11
Managing the Supply of IT Services, Applications and Infrastructure

This chapter considers a number of strategic aspects of organizational IS/IT competencies that have not been covered in preceding chapters. The focus is on competencies in the 'Define the IT Capability', 'Supply' and 'Deliver Solutions' components of the model described in Chapter 8—see Figure 8.10. In particular, to complement the discussion of the management of demand-side IS strategies, this chapter discusses the equivalents on the supply side, but from a managerial not technical perspective. Overall, the supply side or IT strategies can be considered as a number of IT 'services' that the organization uses to enable deployment and exploitation of IS/IT. Those services can be provided by an in-house organization or an external supplier or, most commonly today, by a combination of the two. The nature of those services is first explored and then considered in terms of the different types of service management strategy that can be adopted.

Within the range of IT services, application development, or perhaps application *provision* given the move to buying or renting rather than building systems, is discussed in more detail since it is the 'service' that has the greatest impact on business development through IS/IT. Chapter 9 discussed the management of IS/IT investment and risk, with the assumption that the application development and implementation itself is successful, enabling the organization to realize the expected benefits. This chapter considers some of the issues to be addressed to ensure the development or provisioning process works effectively.

Planning for, justifying and managing investments in IT infrastructure has always been problematic, due to the large 'gap' between infrastructure provision and investment and the visible return for the cost involved. Some important considerations in managing infrastructure

development are discussed in this chapter. Finally, an ever-increasing percentage of organizations' IT services are being provided by external parties—outsourcers—in order to both improve IT economics and obtain skills, competencies and resources that cannot easily be provided in-house.

As discussed in Chapter 8, outsourcing has been a major IT strategy topic over the last 10–15 years, yet it has existed since organizational computing began in the 1960s. Many companies started using IT via bureau services provided by computer manufacturers, often supplemented by network and time-sharing services. Using package software is a form of outsourcing, not only of the development of that software but also of the design of the process models for the business activities covered. Subcontracting of both commodity programming and specialist design and implementation skills has been a common practice since the 1970s and many organizations have also employed IT consultants in a range of roles. 'Facilities Management' companies took over the running of many organizations' data centres in the 1980s. Outsourcing is therefore not new, but now almost any aspect of IT supply can be outsourced, including the provision of services traditionally delivered by applications, and the marketplace for such services is both considerable and influential. Outsource service providers like EDS and Internet Service Providers (ISPs) like AOL are now the largest buyers of IT equipment from the manufacturers. Strategic aspects of outsourcing, both decision making and management are considered toward the end of this chapter.

The scope implied by the chapter title is enormous, and there is no intention to provide full and comprehensive coverage of all possible areas. Instead, important strategic management aspects are covered in overview and the reader is referred to other texts that cover the subjects in much greater depth.

IT SERVICE STRATEGIES

In the late 1980s, it was observed that the role of the IS function in many organizations had changed from a production mode to mainly a service mode of operation.[1] Production (or construction) implied designing and developing application software and delivering operational systems—combinations of hardware and software to the business users. Adopting a service orientation, while including the delivery and support for applications, implies a wider range of approaches to enabling the business users to obtain and utilize information, systems and technology to meet their needs, as and when requirements arise. In the 1980s, organizations established 'Information Centres' that supported 'end-user com-

puting' on PCs and provided access to centrally held information and also external sources. It is estimated that 70–80% of IT costs in most organizations are now spent on services, rather than the development or purchase of application software or IT hardware.

That the IS function was providing a range of services has been recognized in Service Level Agreements (SLAs) for aspects of IT such as network uptime, response times and help-desk support for many years. However, two issues have driven the need to be more explicit about service management. First, many businesses now deliver some aspects of their product or service to customers via IS/IT, or via service centres that are totally dependent on IS/IT, implying that the quality and performance of IT services are visible not only internally but externally and affect the business performance and customer relationships directly. Second, as more and more aspects of service have been outsourced, contracts with suppliers defining service availability, performance and cost have become integral to IS management. If outsourcing decisions are to be based on objective, comparative data, then applying the same rationale for measuring service performance delivered by in-house resources is essential. While there is considerable literature on establishing service-level agreements and measuring service performance, there is very little concerning developing 'IT service strategies'—strategies that are linked closely to delivering and enhancing overall business performance. This is due in part to the difficulty in understanding and measuring the organizational benefits delivered from services. It is easier to measure service deficiencies and costs.

However, there is a considerable body of literature, based on studies of service businesses, that can be used to understand and classify types of IT service, help select appropriate service strategies and address issues in the development and delivery of such services. Using that literature on customer services, a more strategic and business-driven approach to IT service management can be defined. An overview of how that can be done is described below. Once the nature and business contribution of IT services can be understood more clearly, decisions on sourcing can be made more objectively. The need to integrate the development of IT service strategies with application management strategies to produce a distinctive 'IS capability' for the business is considered further in the last chapter.

TYPES OF IT SERVICE

The activities to be managed with regard to IT service provision in an organization were introduced in Chapter 8 (see Table 8.4). These can be classified in a number of ways according to the nature of the service

provided (as in Table 8.4) and how customers or clients utilize the service. Most classifications of IT services take a supply-side view, but, by using models from operations management and customer service, a user or demand-side view can be developed. First, however, some of the characteristics and nature of services in general and IT services in particular need to be considered:

- The service user is, to some extent at least, involved in the delivery process and influences the performance of the service. Different users have different expectations of the service and varying knowledge of how to use it. However, based on their general experience, service users now expect a high quality of service (availability, responsiveness, first-time problem resolution, etc), as they perceive it, whenever they avail of any service, whether it be internal or external. Measuring service performance is primarily about measuring user perceptions of the service delivered against their expectations.
- Services are, to a large extent, produced and consumed simultaneously based on a user request to be served. This implies that it is difficult to build an inventory of work and schedule activity and resources due to the uncertainty of demand. Equally, idle service capacity cannot be reused unless resources are flexible and can be deployed across a range of services or the work profile can be balanced across demand-driven and 'off-line' or developmental activities.
- However 'technical' the service, people and the role they play are critical to the perceptions of the service received—the 'service experience'. Proficiency and efficiency in satisfying the need are essential, but service quality will equally be judged on the nature of the personal interaction between the user and provider, at the point of delivery.
- The more the user understands what is involved in the service delivery process, its complexity or otherwise, the more their expectations of performance will match what can actually be achieved. Equally, if users can see the 'queue' for the service they require, the more 'reasonable' they become in their expectations. Often, the queue for IT services is not visible to the users, unlike in a physical environment such as a fast-food outlet or a sophisticated call centre, which informs callers of their queue position.
- There is often a difference between the user of the IT service and who pays for it, implying different perceptions of service value. This is similar to business-class or first-class travel, where the traveller may enjoy the convenience and quality of treatment, but the company may not see the very significantly higher cost as justified. The IS

budget holder may not be a significant user of IT services, and those who do use the service may be unaware of the costs of its provision.

As discussed in Chapter 8, one way of classifying IT services is based on their relationship to the supply and delivery of IT components such as hardware and application software to the business. In essence, this approach describes the service in terms of the IT-based activities involved, rather than the nature of value derived by the business or the service process required to meet users' needs. It is the latter view that creates an understanding of the range of service attributes needed, enabling the service to be designed and then operated to meet business requirements.

Classifying services according to the technical similarities of activities (e.g. technology delivery and maintenance services, application development services, strategy and planning services) is helpful from an IT resourcing and sourcing perspective. However, it tends to reinforce any user perceptions that, to obtain an effective service, the user has to know how and where to find the solution as well as how to define the problem! It is a view that considers the efficiency and organization of the IS function first and the effectiveness of service provision and the needs of the user second. Even within the broad categories described in Table 8.4, different components will need quite different service delivery processes to meet the users' needs (e.g. capacity planning versus business analysis).

A Service Process-based Classification

From the literature on service management, a matrix based on two key dimensions of the customer view of services can be developed (see Figure 11.1) that is relevant to the majority of IT services. The dimensions are:

- the nature and extent of user–provider contact involved; and
- the degree to which the service is customized to each user or user interaction.

This enables the development of four broad categories of service processes: 'Service Factory', 'Job Shop', 'Mass Service' and 'Professional Service'.[2] Both the *perceived* and *actual* value delivered by the service is different in each of the four quadrants, highlighting that different management issues must be addressed in each category. Service processes with

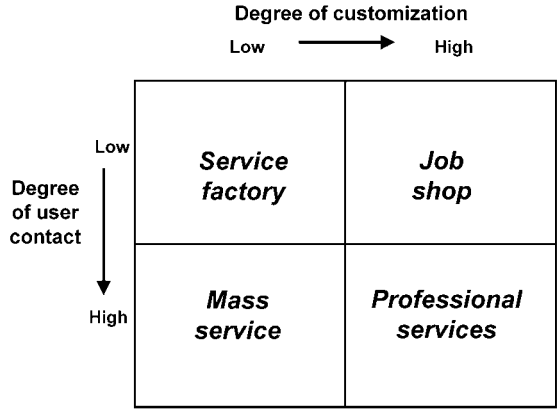

Figure 11.1 *Generic service models*

a high degree of customer contact are more difficult to control and standardize than those with a low degree of customer contact. In a high-contact system, the customer availability and priorities affect the timing of demand, the efficiency of resources used in delivering the service and the quality, or perceived quality, of service since the customer is involved in the process.

Service Factory: relatively low user contact and a low degree of customization. Obvious examples are many of the 'back-office' services such as security, capacity and network maintenance, software release/upgrades and installation of basic desktop facilities. Changes to applications to deal with statutory or compliance requirements (e.g. the Euro) would also be included in this category. Performance measurement can be relatively objective, based on supply-side delivery to agreed service levels, rather than the perceptions of particular service recipients. Key management issues in providing the service are: defining service-level agreements, scheduling service delivery and forecasting demand to avoid overload and promote 'off-peak' usage. Clearly, these types of service are the most amenable to outsourcing.

Job Shop: low user contact, but high customization, where much of the work is again done in the back office, but in response to particular, and possibly one-off, user needs. Software development, technical product evaluation and vendor assessment would be typical of this segment. While the service requests will vary in nature, some consistency in the approach or methodology is needed in order to estimate the time and resources needed and evaluate performance and quality of service across the range of customized tasks performed. User perceptions of their satisfaction with the outcome of each request will be in relation to the

'contract' agreed for the particular request. Accurate estimating of the work involved and ensuring schedules, as well as output quality, are met are essential to achieving customer service expectations. Many of these aspects of services can also be outsourced, but only after the task and service requirements are clearly defined for the eventual supplier. Management issues include: task prioritization and resource scheduling, flexible resourcing (internal and external), quality and consistency of 'back-office' service processes and methods, and defining meaningful performance measures.

Mass Service: considerable user contact and interaction, but low customization. Typically, help desks and essential IS/IT skills training would be in this quadrant, given the 'one-size fits all' rationale to deliver consistent quality of service economically, either from internal or external resources. The attributes of the service staff are critical to the user perception of the performance, hence the development of appropriate interpersonal and communication skills will be as important as their 'technical' knowledge. Given the high degree of user interaction, it has to be clear to both recipient and provider how much of the service is prescriptive and how much discretion is allowed to customize (to a degree) the delivery to the needs and circumstances of the recipient. In many organizations, 'expert users' are established, and it is important that the individual providing the service understands whether they are dealing with the expert or a relative 'novice'. While some flexibility is essential to accommodate the varying levels of user knowledge, a lack of clear service boundaries can produce a drift toward the professional services box. Equally, a lack of interpersonal skills and an overly-prescriptive approach will make the service 'feel' more like the service factory described above.

Measurement of service performance has to be a balanced view between actual performance against the 'contract' plus the recipients' perceptions of the service received. While, once more, these can be outsourced, softer, cultural issues, rather than just economic and technical, need to be considered in choosing the service supplier. The management issues include those for the service factory, but, in addition, involve establishing service parameters and boundaries (degrees of discretion versus prescription), developing staff with the necessary combinations of personal and technical competencies and matching resource levels to the cycles in demand.

Professional Services: while these are highly customized and involve considerable user contact, they are also typified by relatively few, but complex, 'transactions' with any particular user. Considerable judgement and discretion is implied in the provider, to understand and respond to the user requirement and identify the best way to satisfy the needs, or not,

if the requirement does not justify this type of service. To a large extent, how the 'transaction' evolves will rely on either the service user being able to articulate the needs or facilitation to enable the articulation. Equally, the availability of user resources and the knowledge they have about how to use the service effectively will have a significant effect on the service provision. Strategy development, consultancy, business analysis and systems, and process design are services that are normally in this category. Measurement of service performance is essentially subjective, based on how well the perceived need was met, the effectiveness of the process and the nature of the interaction with the service provider. It is not really feasible to set Service Level Agreements in this area, but each 'transaction' will need agreement on schedules, deliverables, costs, etc. if perceptions of performance are to be satisfactorily reconciled with expectations.

The management issues in this quadrant include those of the job shop, but, in addition, the knowledge, personal skills and resourcefulness of the individual staff involved will be crucial to satisfying the users. Obviously, discretion, rather than prescription, will generally be required, implying staff with the understanding and experience of accurately eliciting and then translating requirements through planning to delivery, probably using a range of resources, are essential.

