The careers of high-technology companies, soaring downstream can profit from following these basic guidelines:

claim to provide ‘solutions’ but what they really offer is
a box or software package faster set-up process reduce the use of equipment.

**At your service**

European manufacturers are embracing US-style customer service, with encouraging results for profits and new lines of business, says Peter Marsh.

**Atkins and RBS design one-stop shop venture**

**Manufacturers move on to another service level**

Hitachi, Japan’s largest private-sector employer, on 1938 launched a medium-term programme aimed at transforming the company from an integrated electronic machinery supplier into a solutions and services provider.

**Operators look to new-found funding**

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The new economy?
A new type of firm is emerging at the heart of the UK economy: integrated solutions providers. These firms do not conform to the traditional categories of manufacturing or services. Instead, they add value - and perform their distinctive role - by bringing together products and services in ‘integrated solutions’ that address the needs of large business or government-owned customers.

The opportunity
Integrated solutions provision is of increasing importance to the UK economy, and is one of the most important challenges facing leading international companies. A number of key drivers - the attraction of profitable markets, customer outsourcing, privatisation and liberalisation, and the use of private finance - are encouraging firms in the UK to move into the provision of integrated solutions. As the imperative towards integrated solutions is replicated in other countries, UK-based firms may enjoy first mover advantages in increasingly global and competitive markets.

The problems
Despite the opportunities offered by the need to provide integrated solutions, this is not a challenge that all firms have mastered. Part of the problem that these firms face is that, as yet, there is no accepted business model for providing integrated solutions, including how to plan initial moves into this activity, how to organise and build appropriate capabilities, and how to improve performance in their provision. In addition, firms do not know where they stand in relation to competitors, and face difficulties in learning about best practices across sectors.

The problems are exacerbated by some muddled thinking among commentators on business management. Often companies are being urged to ‘move downstream’ from manufacturing into services. But this perspective misses the point that providing integrated solutions is about a lot more than just provision of services, and in any case many companies that are moving into this new activity are starting from a base in services. We have found that the traditional manufacturing-services dichotomy no longer adequately describes this emerging and distinctive form of economic activity.

Providing answers
Based on the world’s first research in this area, we attempt in this document to provide some clarity by showing how companies - whether starting from a base in manufacturing or services - can change to meet their customers’ needs for integrated solutions.

The document aims to:
- Outline the drivers that are encouraging suppliers of complex products and systems to move into providing integrated solutions
- Offer a framework within which firms can consider the challenges and opportunities encountered in the move towards the provision of integrated solutions
- Show how the case study firms have reacted to their new role as providers of integrated solutions by changing their strategic focus, developing new capabilities, and re-considering their position in the value chain.

In short, for the first time, this document offers the key elements of a business model for the emerging integrated solutions sector.
Building a new business model
The research has identified two key messages for firms wishing to implement an 'integrated solutions' business model:

Firms need to build new capabilities to provide integrated solutions
Suppliers of complex products and systems - such as trains, telecom networks or flight simulators - need to develop four sets of capabilities to move successfully into the provision of integrated solutions. These are:

- **systems integration capabilities**
  to design and integrate components and subsystems into a system

- **operational services capabilities**
  to maintain, finance, renovate and operate systems through the life cycle

- **business consulting capabilities**
  to understand a customer's business and to offer advice and solutions that address a customer's specific needs, and

- **financing capabilities**
  to provide a customer with help in purchasing new capital-intensive systems and in managing a customer's installed base of capital assets.

Firms need to redefine their role in the value chain
Providers of integrated solutions have to adapt to a new role in the value chain. In addition to developing the above capabilities, there are four wider challenges that integrated solutions providers have to face:

- developing the ability to see the problem from the customer's perspective
- managing the fluid organisational boundaries that can arise where these firms are taking on many functions previously undertaken by their customers
- designing clear contractual agreements that outline the responsibilities, risks and rewards attached to high-cost solutions, and
- defining new business structures and cultures around the provision of integrated solutions.

Core capabilities and key challenges are identified here as a result of the world’s first research into integrated solutions provision.

The research
This report draws on research conducted between May 2000 and February 2001, the first phase of a three-year research project. The research involves collaboration with leading international companies across five sectors:

- **Alstom Transport** - railways
- **Ericsson** - mobile communications systems
- **Thales Training & Simulation** - flight simulation
- **Cable & Wireless Global Markets** - corporate telecom networks
- **WS Atkins** - infrastructure and the built environment.

The research is being carried out by the Complex Product Systems Innovation Centre. This is a collaboration between two leading research groups: SPRU (University of Sussex) and CENTRIM (University of Brighton).

The project is funded within the EPSRC's (Engineering and Physical Sciences Research Council) Systems Integration Initiative.

The overall aim of this initiative is to improve UK manufacturing and services by developing greater understanding and increased capability in systems integration.
Some of the world’s leading companies - Ericsson, Alstom, Thales, WS Atkins, and Cable & Wireless - are changing the strategic focus of their activities and following a similar path to success. Increasingly, these firms compete by providing solutions, rather than selling products or services. What is occurring is the emergence of a new type of firm - ‘integrated solutions providers’. These firms are creating new business models to add value - and perform their distinctive role - by bringing together products and services in integrated solutions that address a customer’s pressing business or operational needs.

Take, for example, Alstom Transport, which has until recently focused on manufacturing and delivering trains and railway signalling systems. Instead of concentrating purely on making and selling its product, Alstom is now providing its customers - train operating companies - with solutions for ‘train availability’ during the life cycle of the product. Alstom’s recent contract to renew the train fleet on London Underground’s Northern Line did not specify the size of the total fleet. The contract only required that 96 trains be available for service each day, for the duration of a 20-year contract. To achieve the customer’s targets for train availability, Alstom has built 106 trains.

It is tempting to think - as some authors suggest - that integrated solutions can be characterised as a move downstream from manufacturing to services. But other firms moving into this new activity have traditionally been based in services, from design engineering consultancies like WS Atkins to telecom operators like Cable & Wireless. These firms are enhancing their upstream capabilities as systems integrators of components and subsystems sourced from best-in-class manufacturers, and taking on new service activities previously undertaken by their customers.

Some of these integrated solutions providers have an historical base in manufacturing, such as railway and telecom equipment markets. As their traditional role in the value chain - making physical products - has become less profitable, leading companies such as Ericsson and Alstom are outsourcing a growing proportion of their manufacturing activities, strengthening their existing systems integration capabilities, and moving into the provision of services. Some, like Thales Training and Simulation - one of the world’s leading makers of flight simulators - have moved out of manufacturing altogether.

Figure 1: Integrated Solutions

Added value - the key measure of company performance - is the difference between the market value of a firm’s output and the costs of its inputs. Value accumulates at each stage of the process of production to make up the overall value chain.
By proposing that firms should ‘move downstream’, current thinking on the subject of integrated solutions can offer misleading advice. In reality, companies occupying the high-value space of integrated solutions provision originate from both manufacturing and services. But there are fuzzy boundaries around this activity (see fig. 1). Some integrated solutions providers reach further into manufacturing or services than others.

In practice, integrated solutions do more than simply combine attributes of manufacturing and services. To offer novel solutions to customer needs, companies have to think beyond a traditional focus on products or services. They have to recast existing business models in ways that offer higher profits for their own organisations by creating new value for customers. However, there is much confusion about appropriate strategies, capabilities and organisational structures for moving into this activity. This confusion is largely caused by the absence of a clearly defined or appropriate business model for integrated solutions.

This document aims to provide some clarity to the subject of integrated solutions by presenting key elements of a business model. Drawing on evidence from five case studies of leading providers of integrated solutions, it shows how firms can change their strategic focus from selling products or services to providing solutions. To achieve this, they have to develop new sets of core capabilities and find new positions in the value chain. While different types of integrated solutions providers are involved in varying kinds of activity and markets, they all share five key characteristics:

**Performing systems integration** - to provide customers with world-class solutions these firms have to be able to design, integrate and build systems supplied by best-in-class component and subsystem manufacturers.

**Operational services** – most of these firms now maintain, finance, renovate and operate a system throughout its life cycle.

**Using feedback loops** - knowledge of the performance of systems in service can be fed back to improve the design of current and future generations of systems.

**Cultivating close customer relations** - performing activities closer to the end-user than they would have previously, involving longer-term partnerships with customers.

**Creating solutions** - combining products and services in novel ways to solve a customer’s specific problems.

**Solutions require integrators**

The trend towards integrated solutions has particularly affected capital goods sectors, where firms design, integrate and deliver complex products and systems for business users, operators, service providers or government agencies (see box p. 8).

Suppliers as diverse as makers of flight simulators or managers of global telecom networks want to control the prime contract as the systems integrator. Buyers of systems - such as train operating companies or government agencies (e.g. the Air Force) - employ systems integrators to manage the design, integration and delivery of the product. The systems integrator ensures that components and subsystems are conceived at the start of a project as integrated packages to be produced in-house or by contractors to meet an overall system design. In short, systems integration is about making the whole greater than the sum of the parts.

In short, systems integration is about making the whole greater than the sum of the parts.

Key activities performed by systems integrators are:

- Preparing conceptual designs for the performance of each component and subsystem
- Ensuring that specifications for each component, subsystem and interface in the system are compatible
- Modifying specifications for all affected components and subsystems if specifications change during a project.
Complex Products and Systems (CoPS)

Complex products and systems (CoPS) are high-value, engineering and software-intensive capital goods. They cover a range of business-to-business products, systems, networks, infrastructure, constructs and services. Examples include aircraft, ships, flight simulators, telecom networks, trains, intelligent buildings, baggage handling systems and missiles.

The specific nature of innovation in CoPS can be highlighted by drawing a comparison with the mass production of consumer goods (e.g. cars, PCs, Hi-fis, fridges, and mobile phones):

**Low-volume and customised** - By contrast with high-volume production of standardised consumer goods, CoPS are designed and produced on a project basis as one-off items or in small tailored batches to meet the requirements of large business customers, operators, (e.g. airlines), service providers, and government organisations (e.g. Ministry of Defence).

**Design modifications** - Whereas in mass production, product development is undertaken first to freeze the design, followed by production and marketing, in CoPS the product is developed after the order is secured and the design is modified during production to meet customer requirements.

**Industry structure** - CoPS industries often involve a few large suppliers facing a few large customers - i.e. bilateral oligopoly - in each country. For example, in mobile communications systems markets, several global manufacturers provide equipment to a handful of network operators in each country. Governments are often deeply involved as purchasers, users or regulators of CoPS. In mass production, by contrast, suppliers have to focus more on distribution channels and marketing to reach end-user mass markets.

Increasingly, buyers of complex products and systems want to deal with a single firm that designs and integrates the system and provides services to operate and maintain it. Because systems integrators have a detailed knowledge of their customer’s requirements as well as the products they have designed and built, they are well positioned to carry out many of the services - from maintenance and renovation, to financing and operating systems - required by their customers. As we will see, their involvement in the provision of services provides opportunities to feed back lessons learnt to improve the future design, reliability and performance of systems.

