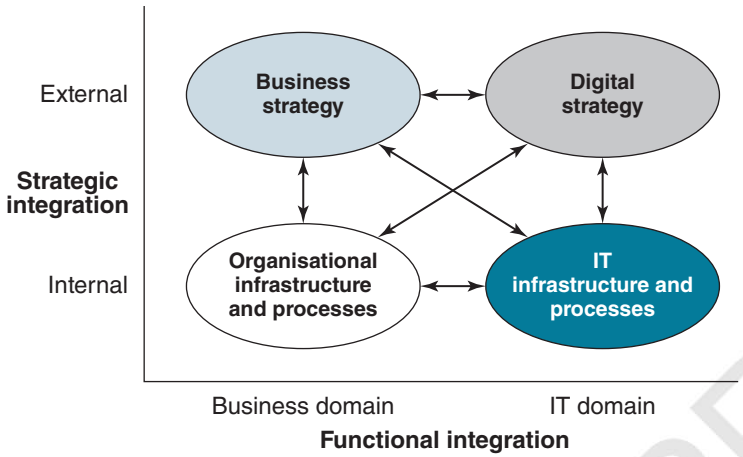


FIGURE 1.8 The strategic alignment model (SAM). (Source: Adapted from J.C. Henderson and N. Venkatraman, 'Strategic alignment: Leveraging information technology for transforming organisations', *IBM Systems Journal*, 32, 1, 1993, 4–16).

In an empirical study that explored business and IS/IT strategic alignment in the Australian banking industry, Broadbent and Weill[72] reported that central to alignment is the nature of the firm-wide strategy formulation processes of the banks. They noted that a key factor for the banks in developing a realized IS/IT strategy, consistent with business needs, is a flexible and issue-oriented strategy formulation process, with concurrent processes taking place at different organizational levels. In addition, their data indicated that those banks with the most effective management of IS/IT were ones in which IS/IT was managed by those closest to business needs. Other studies have shown that it is often informal organization structures and networks and close business/IT working relationships that enable alignment to be developed and sustained over time.[73]

Luftman[74] has developed a 'Strategic Alignment Maturity Assessment' instrument to evaluate the extent of an organization's strategic alignment, based on 12 components or alignment dimensions (see Box 1.6). He notes that achieving alignment is evolutionary and dynamic, requiring strong support from senior management, good working relationships, strong leadership, appropriate prioritization, trust and effective communication, as well as a thorough understanding of the business and technical environments. The challenges of achieving alignment and techniques to help achieve it will be considered later in Chapter 4.

Sustaining alignment when both the business environment and technologies change ever more quickly is complex and difficult. Recently, studies have emphasized the need for IS and IT strategies to adapt quickly to increasingly uncertain and dynamic environments,[75] calling for approaches such as ambidexterity,[76] adaptive,[77] dynamic alignment[78] and co-evolution[79] to be adopted. Although these studies articulate the many problems firms face in dynamic environments, they provide few examples of how dynamic adaptability or co-evolution can be achieved. For example, challenging Tanriverdi and colleagues'[80] argument to abandon the quest for alignment for the quest for co-evolution, Merali[81] notes that 'this then raises the challenge of selecting the dimensions for co-evolutionary fit for which they do not

BOX 1.6
The twelve components of alignment

I Business strategy

1 *Business scope.* Includes the markets, products, services, customers/clients, and locations where an enterprise competes as well as the competitors and potential competitors that affect the business environment.

2 *Distinctive competencies.* The critical success factors and core competencies that provide a firm with a potential competitive edge. This includes brand, research, manufacturing and product development, cost and pricing structure, and sales and distribution channels.

3 *Business governance.* How companies set the relationship between management, shareholders, and the board of directors. Also included are how the company is affected by government regulations, and how the firm manages its relationships and alliances with strategic partners.

II Organizational infrastructure and processes

4 *Administrative structure.* The way the firm organises its businesses. Examples include central, decentral, matrix, horizontal, vertical, geographic, federal, and functional

5 *Processes.* How the firm's businesses activities (the work performed by employees) operate or flow. Major issues include value added activities and process improvement.

6 *Skills.* HR considerations such as how to hire/fire, motivate, train/educate, and culture.

III Digital strategy

7 *Technology scope:* The important information applications and technologies.

8 *Systemic competencies:* Those capabilities (e.g., access to information that is important to the creation/achievement of a company's strategies) that distinguishes the IT services.