The management issues are summarized in Figure 11.2. Although it is tempting to allocate each of the IT service activities to a 'box', the organization has choices about the way it wishes the services to be

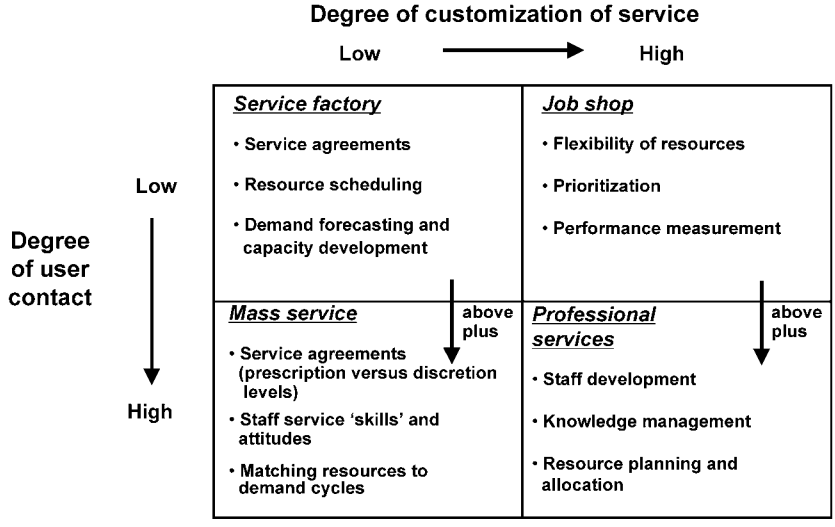

Figure 11.2 *Service models: some key management issues*

operationalized. Many of the service archetypes can be provided to different people through different processes. Training, for example, can be bespoke and tailored to an audience, and thus considered a professional service, or provided as a standard training course, in essence a mass service. If the course is delivered over the Web, it is more correctly positioned as a service factory. In a large pharmaceutical company, for economic reasons, it was decided to centralize application support within the large technical help desk. 'Traffic' volumes were low, very few application users phoned or emailed the help desk, preferring still to consult a local IT person on site, who then could contact the help desk if necessary. The reason was that the real value to the users were the 'workarounds' that the local IT person, with in-depth application knowledge, could suggest while the problem was being fixed. It is important to understand how users derive value from the service before deciding how to provide it.

Examples of types of service that would frequently sit in each quadrant are given in Figure 11.3. Application development or provisioning, which is discussed in the next section, might use a number of the services, located in different quadrants, during the project.

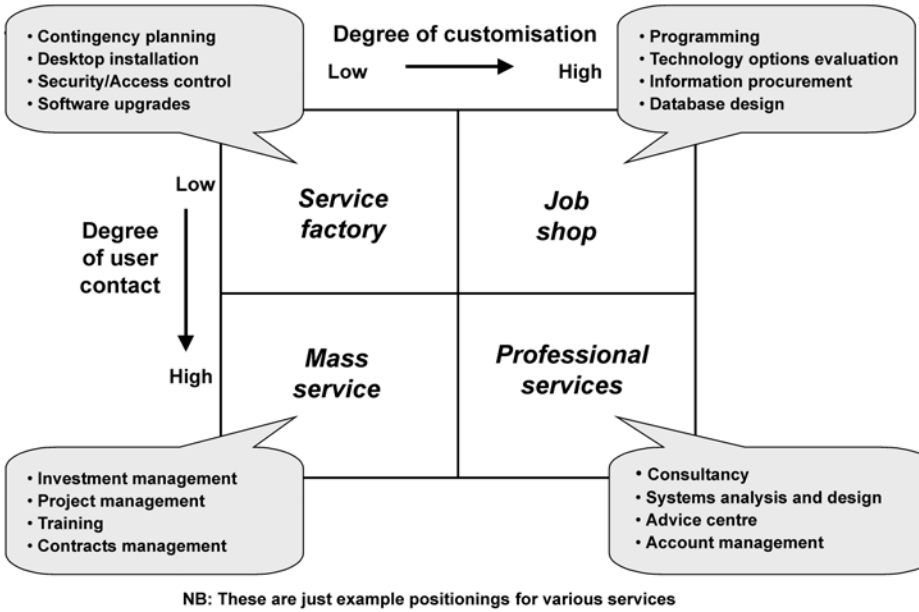

Figure 11.3 *Service models and IT services—examples*

IS/IT Service Quality

Considerable research has been done to develop approaches to defining service quality and measuring both the technical and 'emotional' (i.e. how the user experiences the service) quality.[3] That literature is too extensive to describe in detail here, but an overall framework for structuring and developing an IT service is shown in Figure 11.4. It also forms the basis for measuring the service components in terms of performance to specification and perceived performance by the users. It does rely on the service consumers being able to define the value they expect to obtain from the service—a difficult concept. Often, this has to be in terms of the negative consequences of service unavailability or underperformance, to justify the cost against failure of the business to operate 'normally'. Establishing more effective and relevant ways of describing and then measuring the value derived by both individual users and the organization in total is a major challenge for future IS strategy development, as discussed in the final chapter.

Many IS functions carry out customer service satisfaction surveys, but, if not well constructed, the results can be misleading. Before asking a user to evaluate a service, or its more detailed attributes such as availability or responsiveness, the importance or otherwise of the service or service

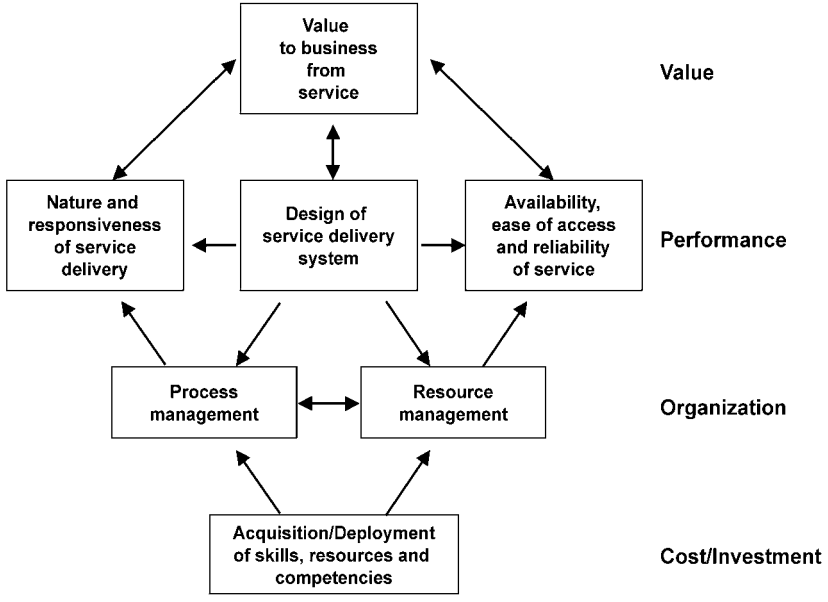

Figure 11.4 *An overall service framework*

attribute to the user needs to be understood. 'Importance' is a surrogate for service value in terms of how dependent the user is in carrying out his or her role and tasks on the quality of service received. Evaluating services, in achieving the required performance for those who depend on it, is more important than satisfying those for whom it is of no great consequence. Therefore, any satisfaction survey must first determine the context within which the user is judging performance.[4]

However services are assessed or measured, users will continually expect improvement, for it to be 'perfect' on every occasion. Of course, there will always be ways, at a cost, of improving any aspect of the service. However, it may not be worthwhile to expend more resources to deliver the ultimate expectations, and an assessment of whether 'gaps' in service delivery are worth overcoming or whether actions to change user expectations are more valid. Work by a number of researchers[5] studying the nature of gaps that can occur in IT service delivery, based on general service management, is very helpful in understanding why the gaps exist and to select the best options for closing them. Figure 11.5 shows the basic model for assessment.

The causes of the gaps (1–5) are as follows:

1. Not understanding what users expect or value due to:
   —a lack of user needs analysis;
   —ineffective communication by either or both parties;
   —excessive bureaucracy in the IS function.
2. Setting the wrong IT Service Standards due to:
   —lack of commitment to IT services by IS management;
   —perceptions of infeasibility in meeting user demands;
   —inadequate task definition and standardization or inadequate resourcing to standards set;
   —absence of objectives for the service to achieve and/or inappropriate performance measurements.
3. Underperformance of the service due to:
   —role ambiguity, including the user's role in service delivery;
   —lack of resource availability;
   —lack of actual or perceived controls;
   —lack of teamwork and inappropriate resource use, or inappropriate use of the service.
4. Poor communication of what the service is and can deliver due to:
   —a propensity to overpromise and/or overreact to 'complaints';
   —inconsistent communication across the user communities;
   —lack of visibility of the service process.
5. Expectation versus perception gap due to:
   —not understanding user requirements and reasons for them;

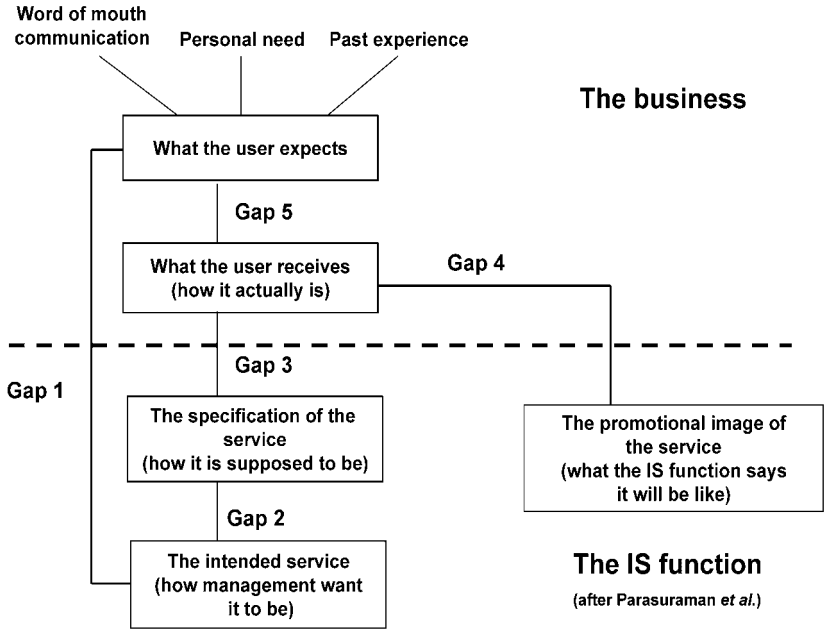

Figure 11.5 *The gaps in the IS service delivery* (source: *based on the work of Parasuraman, Berry and Zeithaml)*

—users not understanding the service process and the implications of their demands;
—user expectations actually being impossible to satisfy!

Regular and balanced assessment of service performance is required to detect emerging problems and issues, the causes and consequences, in order to adjust the appropriate components of the service framework. Failure to do so will directly or indirectly impact business performance, resulting in a poor perception of the role and value of IS/IT in the organization, and difficulties for the IS function to obtain resources and investment to deliver the IT strategy. While most assessment of performance is carried out to enable pertinent improvements to be made, the assessment may well reveal areas of apparent overperformance! If the perceived performance is judged by users to be high but, in reality, compared with similar organizations, actual performance is poor, the business is suffering a degree of 'delusion' if it believes it is using IS/IT successfully!

In the context of outsourcing decision making for IT services, Lacity and Hirschheim[6] provide a simple yet effective matrix for summarizing perceptions of the inevitable trade-off between the service delivered and the cost to the organization of the service provision (see Figure 11.6). Senior management will pay attention to the costs of IT, but are probably minimal users of services, whereas users themselves are very aware of the quality of services, but probably unaware of costs. Ideally, to satisfy both, providing a premium service at minimal cost is the objective, but rarely achievable in every aspect of service.

Choices have to have been made on objectives for each of the other segments—whether the strategy should be to maintain the services at existing levels and find more cost-effective means of meeting them or whether to improve the services by justifiable investment. This must be made explicit to both business users and senior management or once more expectations will not be aligned. If users perceive a service as poor and management deem it expensive—the Black Hole—it may be too late for IS management to retrieve the situation and alternative service suppliers may be considered without reference to the IS management! Outsourcing strategies and the associated issues are considered later in this chapter.

APPLICATION DEVELOPMENT AND PROVISIONING STRATEGIES

As stated earlier, application development might be better labelled application 'provision', in the sense that many applications are now bought in rather than custom-built in-house. The proportion of application software custom-built versus purchased packages varies across industries. In financial services, 80% of all applications were custom-developed even in 2001, whereas the figure for manufacturing industries is much lower.[7]

The emergence of Application Service Providers (ASPs), providing rented software via the Internet, is the latest development in this area; the role and potential of ASPs is considered later in the chapter, under outsourcing. Although less application software is produced in-house, custom-built software is often developed by third parties, and most large software packages require extensive configuration and even some customization before they are implemented. The trend for more and more of an organization's applications to be designed and developed by major software houses or 'business solutions' companies is likely to continue. It is not the purpose of this section to consider all aspects of application development and implementation. There are many good texts covering systems design and development methods and their applicability,

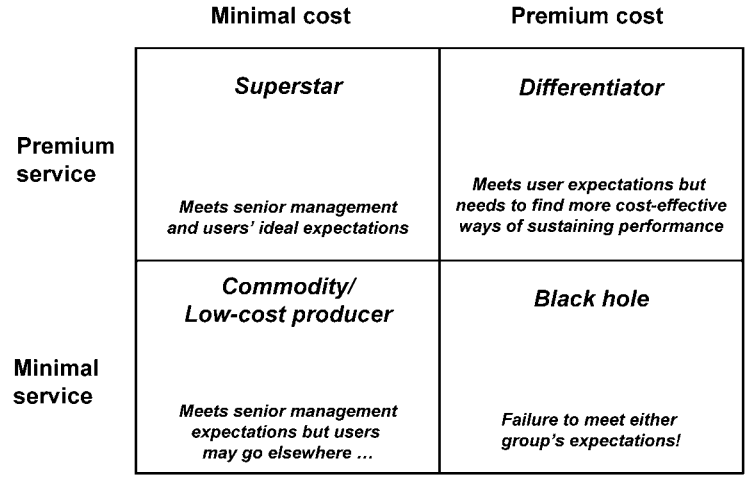

Figure 11.6 *IT cost/service trade-off* (source: *M.C. Lacity and R. Hirschheim,* Beyond the Information Systems Outsourcing Bandwagon: The Insourcing Response, *John Wiley & Sons, Chichester, UK, 1995)*

software engineering, database design and project management.[8] The intention here is to consider a number of strategic issues that have to be addressed in the context of enabling the desired application portfolio to be realized successfully, leading to the delivery of the desired benefits.