Table 1 shows how since 1995 the five collaborating companies in our study have moved from their core focus on products or services into the provision of long term solutions to the problems customers face in managing their businesses.

But if firms are changing the focus of their activities to provide such solutions, this raises the question of where these firms now see themselves in the business value chain, discussed next.
# Table 1: The shift to integrated solutions

<table>
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<tbody>
<tr>
<td><strong>Alstom Transport</strong></td>
<td><em>Products:</em></td>
<td><em>Transport solutions</em> (e.g. ‘train availability’):</td>
</tr>
<tr>
<td><strong>Railways</strong></td>
<td>• subsystems (e.g. propulsion, traction, drive, electronic information systems)</td>
<td>• Systems integrator - turnkey solutions for project management, fixed infrastructure, and finance</td>
</tr>
<tr>
<td></td>
<td>• rolling stock</td>
<td>• Services for maintenance, renovation, parts replacement &amp; service products - ‘Total Train-Life Management’ ©</td>
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<tr>
<td></td>
<td>• signalling and train control systems</td>
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</tr>
<tr>
<td><strong>Ericsson</strong></td>
<td><em>Products:</em></td>
<td><em>Turnkey solutions</em> to design, build and operate mobile phone networks:</td>
</tr>
<tr>
<td><strong>Mobile Communications</strong></td>
<td>• mobile handsets</td>
<td>• Mobile systems - complete supplier, systems integrator and partner</td>
</tr>
<tr>
<td><strong>Systems</strong></td>
<td>• mobile system</td>
<td>• Global Services - services and business consulting to support a customer’s network operations</td>
</tr>
<tr>
<td></td>
<td>• subsystem products: radio base stations, base station controllers, mobile switches, operating systems, and customer databases</td>
<td></td>
</tr>
<tr>
<td><strong>Thales Training &amp;</strong></td>
<td><em>Products:</em></td>
<td><em>Training solutions</em> (e.g. ‘pay as you train’):</td>
</tr>
<tr>
<td><strong>Simulation</strong></td>
<td>standalone flight simulators for commercial and military aircraft</td>
<td>• Systems integration</td>
</tr>
<tr>
<td><strong>Flight Simulation</strong></td>
<td></td>
<td>• Training services: networked training; independent training centres for training services; and synthetic training environments</td>
</tr>
<tr>
<td><strong>WS Atkins</strong></td>
<td><em>Services:</em></td>
<td><em>Integrated solutions</em> for the built environment:</td>
</tr>
<tr>
<td><strong>Infrastructure and the</strong></td>
<td>Engineering consultancy, project management and technical services for infrastructure projects</td>
<td>• design, build, finance and operate infrastructure across industrial sectors</td>
</tr>
<tr>
<td><strong>Built Environment</strong></td>
<td></td>
<td>• Total Solutions for Industry (TS4i) provides one-stop-shop for design, construction, maintenance and finance</td>
</tr>
<tr>
<td><strong>Cable &amp; Wireless</strong></td>
<td><em>Services:</em></td>
<td>*Provides ‘global outsourcing solutions’ for a multinational corporation’s entire telecom and IT needs on a global basis:</td>
</tr>
<tr>
<td><strong>Global Markets</strong></td>
<td>Provides ‘managed network services’ for multinational corporations</td>
<td>• Network design</td>
</tr>
<tr>
<td><strong>Corporate Networks</strong></td>
<td>• Network design</td>
<td>• Supplies telecom infrastructure and applications</td>
</tr>
<tr>
<td></td>
<td>• Supply telecom infrastructure and applications</td>
<td>• Network management</td>
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<td></td>
<td>• Network management</td>
<td>• Ownership of the network</td>
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<td>• Business process applications</td>
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<td></td>
<td></td>
<td>• Service Level Agreements</td>
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In stating our claim that integrated solutions provision is a new economic activity, it is useful to consider how these firms are redefining their role in the value chain to provide solutions to customer needs.

There are many steps, or activities, in the process of delivering a service to final consumers - from the manufacture of components and subsystems, to the design, integration and delivery of a complete system, and finally the operation of a system to deliver services. Each of these steps in the value chain is progressively closer to the final consumer (the mobile phone user, for example).

Some analysts have noted that many leading firms - mostly based in manufacturing - are expanding their activities beyond simply making and delivering a product. As we have seen, this is frequently described as moving ‘down the value chain’, or moving ‘downstream’ towards the final consumer. These firms are taking on more profitable service activities previously undertaken - but now outsourced - by their customers. In these cases, the boundary between manufacturing and services is becoming increasingly blurred. But our research shows that this does not simply mean that firms are ‘moving downstream’. While some firms are moving out of manufacturing, others such as Cable & Wireless have never been in manufacturing. Rather the key to this activity is the provision of products and services as integrated solutions.

Solutions in the stream

Many of the new activities being taken on by supplier firms are dominated by the provision of services rather than the manufacture of products. Whereas making components and subsystems for a mobile phone network is a manufacturing process, some firms such as Ericsson are now responding to demand from customer firms who request suppliers that can not only design, integrate and build their mobile phone network but also finance, maintain and operate it through its entire life. This implies a very different kind of relationship with the customer and the ability for the supplier firm to provide services that can complement the more tangible activities involved in making products and building systems. This is even more the case when the customer needs assistance with financing the deal, with training for staff on how to use the system, and with providing round-the-clock support to ensure continuous operation, as is the case with some of Ericsson’s mobile operator customers. The integration of products and services is the key to this shift in focus. But what are services?

At your service

There are two competing ways of thinking about ‘services’ in most discussions on these issues. The first is perhaps the more obvious, traditional definition: while manufacturing involves making products, services related to these products involve any activity required for the product to be able to deliver its value to the customer - such as maintenance and repair, marketing, the provision of finance and so on. Here, the distinction is that whereas products are tangible, services are thought of as any activity that adds value for the user in an intangible, knowledge-based way. Under this definition, services are mostly thought to exist at the customer end of the value chain.

The second way of thinking about services holds that services can exist at any point in the value chain, including within the manufacturing process. For example, under this definition, design, R&D and market research are all services, even when carried out as part of the manufacturing process. Authors who use this definition claim that traditional physical or tangible assets - access to raw materials, manufacturing plants, equipment, and integrated production processes - are no longer a source of competitive advantage. Such physical assets can easily be copied or bypassed. Successful firms in the ‘new economy’ derive their competitive edge not
by making ephemerally superior products but from service-based activities that exploit the firm's intangible assets - such as knowledge, design, brand name reputation, access to world-class suppliers and close relationships with customers.

The first definition - underpinned as it is by the traditional manufacturing-services distinction - is useful in highlighting where firms are in the value chain. The second, broader value-chain definition of services reminds firms that they could be expanding their revenue-raising activities by selling services to external clients that are currently provided exclusively in-house. Alternatively, they could choose to focus on particular core activities by outsourcing some manufacturing and service functions (market research, for example).

But both of these perspectives on the value chain are unable to think beyond the conventional view that the source of competitive advantage is either the product or the service. Our research shows that competition is no longer between products or services, but between competing business models to provide solutions to customers.

**Expanding into high-value territory**

To move successfully into integrated solutions, companies are withdrawing from some activities previously undertaken in-house and taking over key functions at the customer's end of the value chain. As illustrated in Figure 1, integrated solutions providers are occupying the high value territory in the value chain between manufacturing and final consumer services. A new pattern of specialisation and integration is occurring, as providers of integrated solutions redefine their role in the value chain, and cultivate new relationships with their suppliers and customers.

Component and subsystem manufacturers reside up the value chain from integrated solutions providers. As large vertically-integrated manufacturers begin to outsource key production activities, a new breed of contract manufacturers (e.g. Flextronics) and specialised component suppliers are growing by making components, subsystems and products for other companies - the integrated solution providers - in high volume and at low unit cost. Often these companies work as partners with integrated solution providers, supplying critical components in an integrated solution. By effective outsourcing and managing of upstream manufacturers, integrated solutions providers can concentrate on their core systems integration activity and surround that activity with depth in services, such as design, project management, maintenance, finance and operational capabilities. These activities provide higher margins and require fewer assets than product manufacturing.

Integrated solutions providers are also entering into closer and new types of relationships with their customers - the operators (e.g. Vodafone), service providers (e.g. Virgin Mobile), business users, and government agencies - which operate systems to deliver services to final consumers. These customers are now focusing on providing more competitive services, and outsourcing non-core activities. Intangible assets such as reputation, brand, billing and marketing skills are becoming more important to the competitive success of these customers than designing, building or maintaining the systems on which their services depend.

The decision to focus on these downstream activities that are closer to the final consumer means that these firms are more inclined to buy in other functions from external suppliers. These customers are entering into longer-term partnerships with their suppliers, ensuring that providers of integrated solutions share the risks of performing critical outsourced activities.

But if the provision of integrated solutions is now so strong, why did this challenging new type of activity emerge? The next section outlines the forces driving firms to embrace integrated solutions provision.

Our research shows that competition is no longer between products or services, but between competing business models to provide solutions to customer needs.
The 1990s saw the first signs of a significant trend towards the provision of integrated solutions. Among the first companies to offer integrated solutions were suppliers of information technology (IT) equipment, such as IBM, Sun Microsystems and Unisys. Several factors encouraged buyers of IT systems to demand integrated solutions to their IT problems including: the growing complexity and size of IT contracts; their importance to user competitiveness; and the seriousness of the problems caused when IT systems fail.

Customers of complex IT systems began to insist that their suppliers take responsibility for supplying not only hardware but also software, and then installing and integrating the system, and providing support throughout the product life cycle. IT vendors responded by offering solutions that allow each customer to select the level of service that addresses its requirements, ranging from individual packages to full service solutions covering service failure prevention, disaster recovery and planning functions.

Now, many firms in sectors ranging from IT and telecoms to aerospace, railways and the built environment have taken up the challenge of integrated solutions. Their customers want to do business with systems integrators that have a broad range of service capabilities.

For example, Ericsson is finding that the switch to third generation (3G) mobile communication systems has created much greater demand for it to deliver integrated solutions. In making this transition to a new technology, network operators have sought to avoid the need to build up expensive in-house expertise. In addition to demanding a complete portfolio of 3G products, these customers are working more closely with equipment suppliers for advice on how to select technologies, procure equipment, finance their investments and develop applications for 3G services.

Key drivers

A number of factors are driving firms to embrace integrated solutions provision. Our research has revealed four main drivers:

- **The attraction of profitable markets**
- **Demand from customers and the outsourcing trend**
- **Government-led market reforms: privatisation, de-regulation and liberalisation**
- **The use of private finance.**

These forces have all had their individual effects, but it is the combination of all four working together that has now made such a strong trend. The emergence of integrated solutions provision has taken hold particularly strongly in countries like the US and UK, which have led the world in promoting privatisation, liberalisation, de-regulation and new forms of private finance. As the imperative towards integrated solutions provision is replicated in other countries, suppliers based in the US and UK may enjoy first mover advantages in increasingly global and competitive markets.

This section outlines each of the four drivers in turn. The aim is to explain the main forces at work in order to clarify the factors behind the new business model being adopted by the case study firms.