9 *IT governance.* How the authority for resources, risk, conflict resolution, and responsibility for IT is shared among business partners, IT management, and service providers. Project selection and prioritisation issues are included here.

IV IT infrastructure and processes

10 *Architecture.* The technology priorities, policies, and choices that allow applications, software, network, hardware, and data management to be integrated into a cohesive platform.

11 *Processes.* Those practices and activities carried out to develop and maintain applications and manage IT infrastructure.

12 *Skills.* IT human resource considerations such as how to recruit, motivate, train/educate, and culture.

Source: J. Luftman, 'Assessing business-IT alignment maturity', *Communications of AIS*, 2000. Reproduced with permission.

propose a solution'. Similarly, Weill and Aral[82] discuss the need to vary the criteria used in IS/IT investment decisions as business conditions and strategies evolve but offer limited advice on when to do so and how changes can be made.

The notion of co-evolution of business and IS/IT strategies signifies clearly that IS/IT does not only enable the execution of a strategy but it can also shape the strategy,[83] by providing opportunities for new strategies not possible without

technology: Rolls-Royce's 'Power by the Hour' engine availability service, for example, is not possible without sensor, satellite, communications and advanced analytics technologies. The implication is that management should not simply seek to identify and adopt the best available technologies to restructure the organization or streamline the business processes, but also consider the distinctive business capabilities and competences and innovative products and services that can be created and shaped by IS/IT.[84] The former identifies the potential impact of IS/IT on business strategy with consequent implications for organizational infrastructure; the latter seeks to provide the organization with new business strategic opportunities.

We have been making a strong argument for organizations to have an IS/IT strategy. We shall explore in depth how an organization can go about developing and managing this strategy in subsequent chapters, but it is also worth highlighting the possible consequences of not having an IS/IT strategy. It can lead to competitive disadvantage and even be a cause of business failure, but more generally it results in many ongoing and serious issues and problems in the organization, affecting both its performance and development. A number of such issues are listed in Box 1.7 – issues which many organizations can probably recognize and will admit exist.

BOX 1.7

Some issues and problems caused by the lack of IS/IT strategy

- IS/IT investments are made that do not support business objectives.
- Loss of control of IS/IT, leading to individuals often striving to achieve incompatible objectives through IS/IT.
- Systems are not integrated. This can also lead to duplication of effort and data leading to inaccuracy and no coherent information resource.
- No means of setting priorities for IS/IT projects, leading to problems in resource allocations and constantly changing plans, leading to delays and lower productivity.
- No mechanisms for deciding optimum resource levels or the best means of supplying applications.
- Poor management information; it is either not available, or inconsistent, inaccurate or too slow.
- Misunderstanding between users and IT specialists leading to conflict and dissatisfaction.
- Technology strategy is incoherent and constrains options: inadequate infrastructure investments made.
- All projects evaluated on a financial basis only.
- Problems caused by IS/IT investments can become a source of conflict between parts of the organization.
- Localized justification of investments can produce benefits that are actually counterproductive in the overall business context.
- Applications, on average, have a shorter than expected business life and require replacing more frequently than should be necessary, causing unnecessary business disruption.

Digital Strategies for the 21st Century: Building a Dynamic Capability to Leverage IS/IT

Neither technology nor competition is static: technology continues to advance at breakneck speed and competitor strategic moves and new entrants mean that managers must be continuously vigilant. In fact, parts of the IS strategy are probably obsolete before the ink even dries. Organizations therefore require more than just an IS/IT strategy but a capability to continuously sense opportunities and threats and respond in a timely fashion. We have suggested that this is a new, fourth era in the evolving use of IS/IT in organizations – what we have called the *IS capability* era.[85] The challenge with this era is not merely to build an IS/IT strategy (a third era objective) but to develop a more comprehensive capacity in an organization to ensure that any expected value is also delivered.

The External Context

The dynamics of IT, and hence the consequences for both business and IS/IT strategy development, are complex. Figure 1.9 attempts to depict this complexity and capture these dynamics. It first illustrates the duality of technology in that it not only supports the strategy of an organization (*arrow a – strategic alignment*) but can also define the business, as strategic moves may not be possible without technology (*arrow b – competitive impact*). Technology also facilitates new ways of organizing, process innovations and can enable the creation of innovative 'network-based businesses'. For example, organizations such as eBay, Uber and Amazon and many others deploy business models that are fundamentally defined by technology. One software company has a development strategy that 'follows the sun', where a virtual team works 24 hours a day on a project: the day begins in Dublin, eight hours later the work is handed over to Los Angeles and after a further eight hours the work is moved to Singapore, eventually returning back to Dublin 24 hours after it first began.