The challenges for application development or provisioning have become more demanding as IS/IT has become integral to business performance. At the same time, the business environment has been changing more quickly and dramatically, producing increased uncertainty and the need for flexibility and adaptability of processes and systems. The main issues for application development can be summarized as:

- providing new applications more quickly in response to changing business demands;
- more cost-effective production or acquisition of more types of application and reduce ongoing maintenance costs;
- increasing the quality and reliability of the software as it becomes integral to the business processes;
- developing more customer-focused applications that can be used easily by untrained people;
- devising more flexible or adaptable applications than can be enhanced or modified quickly at low incremental cost;
- providing efficient, seamless integration of business activities across different applications from the desktop;

- ensuring maximum value can be gained from the information assets of the organization.

In other words—faster, cheaper, better, more flexible and easier to use! Few of these are new demands, except perhaps customer-centric designed systems, but the history of IS/IT has been one of increasing expectations of what can be done 'relatively easily', promoted largely by the IT industry, counterbalanced by the inherent difficulties of designing and implementing complex computer-based systems in complex and evolving businesses.

ALIGNING THE DEVELOPMENT APPROACH TO THE APPLICATIONS PORTFOLIO

The use of the applications portfolio as a guide to the overall approach to key issues in applications management was discussed to some degree in Chapter 7. Within the principles described there, this section considers in more detail the approaches to development or providing the applications, especially the differences across the portfolio.

Strategic Applications

For strategic systems, speed of development and flexibility of design are essential, and cost is less important especially when the goal is gaining and sustaining competitive advantage. The 'window of opportunity' may be short-lived or uncertain. They are best achieved through a close partnership between business users (preferably senior managers who understand the emerging business needs) and very experienced IS/IT business analysts, to ensure that the business needs are analysed and met in the most effective way. This is especially important when the system has external linkages to customers or suppliers and is delivering benefits to both parties. There is often a need for incremental development, since new options and needs will be discovered as implementation proceeds. Typically, the system is not automating an existing business process, but changing or creating one.

Few organizations have developed successful strategic systems without first having established coherent business application and information architectures for key operational systems. Strategic systems frequently use information from a number of different existing systems. The information in the strategic application will often need to be vertically integrated with these underlying systems and may also import information

from outside sources. An example of this comes from some financial institutions, which are now able to offer integrated current, savings and loans (like mortgages) netting off the interest accrued in each and minimizing the amount held in the current account. This required taking data from the underlying different product systems, which are account-orientated, linking all the accounts together by individual customer, then managing the customers' accounts accordingly. Where the underlying product systems have evolved in a piecemeal fashion with relatively little thought toward the total view of the relationship with the customer, this has proved difficult, but new 'online' banks have been able to design the systems from a customer viewpoint.

To create effective new applications, easy access to relevant information is very important and often best served by advanced database technology—relational or object-oriented—associated with a sophisticated data dictionary. Another approach may be to apply a component-based development to produce a set of key objects, stored as reusable modules in a repository. Some objects may be created by 'shrink-wrapping' software modules taken from key operational systems. Both relational and object databases containing the principal elements of the corporate model give the necessary flexibility in terms of viewing, manipulating and accessing information.

Strategic systems are likely to be complex or will become complex as functions are added incrementally. They are also required to be developed quickly, and the application may have to be 'generated' many times as it is changed. A Dynamic Systems Development Methodology (DSDM) incorporating prototyping is most effective here in clarifying needs and options, and building components and applications. Speed, flexibility and complexity all lead to problems of controlling the development, and a DSDM combines time boxing and deliverables/version management to avoid subsequent expensive rework or maintenance. Continuity in terms of the development team, both business and IT members, will be critical to managing the evolving knowledge in an environment that will not encourage accurate documentation, adherence to standards or the best in quality-control processes. Those standards should not be ignored, but business expediency will have to overrule technical idealism in many cases, especially if adherence could extend the development time and perhaps miss the business opportunities.

This need would also argue for the use of integrated development environments employing Rapid Application Development (RAD) tools. The initial analysis and design can be performed using automated tools that would then produce code, which, though not particularly efficient, will at least be very quickly developed and enable changes to be identified and implemented rapidly.

The speed of development of the application is on balance more important than its cost of operation, but high performance, especially if the system is used by customers, could be a critical success factor. Eventually, these applications will probably become key operational, when they may need to be reimplemented in order to make them more efficient and less costly in their operation. Interconnectability, often via middleware rather than full integration, may be the initial goal, in order to assess the value of the strategic system while protecting the installed base of key operational systems. Many front-end consumer Web applications were initially interfaced with core processing systems to 'test the market', but the most successful were those that were quickly integrated with those core processes to deliver end-to-end responsiveness to the customer. The Internet flight-booking systems of easyJet, Ryanair and Southwest Airlines, compared with more traditional airlines, are good examples.

As these systems are taking the enterprise into new areas, there will often be a need for new business processes, competencies or operational skills as well as technical knowledge. For example, in the use of data warehouses and data mining, knowledge of advanced statistical analysis techniques would be required. A customer relationship management system may require customer service staff to develop selling skills. User management must ensure that these essential business skills are developed or the application will fail to be exploited to advantage.

It is unlikely that available software packages will provide all the requirements for this type of application. Significant advantage cannot accrue from generally available software, unless the business adds value to the package (e.g. by considerable enhancement, finding a new use of the package or changing business practices in an innovative way). In these cases, the package becomes a unique application and, as such, it must be supported as if it were tailor-made. Alternatively, a short-lived advantage could accrue from being the first user of a new package—but success could be very quickly and easily copied. It is also high risk to be the first user of an externally supplied package that would normally be tried out in the high potential segment. Fundamentally, sustained advantage comes from the uniqueness of the application, which others cannot easily replicate or improve upon.

Key Operational Applications

These are generally the 'workhorse' systems, carrying out the main operational processes of the business (e.g. customer order entry and fulfilment should be well designed both in business process and technical terms). Key operational systems need to be efficient and robust, to deliver cost-

effective and problem-free use over an extended period. Since they often have to be integrated with other primary business process systems, they benefit from adhering to information management standards and from complying with the evolving long-term systems and information architecture. They can often be met by application packages or third-party-developed software, but further development may be needed to provide effective integration, resource sharing and information management. By selecting a comprehensive package (e.g. ERP), the additional work can be avoided, but some user needs may have to be compromised. When developed in-house, they are usually produced using traditional project management (e.g. PRINCE) and formal structured methods (e.g. SSADM), automated with software and information engineering tools. In most cases, key operational 'developments' are replacements for old systems and design and construction, or configuration in the case of a package, must be comprehensive and precise if business operations are not to be adversely affected on implementation. There is always a trade-off to be made between the system functionality provided and the extent of the business change that can be made to reduce process complexity, especially with large software packages. Therefore, it is important to understand which core process is most critical to success.

Often, bringing in a package is the best way of achieving integration of application requirements among the various departments or functions, who would otherwise attempt to satisfy their own needs without regard to the effects on others. 'Making the package work' can often override localized objectives, although, if badly managed, it could become a target for every department to engineer its failure! Unlike support-type packages, however, a key operational package will probably need considerable IS professional support to ensure that integration and effective operation are achieved.

Key operational applications will tend to be functionally complex, have integrated interfaces and dependencies and should satisfy requirements with minimum compromise of the user's main needs. Even where a package is selected, it may have to be customized, despite the risks involved—and this will require a thorough technical understanding of how the package works as well as what it does. Whether a system is developed or a package modified, an accurate specification of *what it has to do* and *how it has to do it* will have to be established. A structured logical model of the system must be developed to enable the application to be engineered accurately. That model, documented or simulated via software engineering tools, and supporting data dictionaries, etc. must be maintained and updated whenever the system changes. Strict change-control procedures must be in place to prevent errors being introduced, when amendments and upgrades are implemented. These errors may not

be easy to predict since they may only manifest themselves in downstream systems.

Because this type of system will require ongoing modification in order to avoid falling behind the business requirements, there should be a high level of technical support skills available for both emergency action and changes. If a package is used, it can present difficulties to the organization when new releases of the underlying application package need to be implemented (i.e. changes may have to be made even if the business does not require them). Worse still, if the package has been heavily customized, valuable new functionality that becomes available may not be able to be adopted. For many of these systems, a dedicated support team is required after implementation, consisting of both users and IS professionals. It is important to develop skills related to the specific system, not just employ generalists to correct and amend the system when available. Releases of new versions of the system software must be carefully tested, updated user training carried out and reviewed in terms of the effective use of the new functionality.

Support Applications

If new support applications are required or existing ones are to be replaced, the most appropriate solution is to buy in sound standard proprietary packages that meet the business requirements as closely as possible. The package should not be customized: business processes and procedures should be amended to fit the package. Very rarely can an organization justify the allocation of valuable skills and resources to developing support systems for themselves or the future costs of modifying every new package release to satisfy their business idiosyncrasies.

The resources required to implement a package for both key operational or support environments are frequently underestimated. Requirements still need to be carefully analysed and documented, and the evaluation process undertaken must be linked to the justification, prioritization and benefit management processes. Even if no tailoring of the package is necessary, there are often interfaces to be built to existing systems and databases, and there may be considerable work needed to configure package parameters, undertake user training programs, develop adequate testing material, convert existing data and implement the system. An allowance of resources may also be needed for the work involved in vendor management relating to supply and service activities.

Even if the 'databases' in the packages are not ideally suited to the organization's information architecture, integration of information is often less critical in support applications than the ability to transfer information. Meeting the task requirement in the overall most efficient

way is essential to success, therefore packages should not be ruled out just because they cannot be integrated. User needs are paramount in the final choice, but the IS function's veto of certain options must be allowed if they cannot provide support for the required technical environment, otherwise overhead cost build-up will offset the direct efficiency benefits. Equally, it is best to adopt a low risk or conservative approach, only selecting packages with a well-established base of customers, rather than be the first user of a new package, however good its apparent features. A package selection checklist can easily be drawn up to help users to define requirements and decide on options.

Support systems, because they are not critical to success, are prime candidates for outsourcing to a third party, especially if the system is using up resources that are needed on more important applications and, in addition, the organization needs to develop different skills.

High Potential 'Applications'

As discussed in Chapter 7, the term 'applications' is perhaps inappropriate in the high potential segment, since it is the research and development (R&D) activity enabling new technology to be tried out to ascertain its potential applications for the organization, or to explore the potential of technology in relation to an innovative business idea. The need is for independent, rapid, low-cost development of prototypes and even pilot implementations that, if they fail, can be abandoned without wasting significant resources. Since risk is high and success is far from certain, effective cost control is essential.

As has been said before, these R&D-type activities should be separated from mainstream systems, to enable them to be evaluated on their merits. The main objective is to evaluate the business potential of applying any technology, but in some cases the potential may not only be where the initial use of a new technology is tried. This may mean splitting the prototyping objectives into those that are application-specific and those that are for more general learning. Equally, the potential of the technology should not be explored in abstract without some application in mind. This is a recipe for pouring money down the drain. Clear terms of reference or objectives should be established at the start, but they may need to be consciously (and overtly) modified as knowledge is acquired.

The most obvious danger is that users and even senior management become so enthusiastic about a successful prototype that it becomes a fully operational system, even though it is made of 'string and glue' and has not been designed for use on a large scale. Many good ideas, especially for Internet applications, have proved less than successful when implemented, since the required performance or reliability could

not be achieved in operation. An example is boo.com's clothing website, which was far too slow in loading complex graphics. This frustrated potential customers and probably contributed to the company's demise.

Often, the organization will have to acquire or develop new technological skills to develop the applications and support the process of evaluation. Some skills may have to be acquired through the vendor or outside experts, but it is important that effective knowledge transfer occurs during the evaluation phase, to avoid future dependence on technical skills only available outside.

While high-potential applications should be evaluated in association with a particular technology, it may be that more than one option exists for evaluation. It can be advisable to carry out parallel, competing R&D projects focused on one business application, especially if the potential benefits appear very high, if speed is of the essence and/or competitors are carrying out similar evaluations. However, in this case the eventual decision criteria must be clearly spelled out or the process will only leave more uncertainty at the end than there was at the start!

Figure 11.7 summarizes some of the key issues in managing application developments in each of the segments of the portfolio.