**The attraction of profitable markets**

Suppliers are being attracted into integrated solutions markets by highly profitable contracts for systems integration projects and services provided throughout the product life cycle.

**Systems integration**

Many of the world’s leading companies - whether in manufacturing or services - want to be systems integrators in control of the high-value prime contract. These companies provide their customers with fully integrated and functioning systems.
comprised of components and subsystems produced in-house or externally by best-in-class manufacturers.

A typical example of this type of contract is a turnkey - or Build-Operate-Transfer - project, where the design, integration and construction of a complete system is managed by a single firm and delivered ready for immediate use by the customer. The 1990s experienced a dramatic increase in demand for turnkey projects across a range of industries. In 1997, for example, the growth in the $27.8bn market for railway equipment was driven by demand for turnkey projects, in which suppliers are responsible for designing and building rolling stock and railway systems, as well as providing long-term maintenance, leasing and financial services.

For manufacturing companies like Alstom, Ericsson and Thales, the attraction of being a systems integrator - rather than a second tier manufacturer - is reinforced by difficulties these companies face in markets suffering from declining profitability, rapid price erosion and shorter product life cycles. In the face of these challenges, these companies are selling off manufacturing assets and outsourcing some of their production activities to contract manufacturers. Flextronics, for example, now produces mobile handsets and network equipment for Ericsson. Around 90% of the components in trains designed and built by Alstom are now outsourced.

While systems integration projects promise large revenues, high-cost capital goods (such as flight simulators, trains and mobile phone networks) tend to be bought in surges at irregular intervals. Consequently, companies that are dependent on these contracts are vulnerable in periods when the volume of work declines, suffering shrinking revenues and operating margins.

Operational services
Services provided through the product life cycle have the benefit of offering continuous revenue streams. By expanding the definition of product scope to include services, companies can capture more of the life cycle profits associated with a product. The promise of smooth, counter-cyclical growth is attractive to systems integrators that have been dependent on erratic - or ‘lumpy’ - sources of revenue. In recognition of this, and building on their core systems integration capabilities, suppliers across sectors as diverse as IT, telecoms, railway and aerospace now provide services to maintain, upgrade, finance, and operate products and systems.

According to one estimate, revenues from operational services now represent ten to 30 times the annual volume of underlying product sales. In other words, the purchase cost of a product often represents only a fraction of the total cost of operating and maintaining it over its life cycle. For example, railway companies spend $28 billion a year maintaining and operating their locomotives and fixed infrastructure, but buy less than $1.4 billion of new locomotives.

Yet it is increasingly difficult to disentangle systems integration from service revenue streams, as both sets of activities are now often provided under a single contract. Customers are taking the view that projects should be designed and costed as a total package for the whole life cycle, including costs for the design, build, operation and final de-commissioning of a product or system. For example, in addition to a large up-front expenditure for the delivery of a system, many large systems integration projects include payments for services in instalments spread over the period of a 20 or 30 year contract.

Operational services offer smooth long-term revenues.

The purchase cost of a complex product represents only a fraction of its total lifetime cost.
Ericsson estimates that equipment costs represent a small proportion - only 6% - of their customers’ total costs of designing, building and operating telecommunication networks. More than 80% of an operator’s costs are in operation, maintenance and administration, and these costs are spread over a ten-year period. This percentage increases as networks grow older. Ericsson has reacted to this by providing integrated - or one-stop-shop - solutions for the design, build and operation of networks.

Thales Training and Simulation has found that technological advances have squeezed profit margins in military simulation markets. The rise of cheap computer power and high-fidelity image generators has made it harder for contractors to sell expensive simulators. In the words of Bernard Retat, vice chairman of Thomson-CSF, as Thales was called at the time, ‘Whereas a few years ago you could sell a unit and walk away, generating a profit now depends more on selling services, selling hours on simulator services’.

Even systems integrators that have not had a traditional base in manufacturing, such as Cable & Wireless, are expanding into more profitable activities. In the late 1990s, Cable & Wireless decided to move out of selling low-margin basic voice telephony to final consumers and to diversify into high margin value-added services for business customers. This was in recognition that greater profits could be generated by performing all the activities - software applications, internet-based services, systems integration and business consultancy - necessary to offer corporate customers total solutions for their global communications requirements. In 1998, when Cable & Wireless made its strategic decision to focus on profitable business-to-business markets, the global outsourcing market for an estimated 2,500 multinational customers was expected to reach $15 billion by the end of 2000.

In summary, the first key factor attracting firms to providing integrated solutions is the attraction of the lucrative markets that exist for bundles of systems and services.

**Demand from customers – outsourcing**

As well as being attracted by higher profits, suppliers of complex products and systems are being encouraged to move downstream by strong demand from their customers. These customers - such as airlines, railway and telecoms operators, large business users and government organisations - are concentrating on the provision of services to final consumers, and are outsourcing other non-core activities. To meet this demand, suppliers are carrying out activities previously handled in-house by the customer, such as design, systems integration, and project management. In full outsourcing solutions, this includes the transfer of assets and staff to supplier firms.

Until the early-1990s, manufacturers in former state-owned sectors, such as railways, electricity and telecoms, supplied and installed equipment but rarely performed systems integration. Their customers, public operators and energy utilities, had sufficient engineering and project management knowledge in-house to design, set specifications, and integrate components sourced from outside. Suppliers assumed the role of manufacturer, responding passively to detailed specifications - so-called ‘build to print’ - set by their customers.

Since the mid-1990s, traditional and privately-owned operators have begun to focus on providing core services in more competitive, privatised and de-regulated markets, and to outsource non-core activities. Operators now expect their suppliers not only to design and integrate systems, but to maintain and operate them as well. In this more competitive environment, customers no longer require their suppliers to meet detailed technical specifications. They expect them to provide conceptual solutions that address their business needs - so-called ‘bid to concept’ - offering products and services as integrated solutions that can be assembled directly from a supplier’s portfolio.
For example, Ericsson’s move into integrated solutions has stemmed almost entirely from customer demand. Ericsson first started to notice demand for integrated solutions in the mid-1990s when mobile phone operators began to focus on their core activities and to seek cost reductions by outsourcing systems integration and related service activities, such as maintenance and network management. These operators are asking their suppliers to take on a more prominent role in designing, integrating equipment, building, maintaining and, possibly, operating the network. Unburdened by the need to design and build networks in every country in which they operate, Ericsson’s customers - the mobile operators - are able to expand more rapidly in global markets by concentrating on their core activity - providing competitive mobile services to final consumers.

With limited telecom expertise in-house, newly licensed mobile operators and service providers are also outsourcing a larger proportion of their activities than traditional operators, which have tended to have in-house expertise. For example, as a service provider Virgin Mobile is concentrating on its brand, marketing, distribution and customer care activities and is outsourcing all maintenance and operational activities, including buying capacity from another network operator to carry its radio telephony. This focus on end-user services is also the strategy of Virgin Trains in the UK’s railway sector.

But demand for outsourcing is not just confined to newly liberalised network operators and service companies. It affects all business users which depend on complex systems - such as telecoms networks, information technologies, and facilities management for buildings - which form a large part of a company’s overhead costs. Many of these firms are seeking to buy in such services from specialised suppliers competing in each of these areas.

Cable & Wireless is finding that its multinational corporate customers are focusing on their core businesses, such as making cars or providing financial services, and are outsourcing non-core network management, IT and telecom functions. As customers stop providing all their telecoms needs internally, they have to rely on external providers like Cable & Wireless to use telecommunications to solve business problems, reduce costs and increase efficiency.

In summary, outsourcing is the second driver encouraging firms to meet the demand for integrated solutions.

Government-led market reforms: privatisation, de-regulation and liberalisation

The two drivers of the growth in integrated solutions just discussed - more profitable activities and customer demand - have in turn been driven by processes of privatisation, de-regulation and liberalisation. These have brought about completely new market structures and sets of incentives and rewards in sectors such as railways, telecoms, and airports. Four of the case study firms are in these sectors: here we illustrate how these government-driven market changes have affected these firms.

Alstom’s decision to change its business model was heavily influenced by privatisation and de-regulation of the railways. Under the nationalised industry arrangements, Alstom built a train to meet technical specifications set by nationalised railway companies such as British Rail (BR). After a train was delivered to the customer, the manufacturer was almost completely cut out of the circuit: it was rarely involved in maintaining the train during its operating life, except for specialised requirements such as individual parts supply.

Privatisation and liberalisation bring new market incentives that favour integrated solutions.

Demand for outsourcing is affecting all users of complex products and systems.
Privatisation of BR in 1993 created a railway network composed of over 100 separate companies. Many new entrants had no experience in railway operations such as Virgin, Group 4 and the banks that own the trains. Privatisation hugely increased the number and variety of customers in the railway industry - see diagrams from an Alstom presentation below. In particular, new train operating companies require greater support from Alstom for systems, services, and experience to meet their own operating requirements for reliability and availability, cost, safety, image and innovation.

Privatisation and liberalisation therefore drove outsourcing in the UK railway industry. Manufacturers like Alstom and Bombardier and specialised technical consultancy organisations like WS Atkins and AEA Technology have taken over design, build and maintenance activities previously carried out internally by BR. This is part of a general outsourcing trend that is now affecting the rail industry in other countries.

Cable & Wireless has also been affected by these processes. Liberalisation of telecoms markets in the EU in 1998 introduced full competition between traditional operators and new entrants. The new operators were the first to introduce low-cost services based on internet protocol technologies for profitable business markets. The adoption of optical fibre transmission technology brought about a dramatic reduction in the price of bandwidth capacity and eroded the margins that operators can obtain from basic telecom services. For example, the cost of a 2 megabits per second (mbps) transmission circuit from London to New York in 1995 was around five times more expensive than a 45mbps circuit in 2000. As voice telephony becomes a low-cost commodity, operators such as Cable & Wireless are diversifying into higher value activities, especially systems integration and business consulting services, to provide corporate customers with integrated solutions for their entire telecoms and IT needs.

In summary, privatisation, liberalisation and de-regulation have all contributed to creating markets for integrated solutions. These processes have strengthened the tendency for firms to outsource solutions, and have in turn been strengthened by policy moves towards greater use of private finance in public sector projects, as discussed next.

The use of private finance

The recent and rapid growth in the use of private finance to design, build and operate systems has been promoted by changes in government policies towards the financing of public sector projects.

In many large public infrastructure projects a new concept of private finance has replaced traditional forms of public procurement. In 1992 the use of private...
finance to fund major public projects became the standard for government procurement policy in the UK. With limited funds for public infrastructure projects, the government launched the Private Finance Initiative (PFI). Under PFI, private sector companies ‘design, build, finance and operate’ (DBFO) public sector projects. PFI has since become the primary means of funding new projects, ranging from roads, prisons and hospitals, to more complex IT, rail link and weapons systems. By the late 1990s PFI had started to take hold elsewhere in the world. The drivers attracting countries to adopt PFI are the same throughout the world:

- the desire to provide capital-intensive infrastructure without raising taxes
- the wish to remove such expenditures from the government’s balance sheet
- a belief that the incentives built into PFI deliver better value for money, and
- the assumption that by giving the private sector responsibility for the risks of maintaining and operating projects, more cost-effective life-cycle design and maintenance can be secured.