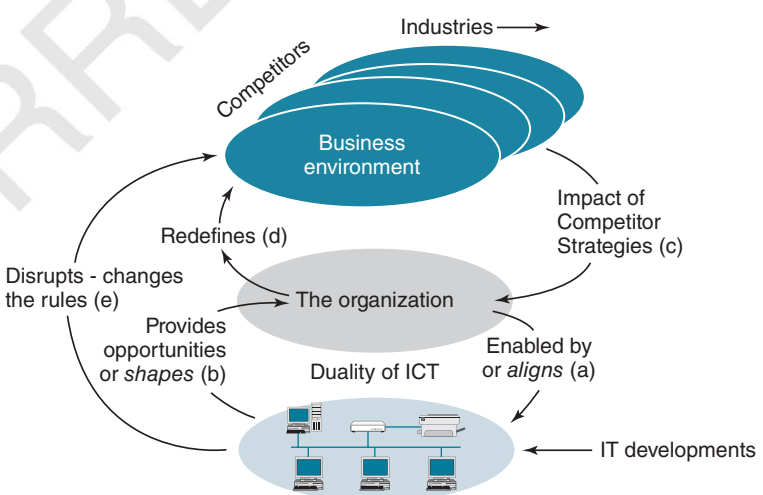


FIGURE 1.9 The competitive dynamics of IS/IT.

Some pharmaceutical companies operate their R&D activities in a similar way, which again is critically dependent on technology.

Most organizations do not exist in isolation but have competitors and are part of a wider industry and business environment. Competitors' moves, including new entrants, affect the dynamics of an industry and, consequently, the organization and its strategies (*arrow c*); at the same time, strategic plays made by the organization affect competitor moves *(arrow d*). Technological innovations can have disruptive effects on an industry (*arrow e*), rewriting the rules of competition and even challenging traditional notions of industry structure. For example, many retailers have entered the financial services industry on the premise that they know more about the customers of banks than the banks know about their own customers.

While this dynamic is driven by new technological innovations, it is less of a technology revolution than a revolution in the economics of information and how information is captured, processed, stored, planned and used in an organization. It is within this context that management must determine how the organization can best utilize technology to leverage information discontinuities, asymmetries and imperfections for business advantage.[86]

The Internal Context

Although organizations may gain some 'first mover advantage' with an innovative application, it is very probable that it will be quickly copied and therefore does not produce an advantage that is sustainable.[87] Furthermore, patent protection for IS applications is almost non-existent and keeping an IS innovation secret is difficult, especially when it is used by customers or suppliers.

While it would be easy to suggest that the 'classic' competitive advantage examples – many of which are mentioned in this book – resulted from a formal approach to IS/IT strategy development, more often than not they were the product of excellent exploitation of particular situations that arose in the course of business. Indeed, applications providing a basis for strategic advantage are sometimes due more to serendipity than any prescribed approaches to strategy formulation.[88]

While luck can certainly have a role to play in identifying potential competitive applications, the approach presented in this book together with its tools and techniques should enable organizations to reduce any dependence on luck; but luck should not be discounted. Energy company BP has coined the concept of 'manufactured serendipity' to refer to situations that might seem like 'ah-ha' moments when a possible IS/IT application is identified, but are actually the result of an orchestrated series of events, workshops and discussions held over many months. The company is very proactive in seeking out opportunities to leverage IS/IT to resolve business problems but also to provide what it calls 'game changer' opportunities, where IS/IT will significantly shape one of its businesses and bring in significant revenue.

One analysis of some of the early examples of competitive advantage from IS/IT[89] concluded that the attainment of sustained IS/IT-based competitive advantage may be more a process of building organizational infrastructure in order to enable what the authors refer to as 'innovative action strategies'. Another study[90] investigated the linkages between IT and the performance of firms in the retail industry, asserting that 'IT alone is not enough'. These authors conclude that some firms have gained advantage by using IT to leverage intangibles, complementary human and business

resources such as organizational flexibility, integrating business strategy and IS/IT strategy, and supplier relationships.