THE SPECIAL CASE OF 'ENTERPRISE SYSTEMS'

The 1990s saw the extensive implementation of Enterprise (or Enterprise-wide) Systems (ES) across many industries. The best known are probably the Enterprise Resource Planning (ERP) packages provided by a range of vendors, initially for the manufacturing sector. Since then, versions of ERP have been developed for other industries such as logistics, utilities, health care, retail and even education. ES systems, either package based or custom built, have been developed across most industrial and commercial sectors, ranging from Customer Relationship Management (CRM), Call Centre Management, Supply Chain Management (SCM), Policy Administration (in insurance) to Electronic Patient Records in health care. Their chief characteristic is that they affect a large number of organizational processes and functions, standardizing and integrating information and activities. Few are truly enterprise-wide in the sense that they deal with all the business information needs, but all have a significant influence on the overall IS strategy of the organization. ES do not normally fit into any one of the four portfolio segments, given the activities covered and the range of potential benefits available. Therefore, they often involve a combination of all the portfolio issues, the mixture being dependent on both the intent of the investment and the current situation across the activities.

STRATEGIC	HIGH POTENTIAL
• Application generators • Dynamic Systems Development Methodologies (DSDM) • Joint Application Development teams (JAD) - share knowledge • Iterative development via prototypes/pilots • Create new processes and databases • Effective links to key operational systems - but protect core systems • Packages unlikely to meet needs unless modified to unique version • Design for adaptability to meet changing needs	• Prototyping and business pilots of applications to test performance, scaling, acceptance • Evaluation of benefits and how to achieve them • Rapid, low-cost, iterative development • Business champion • Fixed time/cost allowance • New skills/skills transfer from external expertise • Independent - low integration
• Structured Systems Development Methodologies (SSDM) • Software engineering • Industry-specific packages - integrate/interface across packages but minimal customization • Corporate data management controls • Combined systems and business knowledge in development team • Process re-engineering • Strict specification and change control processes • Design for performance	• Standard functional packages - compromise business needs to package capabilities. No customization • Low-risk, proven solutions • Outsource operation and maintenance - if cost-effective • Interface, not integrate • Use package databases and data standards • Design procedures and processes to use the software efficiently • Buy, not build
KEY OPERATIONAL	SUPPORT

Figure 11.7 *Development approaches and characteristics*

While part of the reason for the growth in their use has been the development of comprehensive packages by the software suppliers, five other issues have accelerated their adoption:

- replacement of existing systems to satisfy the Y2K requirements, more cost-effectively than amending all the existing applications;
- replacement of non-integrated legacy systems by integrated applications and data bases to reduce long-term costs and provide higher-quality systems that incorporate industry 'best practice';
- increasing legislation and regulation in many industries has made

'compliance' a major issue, and buying comprehensive 'compliant' software can help avoid the serious consequences of failure to satisfy the regulators;

- provision of application architectures and business processes, to enable quick and effective moves into electronic commerce and internal adoption of e-business practices;
- in multinational or global organizations, the need to expand the business by rapid replication of existing business models, to use resources and knowledge flexibly across products, services and markets as well as to deal consistently and effectively with large global customers.

Overall, whatever the particular type of ES, the main differences from more traditional IS developments are the ambitious intentions, the application complexity and cross-functional scope, the range of different stakeholders involved, and extent of business and organization changes needed to accommodate the new business models inherent in the ES. Oh! and the possibility of bringing the business to a grinding halt if it fails!

In the late 1990s many papers and books were written to provide understanding of these issues, their interrelationships and how to address them.[9] Most writings to date have been based on the now extensive experience available from ERP implementations, but the lessons are equally valid for other ES developments. The main ones are summarized here.

While ES implementations are, based on their scope and potential impact, major organizational change initiatives, many default to become 'software projects'. In a survey of the success criteria[10] for ERP projects, 89% were judged successful—the software worked and the project was delivered close to time and cost forecasts. But only 25% had achieved the intended business benefits. The example in Table 11.1 perhaps summarizes the main reasons for this. The company concerned implemented an ERP package twice! The first time was unsuccessful, but they realised why and had the courage to try again and this time succeeded.

This company's experience is not unusual—many organizations are reimplementing such systems to gain the benefits that were not achieved the first time. A major pharmaceutical company implemented an ERP system worldwide in the 1990s across all its manufacturing units, but allowed considerable degrees of freedom to each unit in how it 'customized' and utilized the package. As a result, the major supply-chain benefits that were expected did not accrue. The reimplementation is more standardized and requires the units to change their practices to

Table 11.1 *Implementing 'Enterprise Resource Planning' systems—one company's experience* (source: Achieving the Benefits from Software Package Enabled Business Improvement Programmes, *Best Practice Guidelines, IMPACT, London, 1998)*

First attempt—failure	Second attempt—success
IS led, with insufficient knowledge of the business function concerned	Business Function led, by a newly recruited manager, experienced in the function, supported by IS
Belief that the requirements were simple and already known—just use the package to automate the current processes	Site visits and reviews of other companies procedures to establish best practice and system requirements
Belief that this was a low-risk and straightforward implementation	Knowledge that this would require some major changes
Lack of business buy-in led to both the new and old (mainly manual) system remaining in place, and little move by the business to adopt the new system	New procedures completely replaced the previous system and all staff were required to use them; facilities for the old system withdrawn
Little business change	Organizational and business process changes
Bespoke amendment of package. Longer and more complex system build, and difficulty applying upgrades	Minimal changes to the package, and innovative use of built-in facilities. Shorter delivery timescale and easy future upgrade paths
Costs, no benefits	Benefits have exceeded expectations

improve the performance and agility of the supply chains for all the main products.

One general theme from research[11] into ES implementations that has emerged reflects this recurring two-phase approach. Phase I involves creating a coherent link between the future business vision and how the ES either creates that vision or enables it to happen. Unfortunately, that vision often ignores or minimizes the current problems and constraints that limit the organization's ability to implement the ES successfully. A more appropriate approach to the first phase is to establish an overall vision for how the business will operate once the full benefits of the ES can be realized, but set an initial intent that delivers a 'new baseline' where the problems and constraints have been removed. Phase I implementation should deliver this new baseline, often via a basic, even limited, standard (or 'vanilla') implementation of the software with associated

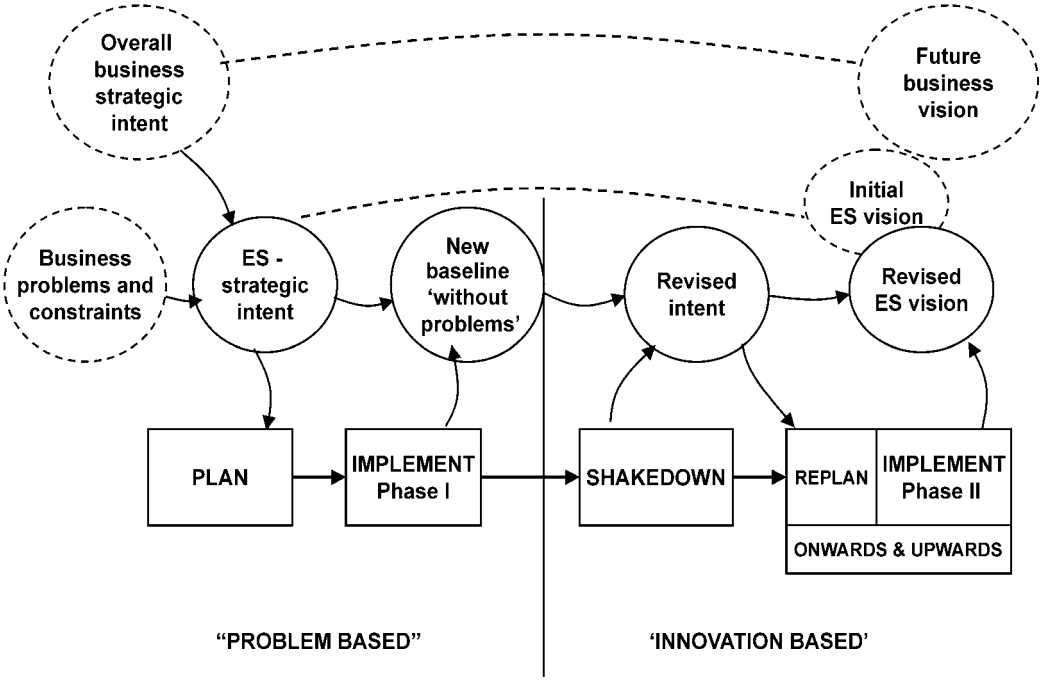

Figure 11.8 *Enterprise systems—the two-stage view of implementation*

essential business practice changes. Studies[12] show that business performance often deteriorates immediately after implementation, and contingencies to allow for this are needed—increased inventories, more resources and informing trading partners of expectations. A 'shakedown' phase normally follows in which an understanding of:

(a) how to optimize performance through further changes to business practices and software reconfiguration; and
(b) how further benefits can now be achieved by using more capabilities of the software and by more radical or extensive business and organizational changes.

A new vision (hopefully not much reduced from the original!) is then needed to develop new objectives and plans to achieve innovations in business processes and practices based on the ES capability now available to the business. A model, based on the results of a number of studies but using much of the terminology of Markus *et al.*,[13] is shown in Figure 11.8. The two stages can be summarized as 'problem based' to achieve a new starting point from which 'innovation-based' development can be

launched. At the start of such a large, ambitious project, it is difficult to get sufficient consensus on what the future will look like and how to get there, when a wide variety of current issues and problems are the focus of day-to-day management attention across the organization. Removing those problems releases the organizational ability to envisage and agree how new ways of conducting business can be created.

As was said earlier, the implementation of an ES is a business transformation program, not an IS/IT project. Very few fail because of the inadequacies of the technology. When they do fail, the reasons are organizational and, in many cases, due to different perceptions of the intent and benefits and extent of changes required between senior executives and operational line management and among the line managers in different functions or units. Evidence from one study[14] is that successful implementations have been carefully, even slowly, planned to gain the understanding and commitment of the majority, if not all, the stakeholders to the benefits and establish how best to implement the changes in each area, followed by rapid implementation. Often, two-thirds of the project duration was effectively 'planning' and one-third was implementation. Many failures resulted from a short planning phase, during which few of the differences in perceptions were addressed or reconciled, followed by an interminable implementation phase!

As was also said earlier, there has been considerable literature published in the last 5 years on this topic; Table 11.2 contains a summary of some of the particular key issues that need to be addressed in relation to the 'special case' of ES. There are, of course, further specific issues associated with the type of ES involved (e.g. ERP and CRM systems). Details can be found in some of the publications referenced in the endnotes.[15]

STRATEGIES FOR MANAGING THE IT INFRASTRUCTURE

This section is concerned with the management of the technology infrastructure from a strategic perspective and, in particular, the issues affecting investment in its development and its contribution and alignment to the business strategy.

Defining IT infrastructure and its components is becoming more difficult as technology evolves and becomes increasingly a business utility. Perhaps the best definition is 'the enabling base of shared IT capabilities which provide the foundation for other business systems.'[16] This definition by McKay and Brockway includes the managerial expertise to provide IT services as well as the technology itself. Many authors[17] include 'services' in the IT infrastructure, since it is difficult to separate

Table 11.2 *Key issues in Enterprise Systems implementation*

- To succeed, business models will have to change and so will business and organizational structures and relationships. The drivers and need for change must be understood throughout the organization.
- Corporate IS/IT initiatives are often distrusted by the business units or functions due to increasing control and loss of autonomy.
- There must be explicitly identified benefits both to the corporation and to most, if not all, the units/functions involved, to enable the business changes to be made: *but* implementing an ES will rarely deliver sufficient immediate benefits to justify the cost and effort. Exploiting the new capability will deliver further benefits, which need to be identified at the start and actioned once the basic implementation is completed.
- It is the business changes enabled by the Enterprise Systems (ES), not the software, that produces the major and lasting business benefits.
- The technology is rarely the cause of failure, it is normally the result of organizational or cultural issues being unresolved or a poor implementation process.
- A strong, empowered, multidisciplinary, business-led team using sound project management principles is essential to success.
- Changing the performance measures (and even reward systems) to reflect the interdependencies resulting from the new business model are essential, if behaviours are to change.
- Poorly defined or ineffectively communicated business vision and strategy will reduce the ES to a technology project only, owned by the IS function!
- Most organizations realize (after the event) that more resources and expertise should have been devoted to change management!

the issues of infrastructure management associated with its procurement from those affecting its use in services and applications. IT infrastructure is therefore considered to comprise:

- Physical infrastructure, which consists of a range of network, hardware and base software products and services, deployed to enable applications and the general purpose use of technology to function successfully. A component is considered as being part of the infrastructure if it is used by more than one application (e.g. middleware) or by a wide range of people. Hence, software such as groupware to enable knowledge sharing and collaborative working is part of the infrastructure, since it has many applications. It can be argued that Enterprise Systems software packages, once installed, are essentially part of the infrastructure, given the range of activities they support and the influence they have over the business and IT architecture.

- Architectures, which describe the physical infrastructure and show the current and, where possible, future configurations. As well as models of the physical infrastructure and where it is located, etc., these also include models of information, processes and organizational structure. The technology architecture is a representation of a set of hardware and software components, described in terms of how they support the applications and information requirements of the business.
- Policies and standards, which cover technology aspects to determine how the infrastructure, its acquisition, deployment and support are managed. These address matters such as sourcing, contracts, service levels, back-up and recovery, contingency plans and, increasingly importantly, security and access controls.
- Management processes to ensure investments in infrastructure are coherently planned and justified, and relationships with technology suppliers and outsourcing providers are appropriate for their role in enabling the business strategy.