The election of the Labour Government in 1997 ushered in a new programme of public-private partnerships (PPP). In contrast to PFI where the private sector finances projects and assumes much of the risk, PPP provides a way of financing public projects partly from the private sector, while the state shares or underwrites some of the risk. Examples of PPP include the Channel Tunnel Rail Link project, and plans to modernise the London Underground and the semi-privatisation of air traffic control. At the beginning of 2001, PFI and PPP projects worth £16 billion had already been procured, with another £16 billion in the process of procurement.

As a result of the increasing use of PFI and PPP for Ministry of Defence (MoD) contracts, private contractors are becoming more deeply involved in UK military operations.

Thales Training & Simulation has benefited from the MoD’s decision to contract out almost all of its flight training facilities, including ownership of the buildings. In 2000, for example, the MoD launched a £10 billion programme under which almost all flying training by all three services will be taken over by a PFI contractor, which will also own the trainer aircraft.

WS Atkins has been at the forefront of responding to the UK’s PFI and PPP initiatives. The firm was heavily involved in the Channel Tunnel, the first large scale privately financed public infrastructure project since the 2nd World War. This provided a significant platform from which to springboard into the provision of DBFO projects. The growing PFI market now represents an increasing part of the activities of WS Atkins, ranging from schools to large infrastructure projects.

**Conclusions: integrated solutions - key drivers**

To conclude this section, four main drivers—profitable systems integration and service activities, outsourcing demand, privatisation and liberalisation, and the use of private finance—have brought about a situation where the provision of integrated solutions is emerging as a significant area of industrial activity. However, little research has been conducted into this subject, and most analysts still try to place integrated solutions provision onto the procrustean bed of the manufacturing-services dichotomy. In fact, this activity is distinct from the traditional categories of manufacturing and services, and requires a different set of capabilities. In the next section, we examine a key challenge facing integrated solutions providers – building these capabilities.
Integrated solutions providers have to think and act in ways that are significantly different from firms that are based in either manufacturing or services. They have to enter new relationships with their customers, take on different risks, and implement new ways of assuring quality.

All of these changes bring with them the need for new organisational forms, management approaches and strategies. In particular, the delivery of solutions requires firms to enhance their core capabilities in systems integration and operational services. By 'capabilities' we mean the organisational structures, knowledge, skills and experience that a firm has to develop to carry out particular activities such as systems integration or maintenance.

So what sets integrated solutions providers apart from manufacturers and service providers? The figure below shows the four sets of capabilities commonly displayed by integrated solutions providers. These capabilities are:

- systems integration capabilities - to provide customers with complex products these firms have to design and integrate components and subsystems into a system
- operational services capabilities - to maintain, finance, renovate and operate a product or system through the life cycle
- business consulting capabilities - to understand a customer’s business and to offer advice and solutions that address a customer’s specific needs
- financing capabilities - to provide a customer with help in purchasing new systems and in managing a customer’s installed base of capital assets.

Not all integrated solutions firms have strong capabilities in each of these areas: some capabilities are more ‘core’ than others for the provision of integrated solutions (see Figure 2 text).

Figure 2:
Capabilities Framework
The diagram suggests the relative importance of the four capabilities in this context. As the diagram suggests, all solutions providers have systems integration capabilities, most have operational service capabilities to maintain and operate systems, while only some have capabilities in business consulting and financing.

building capabilities to deliver integrated solutions
In addition, there are two further activities which these firms may or may not be involved in – manufacturing and final consumer services. As we have already seen, these are well-known categories of activity in their own right. Here, we are interested in identifying the core capabilities that integrated solutions providers need to develop.

The four sets of capabilities are briefly elaborated in the following sections.

**Systems integration capabilities**

Systems integration is a central management task in the design and production of complex products and systems. This is the first and most central capability required of integrated solutions providers. As noted earlier, the primary focus of systems integration is to ensure that components and subsystems are conceived and developed as integrated packages to meet an overall system design and to work together to the desired outcome. To achieve this, systems integrators perform a range of activities such as technology development, design, project management, construction, assembly or integration of components, maintaining relationships with customers, and managing internal or external suppliers of specialised components. All except construction and assembly of physical components are service activities.

The systems integration - or prime contractor - function can be performed either in-house by vertically integrated suppliers or by specialised prime contractor organisations. Many large manufacturers have recently begun to outsource a large proportion of component and subsystem manufacture. Ericsson, for example, has recently pulled out of mobile handset manufacturing, while maintaining in-house control of research and development, product design and marketing functions. Thales Training & Simulation has gone further, by focusing on being a pure systems integrator and outsourcing the manufacture of all simulation components and subsystems. As companies like Thales pull out of manufacturing altogether, they have to develop the new capability to co-ordinate the activities of upstream suppliers. Systems integrators have to rely on contracts and long-term partnerships with external manufacturers for high-quality components and subsystems that meet customers’ performance requirements.

Integrated solutions providers are also developing the capability to integrate equipment supplied by competing systems manufacturers, as this is sometimes requested by their customers. These are known as ‘multi-vendor’ systems. For example, Ericsson is able to integrate mobile equipment manufactured by other leading competitors such as Nokia, Nortel, Siemens and Lucent Technologies. Similarly, Alstom is able to design and build rolling stock using components supplied by its competitors, Bombardier and Siemens.

There are indications that the systems integration trend is becoming widespread across diverse civil and military capital goods sectors. Many other leading suppliers – such as Boeing, BAE Systems, Marconi, and Lucent Technologies – are moving from being broad-based manufacturers into systems integration and service provision.

**Operational service capabilities**

The second set of core capabilities for integrated solutions is in the provision of operational services. Suppliers are building on their base in systems integration and crossing the boundary into the provision of services to maintain, renovate and operate products and systems.

These operational services require the expansion of existing capabilities, such as maintenance and the supply of spare parts, as well as the development of entirely new activities, such as training, operational management and the provision of support services to customers. In the same way that the delivery of a product opens the door for the provision of a continuing service through the product life cycle, being
Providing operational services allows - and encourages - firms to identify problems and feed this information into the design and build process.

Being involved in operational services allows companies to grasp in-service problems and opportunities to improve system performance. Lessons learnt can be fed back into the design and build of current and future generations of systems.

Because providers of integrated solutions are responsible for both systems integration and operational services, new feedback loops are being created between different parts of the same company. System designers and service providers operate in a closed loop, in which responsibility for operational performance and costs remain in the hands of a single organisation. As depicted in Figure 3, this can initiate a virtuous cycle of innovative improvements between service and system integration activities, leading to the design of more reliable and efficient systems being built in the future.

For example, instead of building the rolling stock and selling it to the train operator, who then arranges maintenance, overhaul and train operations, Alstom now maintains, upgrades, converts and re-deploys rolling stock as usage patterns change, often recycling trains through the plants where they were originally built and designed. In this closed loop, the rolling stock never leaves the oversight of the designer and builder.

In the case of Alstom’s contract for the Northern Line extension of the London Underground, the managers responsible for maintenance and operational services were deeply involved in the front-end design of the rolling stock. As a result of their recommendations, the train designers made more than 250 modifications to create easy-to-maintain and easy-to-use trains.

Business consulting capabilities

In moving into integrated solutions, firms need to enhance their business consulting capabilities. This is the third capability required of integrated solutions providers. As part of the integrated solutions package, companies are offering business consultancy services to advise customers on how to plan,
design, build, finance, maintain and operate systems. Some companies, such as Ericsson and WS Atkins, have set up specialist business consultancy organisations to perform this task. Other companies prefer to foster a consultancy-based approach within existing business units.

In comparison to the traditional focus in many of the firms on ‘hard’ manufacturing or engineering capabilities, suppliers are developing an entirely new set of ‘soft’, service-based business consulting skills. To solve particular business problems, suppliers are seeing great value in building a detailed understanding of the customer's operational requirements. To achieve this, they have to forge closer relationships with their customers by cultivating an ability to listen and demonstrating an ability to respond creatively and flexibly to a customer's requests.

Business consultancy services are particularly important in the front-end pre-bid and bidding phases of the life cycle, when customers require assistance with business plans, financing arrangements and conceptual solutions. However, consulting skills are also important at later stages, to assist with specific problems such as project implementation and the management of an installed base of assets.

The need to be able to undertake business consultancy is encouraging firms to expand their capabilities in three ways:

- new alliances with other firms that have such capabilities
- acquisitions of other firms already operating in this field, and
- the development of new in-house business consultancy organisations and capabilities.

Firms in the telecoms sector, for example, have pursued all three ways of developing their capabilities in business consultancy. In 1999 Lucent Technologies made a $3.7bn bid to expand its consulting and service business by acquiring International Network Services (INS), an independent network consulting business. Some suppliers prefer to form alliances with independent consulting groups. Cisco Systems, for example, has invested $1bn in KPMG and has a strategic alliance with the consulting group to advise customers on building and maintaining telecom networks. Still others, like Ericsson, are developing these capabilities in-house.

**Financing capabilities**

The ability to provide finance is the fourth capability being developed by some integrated solutions providers. While many capital goods suppliers, such as General Electric, have long had their own financing divisions, the provision of financial services has become a more widespread and profitable activity since the mid-1990s. The growing importance of private finance is generally associated with large public sector PFI and PPP projects. But it has also grown in importance in recent years as an industry-led initiative to provide vendor financing and asset management services in capital-intensive telecom, railway and other large infrastructure systems.

Vendor financing is strongly driven by the high costs of constructing new systems, such as 3G mobile phone systems. Ericsson is considering the benefits of offering vendor financing to help mobile operators with limited funds to build 3G mobile phone networks on expectation of payment at a later date. For example, Mobilcom, the German operator, failed to secure bank loans and is negotiating 1.6 billion Euro of credit from Ericsson. Asset management is also of growing importance as a service for customers, such as train operating companies, seeking to reduce the costs and extend the operating life of an installed base of products. WS Atkins, for example, has set up a joint venture with the Royal Bank of Scotland to help the Bank's customers manage their capital assets, such as rolling stock, mobile networks and baggage handling systems.
More than the sum of the parts

Taken together, these capabilities combine to form a new type of business model, offering integrated solutions to customers’ business and operational problems. From different starting positions in manufacturing, design engineering and network operations, the suppliers in the case studies are moving in a similar direction towards becoming providers of integrated solutions. They are offering bundles of products and services that are configured to solve customer problems. By providing solutions as a ‘one-stop-shop’, customers benefit from having a single point of contact for current and future products and services. Integrated solutions help to maintain long-lasting relationships, build customer loyalty, and earn a steady stream of revenues on recurring upgrades, maintenance and other operational revenues.

To move successfully into integrated solutions, suppliers must not only demonstrate that they have acquired these new capabilities, they must also be seen differently by their customers. Thales Training & Simulation, for example, increasingly wants to be seen as a provider of simulator-based solutions for the training of pilots rather than as a manufacturer of flight simulators. Similarly, Cable & Wireless no longer wants to be seen as a general telecoms carrier but as a solutions provider serving the business market.