These findings are consistent with the Resource Based View (RBV) of business strategy[91] that emerged in the early 1990s. While this perspective is discussed in more detail in Chapter 2, it asserts that sustained competitive advantages result primarily from internal firm resources or capabilities; they are *valuable*, *rare, inimitable and not substitutable* (the *VRIN* attributes). RBV can be used to explain the relative success of some firms in using IS/IT and the underpinning competences that create that success[92] – this is discussed further in Chapter 10.

Using the RBV view as a lens to explore IS/IT and competitive advantage, Mata and colleagues[93] concluded that only IS/IT management skills are likely to be a source of sustained advantage from IS/IT. They described these skills as the ability of IS/IT managers to understand and appreciate business needs, their ability to work with functional managers, their ability to coordinate activities in ways that support other functional managers and their ability to anticipate future needs. Furthermore, they suggest that, in the search for IS/IT-based sources of sustainable advantage, organizations must focus less on IT, *per se*, and more on the process of organizing and managing IT. Further support for this position is provided by a McKinsey study[94] which concluded that what distinguishes organizations with high-performance IT is not technical wizardry but the way they manage their IS/IT activities. Perhaps Keen's[95] contribution to the debate is most helpful; he wrote that the 'wide difference in competitive organisational and economic benefits that companies gain from information technology rests in a management difference and not a technical difference. Some business leaders are somehow able to fit the pieces together better than others.' Our experience would echo this management difference argument.

The challenge is therefore for organizations to build a capability to continually identify and leverage the business and organizational opportunities provided by IS/IT.[96] This is broader than merely defining the IS/IT strategy but is being able to execute that strategy as well as ensuring the ability of employees to work effectively and creatively with information. We see this IS/IT or digital capability as having three core dimensions working in harmony: fusing business knowledge with IS/IT knowledge, a flexible and reusable IT platform, and an effective use process (see Figure 1.10):

1 *Fusing IS/IT knowledge and business knowledge* to ensure the conception of strategies to utilize technological innovation, to seize opportunities quickly and to implement these strategies successfully, including managing change and making appropriate technology sourcing decisions. It also involves knowing the extent of change that the business is capable of absorbing.

   This dimension seeks to overcome an all to frequent occurrence in organizations where those who work in the IS/IT unit are referred to as working in IT or simply given the label 'IT' while everyone else is referred to as 'the business'. This typically results in a 'culture gap', creating an 'us and them' situation.[97] While unhelpful, and indeed contributing to many of the problems that organizations have with IS/IT, it is unfortunately the reality. We suggest that it is more helpful to see the difference as one based on different knowledge bases. IS/IT professionals have primarily process, information and technical knowledge; those employees from the business have primarily functional, customer and industry knowledge.

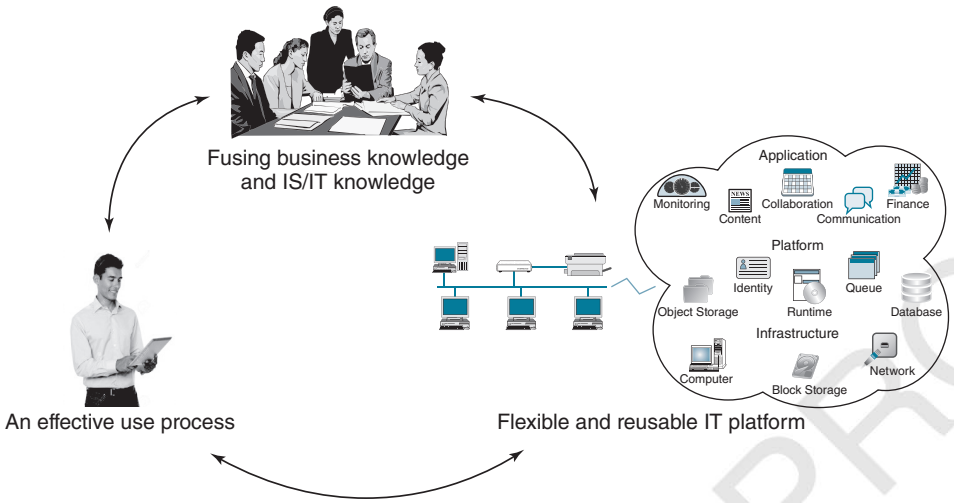


FIGURE 1.10 An organizational IS capability.