The nature of IT services and the related strategic issues were discussed earlier in this chapter, and the management of outsourcing is covered in the last section of this chapter. The purpose of this section is to deal with infrastructure strategy from a general management, not a technical perspective—references to more comprehensive texts on particular aspects are provided.

LINKING THE IT INFRASTRUCTURE WITH THE BUSINESS STRATEGY

Business Objectives of Technology Management

The purpose behind the overall management of the technology infrastructure is to provide an appropriate set of technology, resources, processes and services to meet the evolving needs of the business and the organizational ability to apply them effectively. Specifically, this means underpinning the application portfolio and general-purpose use of IT tools in the short and medium term, and undertaking investments to make justified improvements to the infrastructure to meet longer-term, but uncertain organizational and business needs. This implies a continuous migration plan to move from the current technology infrastructure to the most appropriate set of components to match systems and information architectures, probably passing through multiple stages over a number of years.

In response to business drivers pulling the IT supply strategy, such as cost-effectiveness, flexibility and responsiveness, remote working, global-

Table 11.3 *Examples of objectives for developing the IT infrastructure*

- Provide an appropriate infrastructure to sustain the performance of current applications and development or enhancement of business applications deemed to be critical to meeting business needs.
- Maximize the use of current information and facilities available in the existing applications and technology.
- Provide sufficient integration and consistency across the infrastructure, to minimize cost, maintain quality, and to enable internal and external interconnectivity.
- Facilitate an increase in the productivity of users and their business processes, by equipping them with desktop tools and office software, accessibility to the information they require, and the networking capability to communicate internally and externally as needed (e.g. via Intranets and the Internet, groupware, email, videoconferencing and desktop applications).
- Facilitate rapid application development by providing a modern tool set, and training for users and IS developers.
- Reduce complexity and non-standardization so as to ensure flexibility and responsiveness to change at all organizational levels and locations, and enable staff mobility and consistency of user knowledge required across the organization.
- To build and manage an infrastructure, to serve the whole group, that can handle high-volume multimedia communications within the group and enable communications with customers and suppliers in a consistent and economic way.
- To provide the ability to change business and organization structures without major delay, cost or disruption due to IT constraints. This might also include the ability to minimize the costs and complexity of mergers, acquisitions and divestments.
- To have an infrastructure that is compatible and comparable with other organizations in the industry to gain full benefits from industry IS/IT developments.

ization and employee productivity, there will be a number of specific IT objectives to be met, as illustrated in Table 11.3. However, it may not be possible, for financial, technical or human reasons, to be able to provide an ideal infrastructure at any given time. At best, the technology infrastructure can evolve at the rate demanded by the business and IS plans, but, if necessary, these plans may have to be modified to a rate determined by the evolution of technology or the economics of acquiring and using it.

Business Basis for Managing Technology

Most of the issues that have to be addressed by business managers with responsibility for technology are business issues. In order to manage

technology effectively, it is not necessary to get deeply involved in technical details. This chapter does not attempt to do so either, except in so far as it is necessary to explain the concepts or address the issues raised by technology. Technology changes so quickly; it is beyond even most technical people to keep up to date, and even more difficult and less valuable for business managers to attempt to do so. However, more business managers are required to have enough understanding of the strategic issues to improve their decisions concerning technology: a set of principles by which they can assess the various issues, to ensure a well-rounded decision-making basis and increased likelihood that the long-term best interests of the business are upheld.

Managers responsible for planning, developing and managing the infrastructure are expected to provide a continually improving and expanding service to the business, in response to the demands of the business strategy and any organizational evolution. Additionally, they need to keep abreast of new and emerging technology and current competitive usage of IT, and put forward suggestions as to how technology might be deployed to gain advantage or create new business options. Two particularly enduring problems of IT infrastructure management, in combination, create a number of difficulties for organizations:

- it must be developed as a base for future, uncertain use of applications rather than merely matching current business functionality[18] (i.e. keeping ahead of the needs);
- it is difficult to define the value derived from IT infrastructure[19] (i.e. it is seen as a cost).

The prime difficulty, therefore, is making investments to meet uncertain needs in something that has no explicit value! Therefore, it is important to link infrastructure development to relevant parts of the business strategy. Most organizations could identify current business problems that would result from inadequate infrastructure, but it is more difficult to foresee the future problems that would result from failure to invest in its development. So, some of the issues to be faced are:

- *Linking technology investments to business needs*—how to relate the specific requirements for investment in technology to the business needs, and to determine the implications of gaining or not gaining approval, and how to make sure that the proposed development is the best way of obtaining the indirect benefits. While per unit costs of technology are going down, spending on IT is still increasing, with investments in new applications both for business systems and individual or group working, and in the automation of more activities,

like workflow management. This seems to be acceptable because of the growing belief and some evidence that an effective IT infrastructure enables organizational responsiveness and employee flexibility[20]—all critical characteristics in most of today's businesses—and facilitates coping with growing complexity. This is endorsed by individuals, who, by and large, enjoy the increased power they can obtain from IT. However, all the evidence does not point at realized productivity gains in all uses of IT. Reports suggest[21] that white-collar productivity has not actually improved during the 'desktop' era and there is some evidence that misuse or inadequate skills have caused negative effects on productivity. Justification of infrastructure investments is considered briefly below, within the overall rationale for IS/IT investment covered in detail in Chapter 9.

- *Identifying technical opportunities*—although business managers do not need an in-depth understanding of technology, they do need sufficient understanding of its capability to achieve the business requirements, in terms of its ability to: (i) improve or radically change the products and services of the business, and develop electronic trading capabilities, (ii) improve the productivity and effectiveness of business processes and people and (iii) impact the economics of the business.
- *IT investments by others*—how existing and potential competitors, customers and suppliers are using or could use technology to improve their competitive positions and the likely consequences in terms of (i) impact on the market and customers, (ii) changing relationships and cost structures within the value chain and (iii) threats or opportunities created by new IT-based entrants in the industry. Business managers need the knowledge to assess the situation, understand the options available, assess their implications and be able to respond accordingly in terms of commissioning the investments or provisioning by outside parties.
- *Technical implications and 'hype'*—most business managers are required to make important business decisions, or required to recommend strategies to the overall management team. They are unlikely to have an in-depth understanding of how the multitude of technologies work, but must know enough to be able to ask sensible questions and not to be confused by the advice of potential suppliers or 'in-flight' magazine articles and even TV adverts! However, they will need to rely on technical management and specialists to explain and interpret the essentials for them. Technical management also need to be sufficiently business aware to extract the relevant, factual information from the supplier pressure and hype, so that

they do not fall into line with the technology vendors themselves in promoting the 'solutions looking for problems', based on technically irresistible offerings, rather than business need and sound assessments of performance, cost and risk.

- *Business and technical awareness*—the CIO or IT director not only has a responsibility to instil business judgement and awareness in his technology experts but also to implant a sound, albeit high-level, understanding of technology and technical issues in general management.
- *How to make decisions about IT resources*—this includes the sourcing and, where appropriate, outsourcing of infrastructure products and services.

One major issue for senior management to address is the determination of the degree to which they wish the organization to function as an integrated whole or as separate entities. This decision will have a significant influence on the type of infrastructure that is developed and its overall cost, especially in multi-unit organizations. A model developed by Keen[22] and shown in Figure 11.9 can help management form an opinion on the need for commonality and connectivity across the IT infrastructure. Keen describes two dimensions:

- *reach*—the extent to which the infrastructure must enable connections across systems and platforms among internal and external users;
- *range*—the breadth of services, and variety and volume of different types of information, documents, images, etc. that will be shared among internal and external parties.

In considering how to meet integration requirements, a business needs to define an architecture that delivers the essential levels of capability, *reach* and *range*, and plan to migrate to it gradually. It should determine key parameters; for example, the required responsiveness, speed and efficiency in terms of connectivity and access across the community, and the current and future processing and communication capacity it expects to need.

A study of 26 major international firms by Broadbent *et al.*[23] confirmed that those seeking and achieving inter-unit business synergies had invested in infrastructures that produced high levels of reach *and* range. This also tended to include common application packages using common databases. The study also found that the firms who had integrated business, IS and IT planning processes had more extensive IT infrastructure capabilities in both of Keen's dimensions. Interestingly, the study confirmed, as perhaps expected, that generally the firms

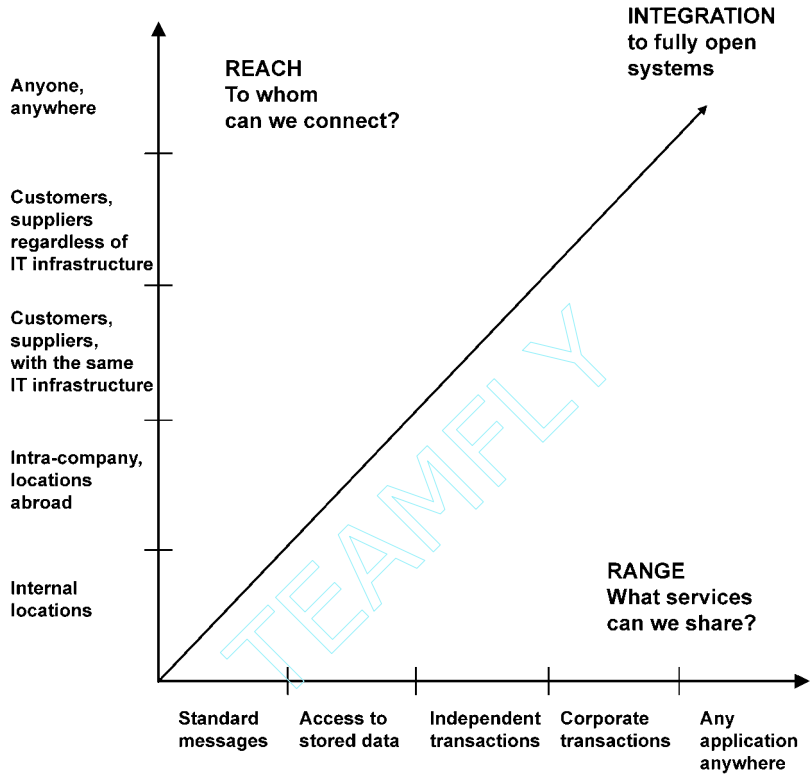

Figure 11.9 *Reach and range* (source: *from P.G.W. Keen,* Shaping the Future*, Harvard Business School Press, Boston, 1991)*

where information was a major component of the product or critical to the value-adding processes, such as oil exploration or research, had invested most in infrastructure as a 'capability' (i.e. centrally planned, coordinated investments with strong controls on IT expenditure).

JUSTIFICATION OF INFRASTRUCTURE INVESTMENTS

Infrastructure contributes to the delivery of business benefits in a number of different ways, and the justification of expenditure, either for procurement of capital items or purchasing software licenses or network or hardware capacity from third-party suppliers, needs to be presented on the basis of the particular contributions being made. These can be described under five headings as depicted in Figure 11.10.

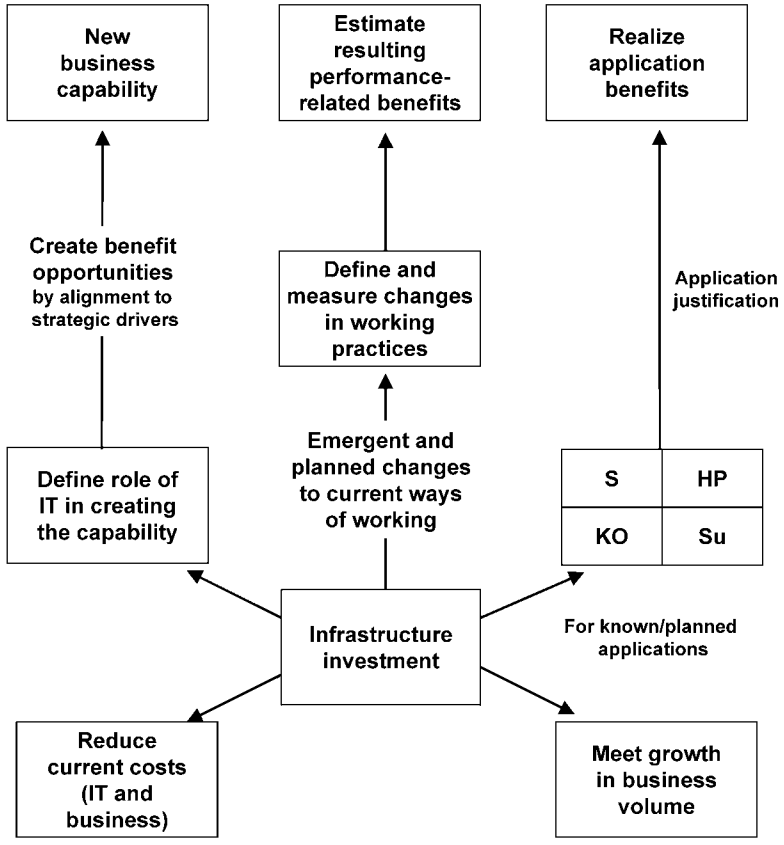

Figure 11.10 *Justifying infrastructure investments*

1. *Application-specific*—infrastructure costs can be justified in part on the basis of the benefits delivered by applications that will use the infrastructure, and the relevant costs should form part of the business justification for those applications. This implies a link between the planned applications portfolio developments and the infrastructure required to enable them. This can be done via a composite Benefits Dependency Network, a technique described in Chapter 9, showing infrastructure components as the enablers of the applications, business changes and benefits.
2. *To reduce costs of running and supporting existing applications, by using more cost-effective technology*—this is most likely to arise in relation to support or some key operational applications as well as

personal productivity and communications usage. The justification will depend on cost savings, mainly in the IT budget, but there may be business cost savings, especially by providing easier-to-use desktop tools or lower-cost means of communication. Included in this category is the 'forced' need to replace a technology that is or is becoming obsolete (i.e. it will no longer be supported or is no longer available because the vendor has ceased to supply the technology or even gone out of business!). As with any technology investments that involve supporting existing applications, it is prudent to question whether each application is still necessary to the business. If it is, there may be several options:

- transferring the application to other existing technology already in use in the business, which may be a less efficient solution, or through replacement with new technology more in keeping with IT policies relating to nominated platforms and standardization across the business;
- modifying or redeveloping the application to take advantage of more cost-effective technology, either existing or new;
- cutting down the functionality of the application to the essentials and delivering them by one or other of the above means.