By providing integrated solutions, therefore, firms adopting this business model are selling the idea that their ‘system’ and core capabilities add up to more than the sum of the parts. This section has shown that these core capabilities are:

- Systems integration
- Operational services
- Business consulting, and
- Financing.

Firms seeking to become integrated solutions providers need to have the first two at the very least, and over time to develop at least the third, if not all four.

In this way, integrated solutions providers are developing new capabilities that set them apart from the usual categories of manufacturing and services. This is not to say that integrated solutions providers do not perform manufacturing or service activities: our intention has purely been to illustrate the other capabilities required to undertake this emerging category of industrial activity.
As we have seen, traditional manufacturing and service companies are adapting to their new role in the value chain by recasting themselves as integrated solutions providers. Not only are they expanding their portfolio of capabilities, they are having to tailor specific packages to different clients. The solution required will depend on the customer's capabilities, their position in the value chain, and their desired level of service.

In addition to the development of new capabilities, integrated solutions providers are being forced to face four wider organisational challenges, as discussed in this section:

- providing appropriate solutions by seeing the problem from the customer's perspective
- managing the fluid organisational boundaries that can arise where these firms are taking on many functions previously undertaken by their customers
- designing clear contractual agreements that outline the responsibilities, risks and rewards attached to providing high-cost solutions, and
- defining new business structures and cultures around the provision of integrated solutions.

**See it my way – the customer's perspective**

In a shift away from formal, defined business-to-business relationships, integrated solution providers are incorporating customer experiences into their business models\(^1\). No longer merely selling a product and ‘throwing it over the wall’ to the customer, suppliers are engaging themselves in an active dialogue and closer collaboration with their customers. Suppliers have to build up a deeper understanding of customer’s experiences of operating a product or system, which will vary according to their skills as users.

Having identified customer problems, products and services have to be reconfigured to provide integrated solutions.

The lower the level of the customer's technical and project management capabilities, the earlier in the life cycle they require services from their suppliers. These include systems integrating services sold as:

- **individual packages** (e.g. design, business consultancy, and project management) or **complete turnkey solutions** (where suppliers perform all the activities to deliver fully-functioning systems)

**operational services** through the life cycle which include on-going services to run the system.

Customers with limited technical knowledge and experience (new entrants like Virgin Trains) will require partnerships as early as the pre-bid phase to discuss business ideas, user requirements, and conceptual solutions, prior to specifying products and implementing systems. More experienced buyers and traditional operators like BT often only require assistance at later stages.

As a result of this variety, companies have to interact with and listen more closely to their customers\(^2\). Suppliers have to build up a detailed understanding and profile of the valuable activities a customer performs. They need to understand their customer's requirements for support at different phases of the product life cycle, from bid, through project implementation, to delivery to the customer and beyond that into after-sales service provision.

**Managing fluid boundaries**

Part of this ability to see the problem from the customer's point of view is the need to build up a detailed understanding of what the customer regards as its core business. There is a need to understand how far a systems integrator can migrate along the value chain before it steps over the boundary into what a customer regards as its core activities. Since the mid-1990s, the
boundary between system supplier and customer has become more fluid. Managing these boundaries has become a major issue, particularly where one supplier may be dealing with varying boundaries with different customers, such as operators and service providers.

For example, to avoid competing with their customers, telecom equipment suppliers have traditionally refrained from moving beyond equipment supply and integration into operations. To fulfil demand, Ericsson is now migrating into the technical operation of mobile phone networks, but has not crossed the final boundary into the provision of services to final consumers.

**Solutions providers accept the risk**

In service-based contracts, the risks of late delivery, quality problems and cost overruns are transferred from the buyer to the integrated solutions provider. If the specification is inadequately defined, the risk for the supplier can be extremely high - liquidated damages can reach hundreds of £millions.

But all the signs are that many firms are now prepared to accept such risks. As customers outsource key activities, both suppliers and customers require new ways of monitoring the performance of the system. Many relationships rely on Service Level Agreements (SLAs). Drawn up at the contractual stage, SLAs ensure that the risks and responsibilities for delivering and managing a system during its operating life are transferred from customer to supplier, but equally that clear reward structures are attached to system performance. SLAs provide guidelines on how to monitor the ongoing relationship between the customer and supplier.

**New business structures... and cultures**

A major challenge for companies moving into integrated solutions is often seen as the need to reconcile the differences between ‘competing’ manufacturing- and service-centred business models. According to this view, as they ‘move into services’, some companies are finding that they have to take on a new form as they outgrow their old manufacturing shell. As we have tried to show, however, the provision of integrated solutions does not fit into business models that are based on the simplistic distinction between manufacturing and services. Our research indicates that this sort of confusion is largely caused by the absence of a clear business model for what these firms are trying to achieve.

It is certainly apparent that companies face difficulties in managing tightly coupled manufacturing and service businesses within the same organisation - if they are still working with the old business models. They can experience a clash of interests between the priorities of manufacturing and resources needed for ‘service provision’.

We have concluded that most of these tensions would be cleared up by the implementation of a new business model that puts the provision of integrated solutions in a category of its own. By acknowledging that they are becoming integrated solutions providers, and by using the capability planning blueprint put forward in this document, companies could clarify their strategies and begin to put in place appropriate new business structures.

As we shall see in the case study reports, many firms are in a period of transition as they redefine what they are doing, where they are going, and how they should be organising themselves to achieve best practice. Many are changing their business structures, but the frequency of the changes that are being made to these structures indicates that they have not yet settled on a solid strategy and structure. This brings us to the final section before the individual case study reports: the future challenges that these firms face.
In this final section, we use and build on the framework for understanding integrated solutions that we put forward earlier in the document to:

- give an overview of the structures and capabilities that the case study firms have been developing in reaction to the integrated solutions challenge, and
- identify challenges for these and other firms for the future.

The pattern of emerging capabilities among the case study firms is illustrated in Table 2. This is arranged around the four sets of integrated solutions capabilities previously identified.

The second column in the table shows that it is clear that all companies seeking to be providers of integrated solutions need to start from a strong base in systems integration. An intimate knowledge of overall systems design and the capability to integrate components and subsystems is essential.

### Table 2: Capabilities of integrated solutions providers – findings from case study firms

<table>
<thead>
<tr>
<th>Company</th>
<th>Systems Integration</th>
<th>Operational Services</th>
<th>Business Consulting</th>
<th>Financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alstom Transport</td>
<td>Design, manufacture and build trains and signalling systems, using equipment developed in-house or externally</td>
<td>Maintain, upgrade and operate trains</td>
<td>Consultancy-based approach to meet customer needs</td>
<td>Vendor financing and asset management</td>
</tr>
<tr>
<td>Ericsson</td>
<td>Design, manufacture and integrate mobile phone systems, using equipment developed in-house or externally</td>
<td>Maintain, support, upgrade, and operate mobile networks</td>
<td>Two business consultancy organisations to meet needs of Ericsson and external customers</td>
<td>Considering, but not yet offering vendor financing</td>
</tr>
<tr>
<td>Thales Training &amp; Simulation</td>
<td>Design and integration of flight simulators</td>
<td>Provide services to train pilots and manage simulator building facilities. Joint venture with GE Capital Training</td>
<td>Consultancy organisation to meet customer needs</td>
<td>Revenue sharing agreement for simulators, e.g. split between TT&amp;S and United Airlines</td>
</tr>
<tr>
<td>WS Atkins</td>
<td>Design and integrate external manufacturers’ equipment across diverse sectors, such as railway and baggage handling systems</td>
<td>Maintain, operate and provide services to end-users, e.g. setting up independent service provider to design, build, finance and operate baggage handling services</td>
<td>Consultancy-based approach to meet customer needs</td>
<td>Created joint-venture company, TS4i, with Royal Bank of Scotland to provide integrated solutions for design, construction, maintenance, and finance</td>
</tr>
<tr>
<td>Cable &amp; Wireless Markets</td>
<td>Design and integrate networks using externally supplied equipment. Developing capability to integrate internet and IT systems</td>
<td>Design, build, operate and manage a global customer’s IT and telecom needs</td>
<td>Consultancy-based approach to meet customer needs</td>
<td>Sometimes takes on responsibility for ownership of networks for duration of contract</td>
</tr>
</tbody>
</table>

Coordination of external contractors for component supply
But there are different approaches to systems integration. There is a general trend for large manufacturers, like Alstom, Ericsson and Thales, to outsource the production of components and to focus only on developing their design, systems integration and brand to achieve a ‘world class’ position in selected product markets. Other suppliers like WS Atkins are implementing systems in partnership with best-in-class systems suppliers across diverse markets, such as manufacturing industries, railways, telecoms and airports.

The third column in the table illustrates that most of the case study companies are moving into the provision of operational services to maintain, support and operate systems. To provide customer-driven solutions, the products and services offered as integrated packages by suppliers must help customers to achieve their business objectives. Systems integration and operational services are closely related. Responsibility for the operation of systems creates opportunities to feed back valuable lessons into the design of new generations of equipment.

For many companies, the capabilities illustrated in the last two columns - moving into vendor financing and business consulting - are uncharted territory. Companies are travelling in different directions and at different speeds, depending on their business sector. Some suppliers like WS Atkins have set up vendor financing companies to win business for PFI and customer outsourcing contracts. Other companies like Ericsson are being more cautious about offering vendor financing, preferring to examine it on a case-by-case basis. Ericsson is, however, moving early into business consultancy, by setting up two organisations to offer customers advice on a range of business problems.

Many of the case study companies are now evaluating their present expertise in various areas. They are identifying areas in which gaps in capabilities might prevent them from taking advantage of the new business opportunities presented by integrated solutions. In all of the case study companies, corporate management has made the strategic decision to become service-based, integrated solution providers.

To achieve these goals, companies have initiated far-reaching changes to their business structures and culture. Now, firms need to identify the capability gaps between them and the best in that particular business. They need to do this for each of the four capabilities. In moving forward, firms then need to decide how best to develop these capabilities. There are basically four options open to them, as they could develop the capabilities:

- in-house
- through joint ventures with partners with established capabilities
- through acquisitions of firms with specialised expertise
- or by outsourcing, an option only possible for some of the less ‘core’ capabilities.

For many companies, developing capabilities in vendor financing and business consulting involves moving into uncharted territory.
Our hope is that by proposing a new framework for understanding integrated solutions, and by outlining the patterns of activity being undertaken by a range of world-class case study firms in five different sectors, we can provide new clarity to an emerging and often confused area of activity.

In particular, the capability framework (reproduced, right) combined with Table 2 (page 25) provides a blueprint for firms to map where they are at present, identify the capabilities that they need to develop to be successful in meeting the new business opportunities, and plan their next moves.

Each of the following case studies gives:

- a basic introduction to the company and its history
- a description of how the company has made its strategic shift into integrated solutions, and
- an analysis of how each firm is developing its capabilities and structures to enable it to deliver integrated solutions.

The research presented in the case studies was carried out in 2000 and early 2001 and does not encompass events in the companies since February 2001.
Alstom is one of the world’s leading energy and transportation infrastructure companies. Formed in 1989 as GEC Alsthom by a merger between GEC of the UK and Alcatel of France, it was floated on the stock exchange in 1998 as an independent company and renamed Alstom.