2 *A flexible and reusable IT infrastructure* provides the technical platform and resources needed to be able to respond quickly to competitor moves as well as the capacity to launch innovative applications creating new business products, services or processes. This infrastructure is the 'supply-side' component of the capability. Having the knowledge and skills, some of which may be bought in, the organization 'creates' an IT infrastructure that influences future options and speed of response and is sustainable. So, if the senior IT management team of an organization changes for example, the infrastructure that they may have been responsible for building remains behind; it is the embodiment of their knowledge.

3 *An effective use process to link IS/IT assets with value realization*, through the application of the technology as well as creating an environment conducive to collecting, organizing and maintaining information, together with embracing the right behaviours, both individually and collectively, for working with information.[98] Technology by itself has no inherent value; this value must be unlocked, a task that can only be achieved by people. While it might seem unnecessary to restate, technology must actually be used for benefits to be delivered!

These dimensions and how they can be established are discussed in the following chapters.

Building further on the RBV, the concept of *dynamic capabilities* has been proposed to explain why some organizations are able to adapt more quickly to changing external market and environmental conditions.[99] There are various definitions of dynamic capabilities, but perhaps the most relevant here is: 'the firm's processes that use resources. . . . to integrate, reconfigure, gain and release resources – to match and even create market change. Dynamic capabilities are therefore the organizational and strategic routines by which firms achieve new resource (and capability) configurations.'[100] Others have explored the extent to which a digital capability can or should be considered a dynamic capability as it undoubtedly can enable organizations to adapt rapidly to and even create market change.[101] An IS/IT or digital strategy as described here can therefore also be considered as a dynamic capability or at least its

aim is to create such a capability. Established aspects of IS/IT strategic management such as portfolio management, a key component of fusing IS/IT and business knowledge, have been shown to have the characteristics of a dynamic capability.[102]

Summary

The evolution of information systems and technology in a business and organizational context has been rapid, but erratic, from being seen as improving back-office efficiency to creating completely new strategic opportunities and business models. IS/IT economics, capabilities and ubiquity are increasing the range and complexity of tasks it can perform, at the same time as decreasing the costs: more and more can be achieved for less and less. The impact on most businesses, many industries and people's jobs and lives has been, and continues to be, profound. Although the progress has been fitful and unsynchronized, patterns can be observed.

Although long gone, the DP and MIS eras provided valuable lessons – in particular, regarding how to plan, develop and manage new applications and the associated projects and for the supporting infrastructure, specialist skills and managerial competences needed. Often the secret of good IS/IT planning was only really discovered after initial enthusiasm had turned to frustration – maybe just before disillusion was about to occur? Necessity was perhaps the mother of invention of better approaches?

The SIS era offered bigger prizes and, reciprocally, greater risks. As businesses became critically dependent on their investments in both IS applications and IT infrastructure, not just for success but, in many cases, for their very survival, IS/IT planning also became strategic for many organizations. That does not mean that previous era effective IS/IT strategy formulation and planning practices became obsolete, merely inadequate for the new era. The SIS era implies winners and losers with IS/IT, not just relative success and failure.

Since the millennium, increasing business pressures, in the main due to global competition and the improving capabilities and price/performance of IT, have led to the consideration of more radical strategies than previously. These can require the transformation of business processes, organizational structures and relationships, including outsourcing many non-core activities, to achieve major improvements in business performance. Changes to the organization's IS/IT or digital capability are often an integral component of this business transformation – in creating and implementing the new products and services, re-engineering processes, connecting with customers and suppliers, enabling new types of organization structures to function effectively and employees to perform more productively. Innovations in the use of information and new technologies are also essential ingredients in creating the options for change. Hence digital or IS/IT strategies, however they are called, will have to be more radical, adaptable and dynamic than they have been in the past.

The last obvious conclusion about the evolution of strategic planning for IS/IT is that it has become difficult to separate aspects of IS/IT strategy from business strategy. Hence, it is important to use the tools and techniques of business strategic analysis and planning to ensure that approaches to IS/IT strategy formulation and planning are, and are seen to be, an essential ingredient of business strategic management. Chapter 2 starts this integration process by considering the nature, processes and tools of business strategic management. Chapters 3 to 6 then address the specifics of the many techniques and issues involved in creating an appropriate, sustainable yet adaptable digital or IS/IT strategy.

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