3. *To enable growth in the volume of business transactions*, both internal and external, or to accommodate the changing mix of transactions, (e.g. customers switching to Internet ordering from the call centre). The growth in transaction volume may be due to changing business practices rather than genuine business volume increases. Customers are tending to move to just-in-time satisfaction of requirements and more single-line ordering rather than consolidating purchases, causing further increases in internal transactions, but still expect rapid response and high service levels. In combination, these create increasingly high-peak loads as well as overall increases in transaction volumes. At the same time, more information is being transferred in many of the transactions (e.g. in the form of multiple large attachments to emails, complex images and video), requiring further network, processing and storage capacity increases. In terms of benefits, it is important to consider three different types of argument for increased capacity:

   - that required to deal with increased business activity (i.e. real growth), which leads to increased revenue;
   - that needed to accommodate the changing mix of transaction types, which should be offset by savings to be made elsewhere. The increasing move to electronic as opposed to paper transac-

tions should produce cost savings associated with printing and paper handling; and

- that required to deal with increasing use of capacity for purely internal reasons. Whether this is of net benefit to the organization needs to be determined in terms of the changes in business practices that are emerging, rather than being planned. For example, centralizing corporate information on an Intranet can produce reduced costs and benefits due to accuracy and consistency, provided its content is managed effectively. If every user is extracting and storing the information they require, along with other pages of information downloaded from the Internet, demands for increased network and server capacity are not justified costs. Equally poor user practices in dealing with accumulations of emails may lead to significant, unjustified capacity increases.

4. *Changes in working practices*—this means deliberate changes as opposed to emergent changes as in Item 3 above, although improved practices developed informally should be extended and built on, based on the benefits that have resulted. Such changes may be associated with specific applications, in which case the benefits should be related via the application to the associated infrastructure. However, increasingly, changes in processes and practices can be made via the use of the infrastructure without major application investment. For example, a bank, having set up its 'product catalogue' on an internal website, stopped sending product update information on paper to its several hundred branches. Two benefits resulted: a large paper cost saving and fast, consistent, up-to-date information to customers in the branches. 'Filing' the mass of paper received in the branches was a problem, often leading to delays in staff having the latest information at the counter.

   Another significant area of potential benefit, which was discussed in the previous chapter, is associated with knowledge sharing within and across organizations. While research[24] has shown that knowledge sharing is driven by people not technology, communities of interest and/or practice—the main conduit of sharing—work best when the management encourages and facilitates their development *and* provides the necessary resources, including technology. Again, where extended infrastructure to support content-rich media (e.g. desktop videoconferencing), is put in place to enable organizational knowledge management, the intended and resulting benefits can and should be specifically identified and measured. Equally, findings from other research[25] suggest that 'workforce agility' or organizational

flexibility, to respond quickly and effectively to changes in the market place, is increased by the provision of a consistent, high-quality, integrated IT infrastructure supporting all users and all applications.

5. *To create a new business capability* that is required for the future business strategy, an explicit strategic intent or a particular strategic initiative. While the details of how the intent will best be met may as yet be unclear, a demonstrated connection between the IT infrastructure implicit in achieving the strategy can often be made. For example, an energy company stated that one of its strategic intentions was 'to become location independent', enabling its technical and professional staff to perform their jobs wherever in the world they happened to be. This was the main justification for a major investment in network capacity and portable workstations, although benefits in other categories were also delivered.

   In the UK, the concerted move to e-government—the electronic access and delivery of government services to the public and others—has led many local authorities to justify the major infrastructure investments required as an integral part of their future strategies. The argument is that the IT infrastructure is, over the long term, a replacement for the traditional infrastructure of local government—based on an extensive 'office coverage' of the authorities' geography. As the infrastructure to enable 'online' access and mobile working by professional staff is implemented, savings in the capital and operating cost of existing office and depot sites are used to offset the IT costs. The reduction in these traditional 'delivery channels' is then planned and implemented, to realize the savings as early as possible, and the net cost reduction achieved is continuously monitored by both management and the elected council.

Overall, any infrastructure investment should be assessed against all of these five criteria to identify the contribution, if any, it is expected to make in each and the direct or indirect benefits that should be realized. It has been argued that firms need to consider their IT infrastructure more as a 'capability' than merely a 'utility', or cost of doing business, in order to align the use of technology with the business strategy.[26] As mentioned in Chapter 9, some authors have proposed the use of real options analysis to address the inherent uncertainties in investments in IT infrastructure, especially in the last of the categories above. Bulasubramarian and colleagues[27] have developed a formal methodology based on real options to evaluate and compare different IT infrastructure investments along with other alternative investments. Their experience in using the approach is that it not only influences the outcome of the decision but also improves understanding of how to align business drivers with the business capabil-

ities that can be developed from an appropriate IT infrastructure. This is likely to be increasingly important as more aspects of IS/IT will become part of the 'infrastructure', either purchased as an 'integrated set' or provided by outsourcing vendors of one form or another. Many organizations are seeking to obtain their infrastructure from outsourcers, to reduce their need for scarce technical expertise in-house and to be able to buy what they need incrementally rather than as higher risk, expensive capital purchases. Outsourcing strategies are considered at the end of this chapter, but outsourcing of IT infrastructure and service provision does not absolve management of the responsibility for defining its role in the strategy or justifying the investment involved.

TECHNOLOGY STRATEGIES IN A MULTI-BUSINESS UNIT ORGANIZATION

Throughout this book, there has been a focus on achieving a coherent IS/IT strategy for a business unit, because each business unit should seek to maximize the benefits from its information, systems and technology, and it is most feasible to achieve that coherence at business unit level. However, most corporations consist of a number of businesses and there is a need to consider the strategic management of technology supply and services across the businesses to obtain the maximum corporate and business unit benefits.

This corporate dimension has been considered in previous chapters in terms of the factors that drive the degree of beneficial central coordination and control over and above the business units. The main factors affecting the technology strategy can be summarized as business-driven factors, including the following:

- degree of intercompany trading;
- similarity of products and business processes;
- coherence of markets served, channels of distribution used and main suppliers;
- similarity in scale of operation;
- industry maturity and competitive situation of units;
- geography, especially in international companies;
- how corporate management exercises its control over the units' business strategies and activities;
- the rate of business and organizational change.

They can also be summarized as IS/IT supply-driven factors, which include:

- the economics of processing and procurement;
- availability of skills and human resources;
- availability of technologies and vendor services in different countries and areas;
- the existing IS/IT investments in the different units.

Often, however, these 'logical' factors can become obscured by organizational and political factors due to the way the business units have been developed or acquired and/or the degree of real trust that exists between the corporate centre and the units. This desire for conformity or independence often manifests itself more emotionally over the control of IT than many other business issues, especially in companies that grow by acquisition, where IT environments often pre-date the organizational relationships. Based on the above factors, there appears to be a structured way of addressing these issues, which is consistent with the earlier discussion of achieving application, information and organizational coherence and synergy to the degree required by the business relationships. It is important that the degree of IT conformity or divergence reflects the business, organizational and cultural characteristics of the organization, not the preference of IT specialists, or it will fail in the long term to deliver corporate benefits.

The extent to which the corporation should direct the technology architecture and the selection process cannot be prescribed, but there is perhaps an escalating scale of corporate intervention that can be considered. At the lowest level, this can provide benefit even if the organization is a conglomerate, buying and selling businesses and operating in many industries with companies of varying sizes and differing business situations. At the highest level, the benefits will be far greater in a corporation that has a number of companies in the same overall industry. The three levels are described in Box 11.1.

This three-level approach is obviously somewhat simplistic, but it is an attempt to reflect in technology management terms the likely business and corporate cultures that will prevail across the spectrum from a 'financial conglomerate' to a highly-focused and organically-developing corporation. Essentially, it suggests an increasing need for central coordination across business units as the intention to gain economic *and* application or process *and* information and knowledge benefits becomes more important. The progression follows a rationale from the support, via the key operational to the strategic/high potential quadrants of the portfolio, in terms of increasing potential gain from central coordination of technology strategy in order to gain the business benefits both corporately and in each part of the business. It also reflects the need to transfer technology knowledge across the organization to gain the

Box 11.1 Managing technology in a multi-business-unit organization

Level 1: Lowest level of control by the corporation over the SBUs—Technology Economics

Centralization of technology control will be mainly an economic issue to exploit corporate buying power with suppliers and ensure that resources are not unnecessarily duplicated. This will have most effect at the 'commodity' end of technology—in data communications, processing power and basic operational software as well as related technical skills to support IT operations. Even if the companies have different application requirements, establishing a target environment based on supply economics can enable selection decisions in each unit to consider a preferred set of options. These will not be mandatory, but will be expected to be adopted, unless the local economics are poor, perhaps due to the unit's size or because its application needs cannot be adequately satisfied. Some centralized resources and skills will then be available to support the companies' implementation and operation of the main hardware, operating systems and networks, and even application packages. This can make the preferred solutions more attractive to the units, provided the charge-out of costs from the centre is equitable. The central resource can also act as the main point of contact with suppliers to ensure that the corporation obtains the best value from group purchasing, and monitor centrally the vendor performance against agreed service levels as and when problems arise anywhere in the organization.

In most, even diverse, organizations, telecommunications management is usually centralized to provide the necessary skills, manage the capacity, deal with major vendors and ensure costs are not unnecessarily incurred.

Level 2: Moderate level of control by the corporation over the SBUs—Application Benefits

If the corporation has a number of businesses operating in different industries, but of a limited number of types (e.g. several manufacturing businesses as well as some distribution and/or service companies), there may be opportunities for further benefits at the corporate level or at a subgroup level, over and above those mentioned at Level 1. For instance, manufacturing companies may all need some form of Enterprise Resource Planning (ERP) system or

each SBU may operate in similar supply chains or trade in similar ways. There is probably some similarity in the type of applications required for comparable internal and external processes, therefore benefits will exist if application software knowledge and even resources are shared among the units. This will add weight to the need for consistency of basic operating environments, otherwise the benefit of application knowledge will be reduced by the need to support diverse implementations on different hardware and operating systems, and deal with a large variety of suppliers. The benefits are not purely economic, although obviously the ability to replicate business benefits is a financial gain. The benefits also accrue by enabling companies of perhaps different sizes and in different stages of maturity to develop applications ahead of their own local ability to develop the necessary skills. Similarly, applications may even be run centrally and hence be able to be upgraded as the hardware and software base changes with less cost and disruption to the units.

The potential downside is that the units do not develop their own business application and technical expertise, to move beyond using IT for essentially support and key operational applications. Too much centralization of IT control can lead to reduced innovation at a unit level, and, if there is no unit or group level management or IS/IT business steering mechanism, merely satisfying the 'lowest common denominator' of needs can stifle overall and local progress.

Level 3: Highest level of control by the corporation over the SBUs—Information Asset Management

Where companies are in the same industry and/or trade with one another and/or deal with a similar customer or supplier base, there is probably business advantage to be gained from strong coordination of technology management at corporate level. Not only are there economic and application supply-side benefits but also significant benefits from sharing information and knowledge as well as its proficient and consistent processing throughout the company and in systems linking the company to its trading partners. For example, they may use a common Customer Relationship Management (CRM) system *and* share a common customer database. Here, it is worth ensuring that the technology environments are consistent to the level of data management software, communications standards and some application software, even if to any one unit company the 'overhead' may appear uneconomic. The benefits of

strong central direction and hence support in terms of skills and resources may again be negated if innovation is stifled. A corporate mechanism to deal with strategic and high potential areas of development must be in place. Equally, the corporation may need to fund part of the cost of technology in the units to encourage commonality. This implies that the units may have to compromise some requirements, and the consequences of such compromise must be understood. The compromise may not always be worthwhile—meaning that the corporate architecture must evolve and develop with the needs and not become a force for business stagnation due to the limited options it allows.

greatest and earliest return from IS/IT competencies possessed by the organization, wherever they exist.

OUTSOURCING STRATEGIES

A *selective* or *smart* sourcing approach using multiple vendors is an increasingly popular strategy to minimize risks, maximize benefits and reduce costs[28] and is likely to be the preferable choice of the future. Willcocks and Sauer[29] report that selective and in-house sourcing had success rates of 77% and 76%, respectively, but only 38% of total outsourcing deals (80% or more of IT activities outsourced) were successful, 35% failed and 27% had mixed results.