With its core capabilities in technology development, systems integration, and the management of turnkey projects, the company is able to provide its customers with components, systems and services covering design and manufacture as well as implementation and long-term maintenance. By 2001, Alstom’s sales exceeded 20 billion Euros and it employed more than 140,000 people in over 70 countries.

Within the company, the Alstom Transport division undertakes train and signaling system design, build, manufacture and after-sales service. In 1999, Alstom Transport was the world’s largest builder of trains and railway systems, with 16 per cent of world equipment sales. Alstom Transport consists of five subsidiary businesses: Passenger; Equipment and Locomotive; Signalling; Systems; and Services.

The manufacture and design of trains is still undertaken by the Passenger business, which remains the largest of the transport businesses in terms of employees and revenues. Primary components - bogies, electrical/electronics and traction systems - are sourced in-house from its Equipment business. External suppliers are used for certain specialised components, such as doors and brakes. Alstom also supplies subsystems (e.g. traction systems) as a second tier supplier in bids led by other prime contractors, which are also its main competitors (e.g. Bombardier).

**Strategic shift to integrated solutions**

Since the mid-1990s, Alstom Transport has been building on its core manufacturing capabilities to focus on meeting high growth in demand for systems integration, maintenance and train services. Alstom is outsourcing a large proportion of rolling stock components, but continuing to design and produce critical subsystems such as traction systems. From this foothold in manufacturing, Alstom is expanding its capabilities downstream in systems integration and beyond, providing services to finance and maintain rolling stock - functions previously conducted by national railway monopolies. Alstom’s changing role in the value chain is illustrated in Figure 1.

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Figure 1:
Alstom’s traditional and emerging value chains
In response to the changes in railway markets outlined earlier, particularly privatisation and outsourcing, Alstom is evolving from being a ‘seller of goods to a system and service provider’. Systems integration and after-sales services have emerged as an increasingly important source of value added for the company. Whereas the world market for new rolling stock is expected to remain at 10 billion Euro annually between 1999 and 2003, the world’s train services market is expected to grow from 3 billion a year to 8 billion Euro over the same period.

Changes in the UK railway market provided the catalyst behind Alstom’s move into services. The break up of British Rail in 1993 led to a growing demand for maintenance outsourcing contracts as well as PFI and PPP projects. In 1995 the company won the PFI contract for the London Underground’s Northern Line. This was the company’s first major contract to design, build, finance and maintain trains, and provided an early indication of how railway markets might evolve in the future.

In 1998, a Service Business was created as a result of a strategic review of Alstom’s global activities, which recognised the huge growth in the market for rolling stock maintenance services, particularly in the UK. By setting up a service organisation at this early stage, Alstom hoped to gain first mover advantage by capturing a large share of the world market for maintenance and rolling stock services.

Capabilities and structures for integrated solutions

From its base in rolling stock design, manufacture and build, Alstom’s move into integrated solutions for the railway sector is led by its Systems and Service businesses.

Alstom’s Systems Business is a pure system integrator organisation, pulling together components and subsystems sourced both in-house and from external suppliers. It provides fixed infrastructure, rolling stock and signalling systems as a single package to solve a particular customer’s problems. By combining skills in project management, systems integration, fixed infrastructure engineering and financial engineering with traditional design and build skills, the Systems Business is able to provide complete turnkey solutions. For example, the Systems Business acted as project manager in the bid to win the Northern Line contract in 1995.

The Service Business was created to meet the growth in demand for train maintenance services. In 2000, the global Service organisation had a staff of 7,500 providing services to operate and maintain trains through the entire product life cycle.

The market for services refers to the revenues obtained by maintaining, financing and operating rolling stock and signalling systems on a life-cycle basis. The typical life cycle extends over 30 years - two years to design, build and manufacture rolling stock and 28 years to provide services. So, for example, whereas the cost of building a typical fleet of 70 diesel trains may be £65 million, the service life generates business worth £200 million.

Growing from 4% of Alstom Transport division’s total sales in 1994 to 23% in 1999, the Service Business now represents the second largest proportion of the division’s total sales. The relative decline in the share of sales of rolling stock as a proportion of Alstom Transport’s total sales from 82% in 1994 to 61% in 1999 - reflects the growth in services as a proportion of the total.

Since the mid-90’s, Alstom has been expanding its capabilities in functions previously conducted by nationalised railways.
In the five years to 1999, sales in the Service Business grew from 4% to 23% of total sales of Alstom’s transport division.

To capture life-cycle services revenues, Alstom’s Service Business offers a set of comprehensive services - which it calls ‘Total TrainLife Management’ - to support all stages in the operating life cycle of a train:

- **Maintenance** - repetitive activities over a defined period to an agreed performance level
- **Renovation** - rebuilding and upgrading to extend the useful life of rolling stock
- **Parts and replacement** - global sourcing for parts and replacements, ranging from standardised to more customised offerings
- **Asset management** - provide the finance to build trains for customers
- **New products** - technical development of maintenance tools to improve rolling stock performance.

In addition, Alstom will also service rolling stock from any original equipment manufacturer for their whole life cycle.

Responsibility for train reliability has encouraged Alstom to incorporate new technology in a customer’s existing rolling stock. For example, in 1998 Alstom had a contract with Great North Eastern Railway (GNER) to improve the reliability of its rolling stock. Technical problems were fed back to Alstom’s team of solution engineers who redesigned aspects of the locomotives to improve performance and extend the operating life of rolling stock.

Providing solutions that address a particular train operator’s problems is essential in services. For example, Alstom’s PFI contract to renew the train fleet on London Underground’s Northern Line did not specify the size of the total fleet. The contract only required that 96 trains be available for service each day, with a performance regime that imposes penalties for a train failing in service or not meeting presentational criteria, yet rewards Alstom with bonuses when the job is done well. To achieve the customer’s targets for train availability, Alstom has built 106 trains.

Vendor financing and asset management is becoming increasingly important, particularly as a result of PFI and outsourcing contracts. For example, Alstom is responsible for ownership of the Northern Line’s trains for the duration of a 20 year service provision agreement (with an option to extend to 36 years). Alstom is also financing the pre-emptive build of around 200 trains, with no firm orders from its customers, on the expectation that it will be first to market in meeting future demands of UK train operating companies.

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WS Atkins is one of the world's leading providers of project management, technical consultancy and support services. Founded in 1938, this engineering consultancy won its first major project in 1946 to design and build the Abbey Steel works at Port Talbot in Wales. Since then it has grown by concentrating on the provision of project management and a range of technical consultancy services to undertake large infrastructure projects across sectors as diverse as transport, property management, defence, and public health.

Starting in the late 1980s, WS Atkins was transformed from a family-owned business into a limited company to meet the growing demand for engineering and technical consultancy services. In 1990 the company employed 2,500 staff offering project management and technical consultancy services across 11 business divisions including: Architecture; Civil Engineering; Control and Communications; Manufacturing and Process Industries; Building Services; Industry and Power; Structural Engineering; Water; Safety and Technology; Environment, Oil and Gas; Property Services and Healthcare.

In 1996 the company floated on the London Stock Exchange. Company turnover has grown from £75 million in 1990 to £600 million in 2000. In 1998, the company restructured again as it moved from a national to multi-national organisation, and from a corporate to group structure. In 2000 the company had 13,500 staff in offices in over 25 countries, servicing projects in 86 countries.

**Strategic shift to integrated solutions**

Over the past decade, WS Atkins has diversified from its core engineering consultancy base in project management and technical consultancy into the provision of outsourcing solutions and support services. Through its involvement in the Channel Tunnel project - one of the world's first large-scale public infrastructure projects since World War 2 - WS Atkins learnt about a new type of privately financed build-own-operate-transfer project which would become widespread in the 1990s. Under this arrangement the private contractor takes the lead in major projects.

During the 1990s, WS Atkins capitalised on its Channel Tunnel experience by winning a large number of privately-financed contracts under the UK government's PFI and PPP schemes. Its growth was also fuelled by business customer demand for outsourcing and support services. By 1999, 55 per cent of the company's staff were involved in meeting demand for outsourcing solutions and this activity accounted for 59 per cent of the company's operating profit.

A strategic review in 1998 reorganised the company to meet the demand for longer-term contracts with customers in the public and private sectors, which involve the provision of ‘an increasing range of services’. The company's strategic vision is to be a customer-focused, service-based organisation which is ‘the world's first choice supplier for technical services and integrated solutions for the built environment.’

In April 1999, the group was reorganised again to focus on the provision of integrated solutions across three consolidated UK national business streams - Property, Transport and Management & Industry. In future, the group sees increasing opportunities for growth in services, driven by outsourcing from the public and private sectors both within the UK and internationally. Compared with its traditional income stream from lumpy infrastructure projects, contracts for PFI, PPP, outsourcing and support services have the advantage of providing Atkins with continuous cash flow over the whole life cycle.

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**case study: WS Atkins Infrastructure and the built environment**
Capabilities and structures for integrated solutions

The move by WS Atkins into the provision of integrated solutions is based on its strength as a systems integrator. Unlike traditional vertically-integrated manufacturers (e.g. Alstom and Ericsson) that provide packaged services to support systems developed internally for a single sector, WS Atkins is a pure systems integrator with no in-house manufacturing facilities. It designs and project manages the integration of systems supplied by world-class manufacturers across diverse sectors. For example, WS Atkins Rail buys and integrates equipment from the world’s leading railway manufacturers as well as more specialised suppliers.

Atkins prefers to handle prime contracts for systems integration projects and to sub-contract parts of the task it cannot do in-house. To fill gaps in its own portfolio of systems integration capabilities, Atkins has recruited people with skills in related industries, and has acquired complementary businesses. In the late 1990s, for example, WS Atkins Rail acquired expertise and complementary technologies by purchasing BR’s Powertrack Unit, NTES (rolling stock design), Opal (signalling), and Adtranz’s signalling systems business.

From this base in engineering design, systems integration and project management, Atkins has expanded into the provision of services to maintain, operate and finance systems for its customers. It has built capabilities in various service activities by acquiring companies involved in specialised services such as facilities management, property services, quantity surveying, and highway and railway engineering.

Services are provided either as individual packages, in any combination, or as fully integrated solutions to meet a customer’s needs across the three business streams. An example is illustrated in Figure 1, which shows a slide from a company presentation which sets out Atkins’s proposed evolution in three stages towards becoming an integrated solutions provider of baggage handling services:

Stage one. As managing agent and/or managing contractor, Atkins is responsible for managing the design and integration of the baggage handling system.

Stage two. As a provider of baggage handling services, Atkins takes over responsibility for operating and maintaining the service and upgrading the system to meet changing performance requirements.

Figure 1: Towards Integrated Baggage Services
Stage three. As an independent operator, Atkins manages and finances an integrated baggage handling service.

In each stage, Atkins progressively takes on the risks as well as the responsibility for a growing number of service activities. Potential revenues can translate into financial penalties if Atkins fails to achieve targets for service delivery. By the time it reaches stage three, Atkins takes on full responsibility for managing the risks of service provision including: financial risk (price per bag); operational risks (systems failure and penalties for service failure); and the cost of upgrading the system over its lifetime.

