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. Since 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
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‘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 provisioning, 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 competences 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 presented 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 literature1 – 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. 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.

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. 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). 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. 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, normally by making changes to the way business is conducted, how the organization operates or how people work. 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

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**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. 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 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 (see the following figure):

- Applications provisioning – essentially providing an information handling capability, either through proprietary applications such as property management, specialized healthcare patient record keeping
Information systems (IS), information technology (IT) and ‘Digital’

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
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. 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’. 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.