Many organizations have chosen a 'best of breed' approach to their outsourcing strategy, contracting with a variety of vendors for the delivery of IT services. For example, British Petroleum (now BP) contracted with three suppliers under an umbrella contract obliging the suppliers to work together. According to BP's IT director at that time, John Cross, '[w]e decided against receiving all our IT needs from a single supplier as some companies have done, because we believed such an approach could make us vulnerable to escalating fees and inflexible services. Instead, we sought a solution that would allow us both to buy IT services from multiple suppliers and to have pieces delivered as if they came from a single supplier.'[30] BP reported that this sourcing strategy reduced IT staff by 80% and reduced IT operating costs from $360 million in 1989 to $132 million in 1994.[31]

While the risks of using a single vendor are mitigated with a multisourcing strategy, they are replaced by the additional time and resources required to manage multiple suppliers. The key to a successful multisourcing arrangement is vendor coordination and management.[32] To

achieve this requirement for seamless service delivery, BP appointed one of its three vendors as the primary contractor at each of its eight business sites. The role of the lead vendor was to coordinate the services provided by all three suppliers to the businesses supported by that site.

We have also seen joint ventures between vendors and clients being established where risks and rewards are established. These include vendors buying client's shares or vice versa, or both parties taking a stake in a new entity,[33] illustrating that their fortunes are bound up together. General Motors took an equity stake in EDS, with EDS effectively operating as a subsidiary of the car manufacturing giant, although since 1996 it has been free to pursue its own strategies. The Swiss Bank–Perot Systems $6.25 billion deal saw both partners agree to sell solutions to the banking industry, with the bank having an option to buy up to 25% of equity in Perot Systems.

One of the largest outsourcing vendors EDS introduced the concept of 'co-sourcing' to refer to contracts where there is a strong element of 'win–win' between the parties. Payment to the vendor is based in part on the performance achieved by the customer. These performance-based contracts (as opposed to fee-based) are proving popular, particularly as experience with outsourcing has been mixed. For example, in 1998, US truck manufacturer Freightliner Corporation outsourced to Debis for IT services in a $70 million, five-year deal. This amount was based on what Freightliner estimated it would have spent over that period on the IT operations that it outsourced. However, Freightliner pays Debis only a baseline amount to cover the vendor's costs. Any profit depends solely on Debis generating savings. When Debis saves Freightliner money by performing IT services at less cost than Freightliner's original IS function estimate, the two companies split the savings based on an agreed percentage.[34]

Risks Associated with Outsourcing

Many companies are disappointed with their results from having outsourced IT activity, and research consistently demonstrates that, despite the growing maturity of vendors and their clients, the practice of outsourcing continues to be a high-risk process. A survey conducted by UK magazine *Computing* revealed that just one-quarter of IT directors would use their main outsourcing vendor again.[35] Research[36] has identified the following risk factors:

- *Treating IT as an undifferentiated commodity to be outsourced.* This risk is more a reflection of management's view of IS/IT than anything else, failing to see the contribution or potential contribution that IS/IT could make regarding competitive applications. Proponents often see outsourcing as an opportunity to offload headcount. Yet, IT is

different from other areas of the business: it evolves rapidly, the economics of supply continually change, IS penetrates all areas of the business and switching costs are high.

- *Incomplete contracting*. This risk is a reflection of the environment within which IT outsourcing takes place, particularly the difficulties in constructing and agreeing long-term contracts in the face of rapid business and technical change. Who, for example, in the early 1990s, could have foreseen the impact the Internet would have on commerce and the opportunities it would provide?
- *Lack of active management of the supplier on (a) contract and (b) relationship dimensions*. Vendor performance must be continually monitored; it has not been unknown for the vendor to devote their attention to winning new business once the contract has been signed. Relationships with vendors require continual development if they are to add value—this requires considerable management time. Later in this chapter, the process of building relationships with vendors is explored.
- *Power asymmetries developing in favour of the vendor*. This is one of the big risks, particularly for long-term contracts. Vendors may attempt to reinterpret the contract, particularly as they often look to recoup investments in the later years of the contract and seek opportunities to make higher charges for services not covered in the original contract. Vendors may themselves subcontract work and may not manage the relationship any better than the client could, but at a significantly higher cost.
- *Inexperienced staff*. Even the biggest vendors experience the same problems as an internal IS function in recruiting experienced staff. And, the reality of many outsourcing deals is that the original staff of the IS function, outsourced to a vendor, often end up back working for the client! In addition, it is important to ensure that vendor staff skills and knowledge are continually updated rather than be allowed to remain relevant to the 'legacy' that (most often) has been outsourced.
- *Outsourcing for short-term financial restructuring or cash injection rather than to leverage IT assets for business advantage*. Managers often engage in outsourcing because they do not perceive any value from their IT expenditures and consequently wish to minimize the costs. While outsourcing to cut costs has an appeal, the longer-term downside can be serious. As Nigel Morris, president of US credit-card group Capital One, succinctly noted, 'If you have a business that churns out products, then outsourcing makes sense. But ... IT is our central nervous system ... if I outsourced tomorrow I might save a dollar or two on each account, but I would lose flexibility, and value and service levels.'[37]

- *Hidden costs*. Proponents of outsourcing argue that IT costs are more clearly defined with outsourcing. However, there can be many hidden costs. The severance package for terminated or transferred employees may be a hidden cost of outsourcing. In a survey of 76 organizations that had a total of 223 contracts, Willcocks and Fitzgerald[38] found that hidden costs were the biggest outsourcing problem. One recommendation is to establish *if* and *where* the vendor makes a profit.[39]
- *Managing multiple vendors*. It is difficult enough managing a single vendor, but the management of multiple vendors adds additional complexity, particularly regarding coordination. One tends to find that each has their own agenda and intention to increase their business with the client. A number of strategies adopted by companies to minimize any risk were highlighted earlier.
- *Loss of innovative capacity*. Once a significant part of IT has been outsourced, there is a danger that the organization can lose the competency to identify innovation-based opportunities from IS/IT. Chapter 5 has highlighted the importance of actively seeking IS/IT opportunities in developing a competitive strategy. Earl[40] notes that much learning about the capability of IT is experiential, a key point particularly when exploring competitive impact opportunities.
- *Cultural incompatibility*. It is important to ensure that the organizational culture and work practices are compatible with those of the vendor.[41]

Willcocks and Sauer[42] recommend a prudent approach to such issues as IT outsourcing contracts, supplier claims, the risk behind disguised multi-supplier contracts, supplier capabilities and resources, single-supplier and long-term deals. From their research, they have developed a risk analysis framework highlighting the various risks that can arise over time. Illustrated in Figure 11.11, it highlights the contextual risk factors, risks associated with contract construction and post-contractual risks. Organizations must ensure that they consider all these factors in making the outsourcing decision in constructing any subsequent contracts and managing the contract during its lifetime. Generally, selective sourcing to multiple suppliers—on relatively short-term, detailed and regularly revisited contracts—has been the effective approach to mitigating the risks of IT outsourcing.

GUIDELINES FOR OUTSOURCING DECISIONS

Although there are no simple rules in making outsourcing decisions, a number of lessons can be deduced from general experiences to date. Such

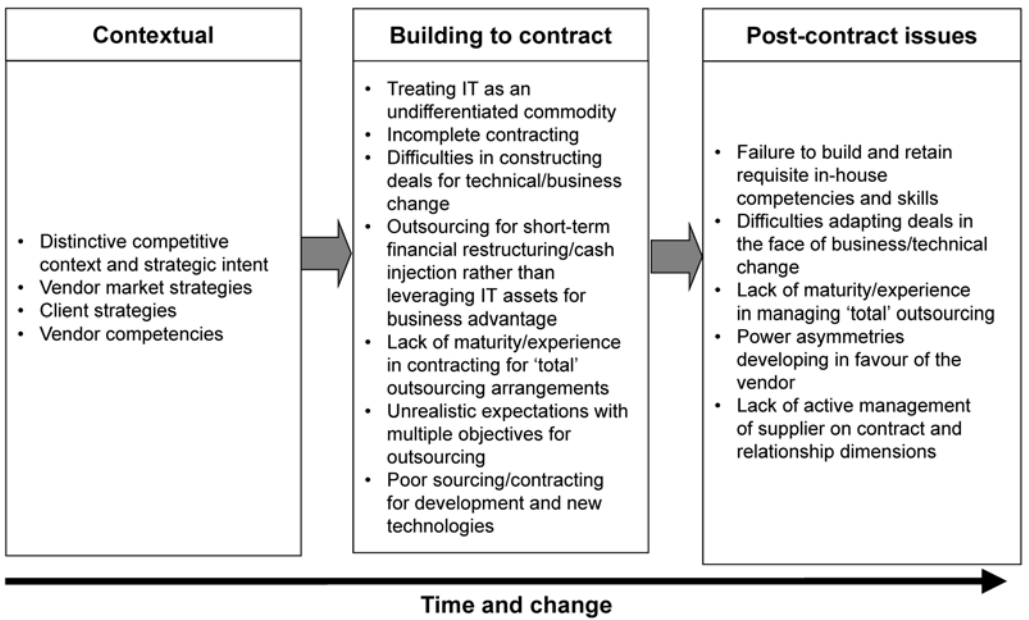

Figure 11.11 *Outsourcing risk-analysis framework (*source: *L. Willcocks and C. Sauer, 'High risks and hidden costs in IT outsourcing',* Financial Times Mastering Risk*, May 2000)*

guidelines will help the decision makers on various issues such as whether to outsource or not, whether to employ one or more vendors or how to cluster the services under contracts.

Managers should not make a one-time decision whether to outsource or not. Instead, they should create an environment in which potential suppliers, external vendors as well as the internal IS function, are constantly competing to provide IS/IT services. Organizations should choose to outsource carefully selected, non-core activities that can be accomplished quicker, cheaper and better by vendors. Earl[43] argues that companies should first ask why they should not *insource* IT services. Indeed, actual outsourcing or, at the very least, the threat of outsourcing is often the symptom of the problem of demonstrating the value of IS.[44]

DiRomualdo and Gurbaxani's[45] research indicates the importance of understanding the different types of strategic intent for IT and the role that outsourcing can play before making any decision. They highlight three strategic intents driving outsourcing:

- IS improvement—'Do IS better';
- business impact—'Use IT to achieve better business results';
- commercial exploitation—'Exploit IT assets externally'.

Each type of strategic intent for IT outsourcing requires different approaches and tactics to be successful. The nature of the strategic intent also drives the type of contract, payments and incentives, pricing provisions and performance measures. Deciding on a sourcing strategy should be based on a combined assessment of business, economic and technical factors,[46] the relative importance of each being determined by the strategic intent.

Business Factors

In assessing the business factors relating to the outsourcing decision, two separate dimensions of business contribution should be considered: *competitive positioning* and *business operations*. The competitive positioning view considers the type of contribution made by an IT activity, whether it is a 'commodity' or a 'differentiator'. An IT activity will be a commodity if it is not expected to distinguish the business from its key competitors, whereas differentiators are IT activities that are expected to provide the capability for the business to achieve competitive advantage. The business operations dimensions can be assessed as either 'useful' or 'critical':

- *Critical differentiators*. IT activities that are not only critical to business operations but also help to distinguish the business from

its competitors. Organizations should look to insource such activities, although they may avail themselves of third-party expertise. These activities would normally be ones that are directly related to creating and sustaining strategic applications, plus the related R&D activity required to identify and prove that differentiation can be achieved.

- *Critical commodities*. IT activities that are critical to business operations, but fail to distinguish the business from competitors (key operational application areas). Here, organizations should 'best-source', but, because of the risks, assessment should be based on clear evidence that the vendor can meet stringent operational requirements.
- *Useful commodities*. The myriad, mainly support, IT activities that provide incremental benefits to the business, but fail to distinguish it from competitors. The strategy here is generally to outsource, as third-party vendors are likely to have achieved low cost through economies of scale and standardization.

Technical Factors

Technical factors guide the choice of supply source and the form of supply arrangements. Two issues need assessment: the degree of technology maturity (i.e. level of maturity in use of technology), and degree of technology integration (i.e. whether IT services require a high or low degree of integration). The latter often limits the options for multiple sourcing if highly integrated services are essential and if the organization is mature or advanced in its technologies—there may be fewer vendors capable of providing services to match the in-house alternatives, even where costs are high. It may not be possible to achieve cost reductions without reductions in the technical quality obtained.

Economic Factors

From their research, Lacity and Hirschheim[47] concluded that the cost efficiency of vendors largely depends on adoption of efficient management practices and, to a lesser extent, economies of scale. In addition, they also found that the internal IS function often possesses equivalent or superior economies of scale to vendors for many activities. Table 11.4 compares costs between the internal IS function and outsourcing vendors across a number of cost drivers.