Another example of the move into integrated solutions is in the Transport business stream, where WS Atkins Rail has grown rapidly since the privatisation of BR by providing consultancy and outsourcing services to Railtrack, train operating companies and rolling stock leasing companies.

Services provided to railway customers include design (e.g. signalling and electrification), business development and operational planning, advice on safety, tender preparation, project implementation, and subsequent services to operate and maintain a system. An example of whole life cycle integrated solutions provision is the West Coast Main Line re-electrification system, designed by WS Atkins in partnership with Railtrack, Balfour Beatty and GTRM, which includes a 12 year warranty and long-term maintenance.

The ability to provide the finance to help its customers to pay for new infrastructure assets and to manage an installed base of assets is becoming one of Atkins’s core capabilities and a source of competitive advantage. To strengthen the group’s finance and asset management capabilities, in 1999 the group created WS Atkins Investments as a holding company to manage the company’s equity investments in joint ventures and PFI contracts.

To gain a lead over its competitors in PFI and outsourcing projects, in 2000 Atkins and the Royal Bank of Scotland (RBS) created Total Solutions for Industry (TS4i), which provides customers with a one-stop-shop source of integrated solutions for design, construction, maintenance and finance packages. Serving contracts with an asset value of between £5 and £20m, TS4i offers to manage assets for customers such as mobile telephone base stations, baggage handling systems and power stations. RBS provides the finance (and specific financial services such as equity savings) and Atkins undertakes design, construction management and asset management.

Atkins has to demonstrate how its financial and asset management services can add value, reduce operating costs and improve a customer’s balance sheet. To achieve this, it offers a business consultancy service which includes developing a detailed appreciation of the critical operations in running a customer’s business.

Using this approach, rather than incur large up-front costs of purchasing and managing industrial assets, customers are able to spread these costs over a longer period by paying for assets in instalments. As a result, the potential gains for the customer are twofold: expensive assets which previously appeared on a customer’s balance sheet are replaced by fixed-price agreements (e.g. for maintenance) with suppliers; and, there are operational efficiency gains as the management of assets is undertaken by a specialist external service provider.

WS Atkins is a pure systems integrator, with no in-house manufacturing facilities.

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Cable & Wireless (C&W) is one of the world's leading international telecom operators. It was established as a private company over 125 years ago to create an international telegraph network linking the UK's former colonies. After World War 2, the company was nationalised and focused on the provision of long-distance telephone services to Commonwealth countries. The privatisation of the company in 1981 initiated another phase of expansion. But unlike other newly-privatised public telecom operators that were trying to break out of their home territory, C&W had an international network from the start.

By the mid-1990s, C&W provided telecoms services to three types of customers - private individuals, small and medium size enterprises, and large multinational companies. Organised as a ‘federation’, C&W’s regional business units (e.g. Mercury in the UK and Hong Kong Telecom) in over 50 countries provided basic voice and data telecoms. Having built its reputation as an international telephone company, the company is now reinventing itself for the age of the internet and global business. By 2000, the company had become a global provider of data and internet protocol (IP) services, serving business customers in 70 countries and employing 54,000 people.

**Strategic shift to integrated solutions**

In 1997 some of C&W’s largest multinational customers - such as Standard Charter Bank, Andersen Consulting, Chase Manhattan and Compaq - began to demand more complex, higher value outsourcing solutions for their telecom and IT needs. Rather than have the hassle of negotiating with numerous operators in different countries, these customers wanted a single point of contact for their end-to-end global communications.

This demand attracted the company away from its traditional core in basic telecom services for consumer markets, and towards the provision of higher value IP and data services. Another factor was that by the late 1990s, the world’s telecoms sector was undergoing radical technical change. The old circuit-switched telephone networks that were designed for voice telephony were being superseded by the introduction of advanced high-capacity networks using packet-switching technologies to provide voice and data IP services. This was driving down costs and therefore eroding the profits that it was possible to make in the provision of basic telephony.

C&W’s move into the provision of integrated solutions for business customers has taken place at the overall corporate strategy level and within Global Markets, the business unit responsible for managing corporate networks. At the strategic level, the decision to focus on business markets was initiated in 1998, when C&W Global Businesses was created to provide global solutions for the telecom needs of large multinational corporations.

At the heart of the new organisation is Global Markets. As a systems integrator, Global Markets designs and integrates corporate networks, using equipment developed by external manufacturers, and network facilities provided by C&W and third party operators. It will also manage the networks on a global basis and telecom voice and data services tailored to the needs of individual companies.

In 1998 Global Markets won its first global outsourcing contract to design, implement, manage and operate a network - called ServiceNet - for Andersen Consulting (now called Accenture). By 1999, revenue from outsourcing contracts was growing at over 25 per cent each year. To meet this demand, David Sexton, chief executive of the Global Markets division, recognised that ‘suppliers must re-define their role as value-generating integrators, rather than lowest cost component suppliers.’

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**case study:**

**Cable & Wireless Global Markets**

**Corporate Telecom Networks**
The Global Markets division’s success in winning several outsourcing contracts contributed to the overall strategic decision to focus on business markets.

In 1999, C&C&W continued to sharpen its focus on business markets through acquisitions and investments, whilst divesting itself of non-strategic consumer activities (e.g. C&C&W Communications and One-2-One in the UK). A new global business - C&C&W Global - was established in June 2000 to focus on providing large and small business customers with global integrated solutions for voice, data and IP services.

In 2000, C&C&W's annual revenues grew by 16 per cent to £9 billion, but its revenue from business customers and IP and data services - the fastest-growing sector of the telecoms market - grew by 46 per cent. In the same year, business markets provided 75 per cent of C&C&W’s revenues and over 40 per cent of this derives from IP and data services.

**Capabilities and structures for integrated solutions**

By 2000, C&C&W’s strategy to satisfy demand for global outsourcing was reformulated in terms of a plan to move higher up the so-called ‘value stack’ (in the telecom sector the value chain is sometimes arranged vertically) from its traditional base in telecom infrastructure and applications into the provision of ‘total integrated solutions’ for a business customer’s entire IT and telecoms requirements as shown in Figure 1.

Traditionally C&C&W developed technologies, expertise and channels to market to perform activities at the lowest levels in the value stack (infrastructure). To provide its customers with total solutions, C&C&W is increasing its systems integration capability, providing new services as it takes over customer activities, and offering business consultancy to address each customer’s specific needs.

As it takes over activities traditionally performed at the customer’s end of the value chain, C&C&W is also forging closer and longer-term relationships with its outsourcing customers. Outsourcing contracts are underpinned by detailed SLAs, which ensure that the roles and expectations are clarified and that the risks and responsibilities of implementing and managing a network are transferred from customer to supplier.

But customer pressure for convergent voice and data technologies over a single IP platform placed new demands on C&C&W’s capabilities as a systems integrator. It could no longer rely on its traditional manufacturers for equipment. The company is developing partnerships with new ‘best-of-breed’ IP suppliers such as Nortel and Cisco Systems to provide equipment which C&C&W installs, maintains and supports. In a contract worth £950m over ten years, Nortel has been chosen to convert C&C&W’s circuit-switched network into a ‘voice over IP’ platform, delivering voice, data and multimedia services (e.g. desktop video conferencing, web-hosting and e-commerce services) over a single network.

In 2000, C&C&W offered five standardised IP services which can be tailored to an individual customer’s requirements including:

- IP migration and outsourcing,
- security,
- e-commerce,
- application software provision, and
- business integration.

These services can be purchased as individual packages, which the customer installs and manages, or as complete turnkey solutions, with on-going support.

**Figure 1: the value stack**

The term ‘systems integration’ in the IT/telecoms value stack has a different meaning than we have used elsewhere, referring more specifically to the capability to integrate IT hardware and software.
C&W is now seeking partnerships, joint ventures or acquisitions at higher levels in the value stack that will bring the knowledge and experience to fill the gaps in C&W’s portfolio of capabilities. Building on the IP platform, C&W’s strategy is to expand its systems integration capabilities. But compared with companies like EDS, Logica and Cap Gemini Ernst & Young, C&W has limited IT-related systems integration capability. It is trying to strengthen these capabilities by acquiring smaller systems integrator companies, such as Jaguar and ML Integration Group.

To provide the highest value adding services at the top of the value stack, C&W is developing the business consulting skills to understand and translate a customer’s business requirements into tailored IP solutions. C&W aims to forge partnerships with the large business consulting organisations, such as Accenture and Price Waterhouse Coopers, to help create channels to markets and provide the overall business solutions required to meet a customer’s needs.

C&W is forging partnerships to help create channels to markets and access the capabilities needed to supply integrated solutions.

3 C&W, p19, op. cit.
Since its foundation in 1876, Ericsson has grown to be one of the world’s leading manufacturers of telecommunications equipment. In 1989, Ericsson had 70,000 employees, more than half of whom worked in a business area called Public Telecommunications, which provided telephone switches and other equipment for fixed networks. By 2000, Ericsson had 100,000 employees and operations in 140 countries. Over the decade, mobile telephony had come to dominate Ericsson’s business. By 1999, mobile systems supplied to network operators and service providers accounted for 69 per cent of Ericsson’s sales.

In the early 1990s, Ericsson started to shift from being a broad-based manufacturer of equipment for all telecommunications networks to concentrate on meeting the huge demand for mobile communications. By 1996 Ericsson had restructured its mobile operations to strengthen its leading position in the market. The mobile communications division was split into two parts to meet the needs of different customer segments: a terminal division responsible for manufacturing mobile handsets sold to consumer markets, and a division producing mobile systems for network operators - comprised of radio base stations, switches, data bases, and operating sub-systems.

Ericsson is now the world’s leading supplier of mobile systems, the focus of this case study. In 1999, for example, 40 per cent of the world’s mobile subscribers were connected to Ericsson’s systems.1 By contrast, Ericsson’s position as the world’s third largest supplier of handsets is now under threat as it is experiencing intense competition, declining sales and shrinking margins in this market segment.

Strategic shift to integrated solutions

Ericsson’s move into the provision of mobile systems as complete solutions to the needs of mobile phone operators took place on two levels within the company: the initial response to customer demands met by Ericsson’s local company in the UK, and an overall strategic decision to create a service-based organisation.

In the mid-1990s, Ericsson experienced a significant shift in customer demand for mobile systems. Traditionally, mobile phone operators had built considerable in-house expertise covering all of the activities involved in designing, integrating, testing, constructing as well as operating networks. Ericsson supplied and installed equipment to meet each operator’s specifications. At this time, however, mobile operators of newly-licensed second generation (2G) mobile systems began to change their business strategies as they adjusted to stronger competition in their markets. In the UK - the world’s most liberalised mobile market - four operators (Vodafone, Cellnet, Mercury Personal Communications and Orange) participated in a race to achieve rapid network coverage and to increase their subscriber base. In this fiercely competitive environment, mobile operators began to concentrate on the provision of services to end-users. This led them to outsource non-core activities, such as systems integration and project management, to their suppliers. To achieve their new business objectives, many operators began to request that mobile systems should be provided as ‘turnkey solutions’.

Ericsson’s first move into turnkey solutions was led by its UK-based mobile systems business unit. In 1995, it won a turnkey contract to design and build the One-2-One network operated by Mercury. To accelerate nationwide coverage, Mercury decided to outsource all of its network implementation activities including: cell planning; site acquisition and construction; network...
design, integration, test and acceptance; and project management of all these activities. Since winning this contract, Ericsson has built the capabilities to provide a growing number of turnkey projects throughout the world.

The move into turnkey solutions in the UK received high-level strategic support from Ericsson’s corporate management in Sweden. This new demand for turnkey projects in the UK was expected to - and did - quickly take hold elsewhere. However, although the move into turnkey solutions was a first step, customer demand for help with the maintenance and operation of their networks has encouraged Ericsson to continue its move into services.

In 1996, Ericsson’s Corporate Executive Committee completed the largest planning study in the company’s history. The report - ‘2005 - Ericsson entering the 21st Century’ - lays the foundations for Ericsson’s current strategy to create an organisation which provides operators with ‘solutions and services’, by helping them to design, build, operate and manage their networks.

As illustrated by Figure 1 from Ericsson’s 1996 report, the telecom value chain has traditionally consisted of three categories of companies: suppliers of components, suppliers of telecom equipment and systems, and telecom operators. Telecom operators occupy the largest and most profitable segment - the one closest to the final consumers. These firms have traditionally undertaken two basic functions - the design and operation of networks, and the provision of final consumer services. Deregulation of telecom markets is forcing traditional and new operators to focus on the latter - supplying competitive services to final consumers. As a result, operators are moving along the value chain, transferring design, build and operational activities to their suppliers.

Ericsson, which was until recently positioned in the middle segment, is moving away from its manufacturing heartland and taking over the systems integration and service activities previously performed internally by its customers. As a result of this decision to move into higher value activities, a growing proportion of Ericsson’s products - including 3G radio base stations and mobile handsets - are now outsourced and manufactured under contract by Flextronics.
Capabilities and structures for integrated solutions

By 2000 Ericsson had been reorganised to support the implementation of turnkey solutions and operational services throughout the world. Two of its five new business divisions are responsible for the provision of mobile systems and services to network operators:

- **Mobile Systems** - supplies mobile equipment and systems covering different technical standards to network operators and service providers.
- **Global Services** - four units (Network Roll-Out, Telecom Management Solutions & Professional Services, Customer Services and Ericsson Education) provide services to Ericsson’s other divisions and its customers.

Traditionally services were provided by each of Ericsson’s separate divisions. But the growth in services soon warranted the creation of a specialised service division. In 1998, for example, Ericsson’s Service Solutions portfolio generated revenues exceeding $1.25 billion. In 1999, Ericsson combined its resources in service offerings and business consulting to create Ericsson Services, ‘thus strengthening Ericsson’s position as complete supplier, system integrator and partner’. In June 2000, Ericsson’s service activities were brought together under a new division - Ericsson Global Services - which is part of Ericsson’s corporate management team. Global Services is responsible for supporting the delivery of systems and services throughout Ericsson’s global operations.

Ericsson offers a portfolio of services - called Service Solutions - which address a customer’s business and operational goals, from initial business idea and planning, through network integration and service start-up, to technical operation. These services include:

- **Advice for operators** entering new markets, developing business plans, and marketing strategies, and offering recommendations for organisation and business processes.
- **Network design** - planning a network design, construction, and business strategy.
- **Network integration** - building or upgrading a network, integrating multi-vendor systems, testing and handing over a fully operational network.
- **Customer training** and skills development.
- **24-hour support** from global response centres to ensure continuous technical operation.
- **Network performance analysis** to improve coverage, capacity, efficiency and reliability.
- **Network management**, which involves working with an operator’s staff or undertaking complete technical operation of the network on behalf of the customer.

Depending upon their specific needs and capabilities, operators can select individual modular services or the entire set of services as a turnkey solution with on-going support.

To strengthen its move into turnkey and service solutions, Ericsson has created two business consultancy organisations. Ericsson Business Consulting provides advice such as business planning to help other parts of Ericsson’s operations implement turnkey solutions. Edgecom, an Ericsson subsidiary, provides customers with advice on their strategies for mobile communications, such as how to write business plans, produce network designs, finance and manage their assets, and develop applications for 3G systems.

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Thales Training and Simulation (TT&S), one of the world’s leading suppliers of simulation systems and training services, is part of the aerospace business of Thales. In late 1990s Thomson-CSF (as Thales was known until December 2000) was one of Europe’s largest defence and commercial electronics manufacturers. Since the late 1990s, a key element of its strategy has been to build the capability to be the systems integrator or prime contractor on big weapons programmes.¹

The company’s renaming as Thales was intended to create a new brand which reflected the global nature of the company’s activities. In 2000, the group was reorganised into three businesses: aerospace, defence, and IT and services.

Thales’s aerospace business, which offers systems and service solutions for all aspects of air transportation, is Europe’s leading aerospace manufacturer. It has 9,300 employees and 75 per cent of its activities are in the civil area. Customers include civil aviation authorities, airports, aircraft manufacturers and airlines. As part of the aerospace business, TT&S has been designing, manufacturing and integrating simulation and training systems for over 50 years. It works closely with airframe manufacturers and other simulation suppliers on most of its major programmes to offer a comprehensive range of simulators and training equipment for aircraft, vehicles, and power stations. In 2000 TT&S had 2,000 employees in France, the UK, Australia and the US, and annual revenues of around 300 million Euros.

**Strategic shift to integrated solutions**

TT&S has recently changed its strategy to focus on being a systems integrator and provider of flight training services. Under the previous arrangement, which lasted until the late 1990s, TT&S supplied its customers - commercial airlines and military air forces - with stand-alone flight simulators, such as computer-based trainers and full-flight simulators. There was a clear division of responsibilities between supplier and customer. Suppliers built simulators to meet a customer’s technical specifications. TT&S was responsible for the design, manufacture and integration of all key components in the final product. This was then delivered to the customer, which was then responsible for training its pilots. At the time, training centres were often owned and operated by the airlines or by independent training service providers.

Since the late 1990s, TT&S has been outsourcing lower margin sub-assembly and component manufacturing activities, and increasing its focus on systems integration. It is working closely with component suppliers to ensure that products are tailored exactly to a customer’s requirements. From this base in systems integration, TT&S is moving along the value chain to take over responsibility for pilot training and other services previously performed by its military and civil customers.

In the military sector, the growth in defence-related PFI and PPP contracts as well as the MoD’s Smart Procurement Programme are encouraging flight simulator manufacturers to provide training services previously performed by their customers, such as the supply and certification of military instructors. Smart Procurement requires that the supplier becomes involved from the early stages of defining specifications for military systems, implementing them and supporting them through the product life cycle. Under PFI and PPP contracts, suppliers may have to acquire, finance and manage the building that houses military training and simulation facilities.

By 2000, TT&S was managing two major PFI contracts. The first was awarded in 1999 for the provision of aircrew training for the RAF Tornado. Having demonstrated operational and financial skills in this project, in July 2000 TT&S was awarded a second £25 million PFI contract to provide aircrew training for Army Lynx helicopters.
In the civil sector, TT&S's move into the provision of pilot training services for airlines has been driven by customer demands for outsourcing solutions. Training pilots is increasingly expensive for the airlines to perform internally. Pilots have to be trained for a specific aircraft, receive further training as that aircraft is upgraded, and be retrained to fly new aircraft. Rather than incur the large associated costs, some airlines are outsourcing, sharing facilities and using independent training centres.

The increasing complexity of flight simulators has added to the expense of buying stand-alone simulators for in-house training. Customers are also finding that they no longer have the knowledge in-house to specify their requirements or perform training with the latest simulators. But despite this outsourcing trend, some major airlines continue to operate their own training facilities, such as British Airways' training centre at Heathrow.

TT&S has responded to these challenges by providing its military and civil customers with flight simulators and training services as integrated solutions. In a shift away from one-off product sales, TT&S is tapping into a more continuous source of revenues by providing training and support services through the life cycle of a training programme. In some cases, this means helping customers to maintain effective operation of their simulators through their life span of around 20-25 years. In other cases, TT&S is providing integrated 'training solutions' - combining flight simulators and training services - for its military and commercial customers. This is forcing TT&S to build closer relationships with its customers and to develop a greater understanding of the pilots’ requirements for training. This move into higher value-added training solutions is illustrated by a diagram from a company presentation in Figure 1.

**Capabilities and structures for integrated solutions**

To meet customers’ requirements for integrated solutions, TT&S is currently developing new services capabilities in-house and through joint ventures with partners with appropriate expertise.

First, TT&S is building the capabilities to be an independent operator of training services, by developing its own training centres in partnership with leading airlines.
and training providers. In 1998, TT&S entered into the world’s first revenue sharing agreement for training services based on the sale of simulator hours. In this move away from supplying stand-alone simulators, TT&S is offering customers the option of buying training services only when required on a ‘pay-as-you-train’ basis. Under the agreement, two simulators have been built by TT&S, which are operated by United Airlines at its Denver training centre in the US. Revenue received from the sale of simulator hours to other airlines is shared between the two companies. The agreement is part of TT&S’s strategy to expand its capabilities in flight crew training services.

In 1999, TT&S strengthened its capabilities in commercial flight training services through a joint venture with GE Capital. Under the agreement, TT&S transferred its aviation training centre operations and six TT&S commercial flight simulators to GE Capital Aviation Training (GECAT), which has a world class reputation as an independent provider of flight training services.

Second, TT&S is offering more advanced simulation systems, such as so-called ‘synthetic training environments’. In synthetic environments, military personnel involved in real military manoeuvres, flight simulators, and computer-generated - or virtual - forces, are brought together in a single networked environment for training, teamwork and mission rehearsal. Synthetic environments are increasingly used as part of the development and procurement cycle for military equipment.

In 1997, TT&S won one of the contracts to develop the UK’s Air Defence Synthetic Environment. The system comprises 10 manned air defence simulators, 15 flight simulators and computer-generated land and air forces networked between eight sites across the UK. This allows simultaneous training exercises involving many personnel performing different functions. This is an improvement on stand-alone simulators, particularly by enhancing the realism of the situations created.

TT&S now offers a range of entire training solutions, some of which bring together simulators and computer-generated situations across many sites.


Wise and Baumgartner, op. cit.

Wise and Baumgartner, p134, op. cit.


Wise and Baumgartner, op. cit.

ibid.


Procrustes: a robber from Greek legend who stretched or cut his captives’ legs to make them fit a bed. Only if and when they fitted the bed were they free to go.


Marsh, op. cit.
A new type of firm is emerging at the heart of modern economies: integrated solutions providers. But there is much confusion among firms and analysts about what these companies should be doing. This is partly because the provision of integrated solutions does not conform to the traditional categories of manufacturing or services.

Based on the world’s first research in this area, this document outlines a capability framework that helps cut through this confusion. It shows the capabilities that firms need to develop, the key business challenges they face, and outlines the experiences of five leading case study firms.

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