In a longitudinal study of evaluation practices in 26 organizations in the lead-up to making IT sourcing decisions, Willcocks and colleagues[48] found that existing internal IT evaluation processes often made it difficult

Table 11.4 *Theoretical economies of scale (*source: *from M.C. Lacity and R. Hirschheim,* Beyond the Information Systems Outsourcing Bandwagon: The Insourcing Response, *John Wiley & Sons, Chichester, UK, 1995)*

Source of IS costs	*Internal IS function*	*Outsourcing vendors*
Data centre operating costs	Comparable to a vendor for 150–200 MIP range	Comparable to large IS function. Inherent advantage over small IS functions
Hardware purchase costs	Large companies: volume discounts comparable to a vendor	Volume discounts comparable to large IS function. Inherent advantage over small companies
Software licensing costs	Comparable due to group licenses	Comparable
Cost of business expertise	Inherent advantage	
Cost of technical expertise		Inherent advantage
Cost to shareholders (the need to generate a profit)	Inherent advantage	
Research and development costs		Inherent advantage
Marketing costs	Inherent advantage	
Opportunity costs		Inherent advantage
Transaction costs	Inherent advantage	

to make objective economic comparisons with outsourcing vendor bids. Difficulties in evaluating and then comparing in-house performance include evaluating total IT contribution, identifying full costs, benchmarking and external comparisons, the role of charging systems and the adoption of service-level agreements by the in-house operation. While it is important to make the most beneficial economic choice, it is even more important to ensure the outsourcing decision is in alignment with the overall IS/IT strategy.

In making sourcing decisions, a company's primary objective should be to maximize flexibility and control so that, in the provision of IS/IT services, the organization can pursue different options as it learns more or its circumstances change.[49]

Contractual Issues

Any decision to outsource will generally result in a contract been drawn up between the organization and the vendor. One of the biggest mistakes companies make is signing suppliers' standard contracts. Such contracts usually contain details that not even a company's legal staff can always understand, especially if the company is outsourcing a technology with which it is not familiar. Interestingly, research indicates that, when companies decided to outsource, detailed contracts were more likely to be successful than relational contracts.[50] Should it ever come to a dispute, only three things matter: the contract, the contract and the contract!

Another way to maintain control over outsourcing arrangements is to split an IT operation between two or more suppliers, thus establishing a threat of competition. According to Lacity and Hirschheim,[51] most of the companies that outsourced emerging technologies experienced disastrous results because they lacked the expertise to negotiate sound contracts and evaluate suppliers' performances. The different contractual issues can be categorized further:

- *Length of contract*. An organization should try whenever possible to sign short-term contracts. Short-term contracts are desirable because they ensure that the prices stipulated will not become out of step with market prices. For economic reasons, companies often look to contract for 10 years or more and to establish a strategic relationship with the supplier. However, contracting for IT services for such a length of time is very risky. As John Cross, IT Director at BP Amoco, pointed out in 1999, 'in the course of five years we experienced two generations of technology.'
- *Service definition*. Services should be defined in a relevant manner according to their purpose and critical business factors. The definition should include the aim and scope of the service and, if applicable, any elements specific to the client's organization. The contract should include regular reviews of service definitions according to changing business needs and technical imperatives.
- *Service-level requirements specifications*. Service-level requirements and the performance metrics must be developed and expressed in both business and technical terms wherever possible, to ensure their relationship to business success factors is clear to both parties. Targets or target ranges for each metric should also be specified.
- *Service-level measurement and verification*. In short-term transactions, the client or a third party should carry out measurement, verification and reporting of the service-levels delivered. In long-

term contracts, the vendor should also report the achievement of service level targets. In either case, the client must also institutionalize periodic or contingent review and verification procedures.

- *Incentives for service-level attainment*. The purpose here is to set up the necessary positive and negative incentive systems that ensure that performance targets are met. Long-term relationships between client and vendor are characterized by stronger reputation effects, which is in itself an effective incentive mechanism for the vendor. Positive, reward-based incentives can be employed when the target is volatile (indeterminate in advance) or when it is hard to achieve. Deterrent incentives and penalties can be employed when the service is critical to the business or when the target is easy to achieve. The conditions for extreme situations such as termination and/or change of vendor should also be clearly specified.
- *Coordination and communication mechanisms*. A steering committee and/or review board should be set up. This should comprise membership from both parties for top-level direction and corrective adjustments to the relationship and the contract. The information collected through monitoring and measurement must be fed to the decision-making bodies for continuous review of performance and to set relevant targets for improvement. It may be advisable to involve an independent third party in the review board to advise or even arbitrate where problems arise, or, perhaps more importantly, to pre-empt disputes.

  In negotiating any contract, a negotiating team should be formed, headed by the top IT executive, and include a variety of specialists. The negotiating team should include in-house technical experts, an IT outsourcing consultant and a contract lawyer specializing in IT who can detect hidden costs and clauses in contracts. Further, in negotiating contracts, there are a number of lessons listed in Table 11.5 that have been gleaned from the practical experience of organizations.

Post-contract Management

During the lifetime of the contract, the following are important principles to remember:

- *Collect fines for non-compliance*. Some companies see a vendor performance shortfall as an opportunity to extract non-monetary payback, extracting some free service on the side in lieu of penalty charges. While such a compromise may be expedient, it sends the wrong message to vendors and undermines the company's position.

Table 11.5 *Lessons gleaned from practical experience of organizations*

- Discard the vendor's standard contract
- Do not sign incomplete contracts
- Measure everything during the baseline period
- Specify escalation procedures
- Beware of 'change of character' clauses
- Include cash penalties for non-performance
- Include a termination clause
- Take care of your people post-contract

- *Don't be afraid to confront the vendor*. Many companies fight hard to win penalty provisions from vendors only to find themselves averse to levying charges or forcing a dispute of any kind. Indeed, conflict avoidance is one of the most common scourges of outsourcing relationships. Ultimately, the company itself is responsible for user satisfaction; so, when a vendor doesn't deliver, it's a client's responsibility to let them know. And go to the top when necessary: involving the senior management of the vendor is often the easiest way to resolve disputes that can otherwise become bogged down in 'technical' arguments.

APPLICATIONS SERVICE PROVIDERS

The convergence of software and IT infrastructure to an Internet-centric environment has enabled the application service provider (ASP) concept to emerge. In its simplest form, an ASP is a third-party service firm that deploys, manages and remotely hosts a pre-packaged software application through centrally-located servers in a 'rental' or lease arrangement. In exchange for accessing the application, the client renders rental-like payments (see Figure 11.12). An early example of an ASP is Hotmail (www.hotmail.com), which provides an email address, with storage and access from any web 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. Software is evolving from custom-coded, proprietary applications to pre-packaged or off-the-shelf applications and now to the development of net-centric applications.

No matter how the ASP is structured, the ultimate objective is a 'seamless' service, in which the client interacts only with the ASP. The most significant elements of a 'seamless' integration of services include providing the hardware and software, integration and testing, a secure

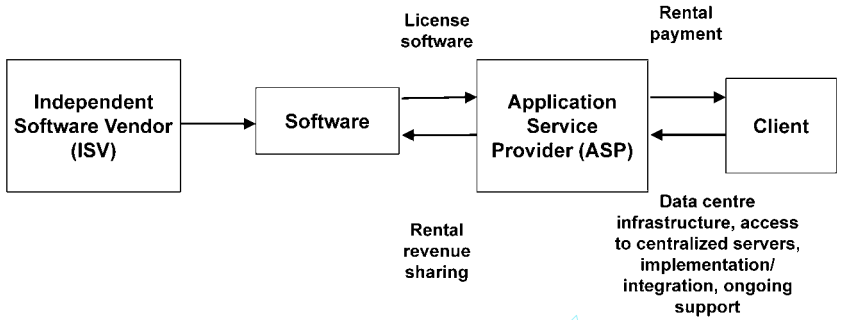

Figure 11.12 *Schematic of application service provider*

network infrastructure, reliable mission-critical data centre facilities and a highly qualified team of IT experts managing the entire solution. The primary categories of services ASPs are providing to date are:

- *Applications provisioning*—essentially providing an information-handling capability, either through proprietary applications such as property management, specialized health-care patient record keeping or analytical/mathematical services or widely-used software packages from the leading ERP and CRM vendors.
- *Infrastructure operations* 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, security and disaster recovery as well as the necessary back-office systems such as service usage, monitoring, accounting and billing.
- *Network connectivity*—providing connections to the Internet for end-customers or the application provider (essentially acting like an 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 ASP delivery chain for the duration of the ASP contract.

Currently, ASPs are primarily targeted at small or medium-sized enterprises (SMEs) that cannot afford their own IS functions or computing infrastructures. They provide a fully functioning, 'big-time application' (e.g. such as enterprise resource planning software), 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 ASP services. The roots of this model stem directly from user-based license pricing for applications. As with user-based applications pricing, the PUPM model allows ASPs to manage pricing based on number 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. In the future, we are likely to see transaction-based pricing such as billing (price per invoice), e-commerce (price per purchase) and e-marketplaces (price per item bought or sold). The future benefits of the ASP model are seen as:

- Reducing 'costs of ownership'. Although costs and service levels vary widely according to the types of application service provided, studies have indicated that, by renting an application from an ASP, a company can save between 30% and 60% over purchasing and managing the hardware and software for the application themselves.
- 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 ASP.
- Flexibility to exit or radically change operating scale. ASP contacts are typically one year with minimal or no exit fees. Many ASPs 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.
- Significant reduction in technology complexity. Buying software has always meant having to buy at once all the technology necessary to support it—networks, hardware, support software. ASP's remove that complexity from the equation—theoretically, at least—by providing all the supporting technology themselves. The organization buys a business service rather than a software application and all that goes with it.[52]

The ASP model is relatively new and unproven, and the initial forecasts of its impact as with e-business and e-marketplaces have proven over-optimistic, mainly because the economics of the model are dependent on customer volumes. At this stage, customers seem wary of making use of ASPs either due to the, as yet, few proven advantages as well as a lack of clarity as to the value-added of ASPs and their differing service offers. In selecting an ASP, the checklist in Table 11.6 should be used to clarify what is or is not offered.[53]

Table 11.6 *Checklist for selecting ASP*

- Failsafe back-up servers to ensure 24 × 7 × 365 application uptime
- Automatic load balancing to ensure accessibility
- Functional access limited by highly configurable application-level security
- Automatic off-line data back-up scheduling
- Service level agreements (SLAs) to ensure performance levels are maintained
- Secure Internet access to application servers, via VPN (virtual private network), etc.
- Support for non-public electronic transaction transmissions like EDI
- System set-up function templates to speed implementation
- Simple sign-up to make adding new users easy
- User statistics logs showing user activity by application
- Automatic data upload/download from applications
- Email delivery of user alerts, application reports, etc.
- Online FAQs (frequently asked questions), manuals, training courses
- Online support via email, self-service helpdesks, real-time Internet chat

Scott McNealy, CEO of Sun Microsystems, is typical of the enthusiasts in the industry who are promoting the ASP service model: 'Five years from now, if you're a CIO with a head for business, you won't be buying computers anymore. You won't buy software either. You'll rent all your resources from a service provider.'[54] In 2002, the customers remain to be convinced, but much can happen in five years in the IT world.

SUMMARY

This chapter has attempted to describe strategies for managing technology in line with previous strategic approaches to resourcing, information and applications. As such, it has dealt with the strategic issues that need to be managed, issues associated with acquisition, sourcing and application of technology and related services rather than by the specific problems of deploying certain types of technology. The key issues tend to be similar across technologies and have to be considered as part of the overall strategic IS/IT management process and understood by those who are not intimately familiar with any particular technology. Technology strategy should never become the exclusive domain of technologists, although obviously their input to the general management process is very valuable and must be able to be incorporated effectively. Four points are worth reiterating in summary:

1. The theme of the technology strategy should always reflect how it can be deployed to add value to the business. Future business success will occur because today's technology is well used and managed. No sensible organization will assume that future technology will resolve current problems in due course—it is more likely to exacerbate them.
2. The organization must be aware of how technology is being deployed and for what purpose by others in the industry, and even in other industries. The influence of what others—customers, suppliers and competitors—are doing and the technology they are using will become a significant factor in determining strategic technology options in the future, especially for firms that cannot easily adopt a leading role in their environment. A responsive 'following' strategy can be very successful, but it requires accurate monitoring of developments elsewhere. Even then, there is a considerable organizational learning process to manage.
3. It is in the technology that an organization is vulnerable to undue outside pressure from IT suppliers, whose interests will not always coincide with those of the business. That is only to be expected, but it means that the organization must adopt a coherent procurement approach, as it would with any set of critical suppliers. As such, it should also exploit the knowledge and resources of those vendors who are also supplying many other organizations, even some in the same industry. Almost every IT vendor will claim to be providing 'business solutions'. It is important to find out how effective those 'solutions' are elsewhere and, in particular, how they are affecting the industry. The organization would be unwise to rely exclusively on its own judgement of particular technologies without a broader understanding of the business context in which they are being deployed. Many companies ignore this and are led up many blind alleys. Establishing mutually-beneficial business partnerships with a number of key IT suppliers can be very important, provided the management of the business remains in the driving seat!
4. The approach, role and skills of the IT specialist need to change, as the role of technology becomes increasingly ubiquitous and its control becomes ever more decentralized, for example, to:

    - demonstrate business acumen and think creatively about how technology could add new dimensions to the competitive success of the business as well as deliver performance improvements across many business and organizational activities;
    - make sure the infrastructure supports responsiveness and flexibility, and investment in its development not only delivers best

value from the sourcing options available but is aligned with the long-term strategic intentions of the business;

- evolve the infrastructure so that it supports a wider range of e-business based activities, both internal (e.g. knowledge management) and external (e.g. e-commerce);
- obtain understanding and commitment from business managers to the increasingly critical role that IT infrastructure fulfils in the organization and develop a coherent investment plan with a clear rationale that is understood and supported by business managers.

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